Midnite Mine Superfund Site
100 Percent Design

Appendix K – Technical Specifications

.

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DIVISION 01 - GENERAL REQUIREMENTS

01010	Summary of Work	01010-1	-	01010-10
01015	Remedial Action Work Plans	01015-1	-	01015-2
01018	Construction Surveying and Staking	01018-1	-	01018-6
01060	Permits	01060-1	-	01060-2
01070	Abbreviations	01070-1	-	01070-6
01090	Reference Standards	01090-1	-	01090-2
01200	Project Meetings	01200-1	-	01200-4
01300	Contractor Submittals	01300-1	-	01300-12
01301	Schedule of Valves	01301-1	-	01301-2
01310	Construction Schedule	01310-1	-	01310-6
01400	Quality Control	01400-1	-	01400-4
01500	Marine Installation Requirements	01500-1	-	01500-4
01505	Mobilization	01505-1	-	01505-2
01510	Temporary Utilities	01510-1	-	01510-4
01515	Temporary Distribution Line	01515-1	-	01515-30
01520	Security	01520-1	-	01520-2
01525	Construction Support Zone Temporary Facilities	01525-1	-	01525-6
01530	Protection of Existing Facilities	01530-1	-	01530-4
01532	Site Conditions Surveys	01532-1	-	01532-2
01551	Construction Access Roads	01551-1	-	01551-6
01552	Staging and Stockpile Areas	01552-1	-	01552-2
01560	Temporary Environmental Controls	01560-1	-	01560-6
01570	Stormwater Pollution Prevention Plan	01570-1	-	01570-10
01575	Spill Prevention Control and Countermeasures Plan	01575-1	-	01575-6
01585	Green and Sustainable Practices	01585-1	-	01585-4
01600	Products, Materials, Equipment and Substitutions	01600-1	-	01600-4
01700	Project Closeout	01700-1	-	01700-2

DIVISION 02 - SITEWORK

02050	Demolition	02050-1	-	02050-8
02016	Well Decommissioning	02016-1	-	02016-6
02017	Monitoring Wells	02017-1	-	02017-10
02100	Site Preparation	02100-1	-	02100-4
02105	Rhoads Borrow Area	02105-1	-	02105-4
02120	Road and Staging Area Maintenance	02120-1	-	02120-2
02140	Dewatering and Control of Water	02140-1	-	02140-6
02160	Sediment and Erosion Control	02160-1	-	02160-8
02200	Earthwork	02200-1	-	02200-22
02205	Mine Waste Excavation and Disposal	02205-1	-	02205-14
02210	Blasting	02210-1	-	02210-10
02223	Alluvial Groundwater Controls	02223-1	-	02223-28
02272	Geomembranes	02272-1	-	02272-14
02273	Riprap	02273-1	-	02273-6
02274	Geotextiles	02274-1	-	02274-6
02275	Geonet	02275-1	-	02275-4
02280	Geocomposite Drainage Layers	02280-1	-	02280-6
02460	Hot Mix Asphalt Pavement and Base	02460-1	-	02460-4
02567	Corrugated Pipe	02567-1	-	02567-4
02570	Multi-Plate Arch Pipe	02570-1	-	02570-4

02593	HDPE Manhole and Valve Boxes	02593-1	-	02593-6
02594	High Density Polyethylene Pipe	02594-1	-	02594-6
02596	HDPE Dual Containment Pipe	02596-1	-	02596-8
02780	Geosynthetic Clay Liner (GCL)	02780-1	-	02780-12
02800	Permanent Access Controls	02800-1	-	02800-2
02831	Chain Link Fencing and Gates	02831-1	-	02831-8
02970	Revegetation	02970-1	-	02970-6

DIVISION 03 - CONCRETE

03300	Cast-in-Place Concrete	03300-1	-	03300-22
03361	Shotcrete	03361-1	-	03361-4
03495	Precast Concrete Manholes, Drop Inlets and Vaults	03495-1	-	03495-6

DIVISION 04 – MASONRY (NOT USED)

DIVISION 05 – METALS

05500	Miscellaneous Metalwork	05500-1	-	05500-12

DIVISION 06 – WOOD AND PLASTIC (NOT USED)

DIVISION 07 – THERMAL AND MOISTURE PROTECTION (NOT USED)

DIVISION 08 – DOORS AND WINDOWS (NOT USED)

DIVISION 09 – FINISHES (NOT USED)

DIVISION 10 – SPECIALTIES (NOT USED)

DIVISION 11 – EQUIPMENT

11000	Equipment General Provisions	11000-1	-	11000-10
11100	Pumps, General	11100-1	-	11100-10
11155	Submersible Pond and Pit Well Pumps	11155-1	-	11155-8

DIVISION 12 – FURNISHINGS (NOT USED)

DIVISION 13 – SPECIAL CONSTRUCTION (NOT USED)

DIVISION 14 – CONVEYING SYSTEMS (NOT USED)

DIVISION 15 – MECHANICAL

15000	Piping, General	15000-1	-	15000-6
15200	Valves, General	15200-1	-	15200-8
15201	Valve Actuators	15201-1	-	15201-4
15202	Butterfly Valves	15202-1	-	15202-2
15203	Check Valves	15203-1	-	15203-2
15230	Miscellaneous Valves	15230-1	-	15230-2

DIVISION 16 – ELECTRICAL

16000	General Electrical Requirements	16000-1	-	16000-10
16111	Conduits	16111-1	-	16111-6
16123	600 Volt Class Cable	16123-1	-	16123-4
16124	Instrumentation Class Cable	16124-1	-	16124-2
16130	Outlet, Pull and Junction Boxes	16130-1	-	16130-8
16141	Wiring Devices	16141-1	-	16141-4
16142	Weatherproof While in Use Outlet Enclosures	16142-1	-	16142-2
16143	Terminal Blocks	16143-1	-	16143-2
16160	Enclosures	16160-1	-	16160-2
16161	Control Panels	16161-1	-	16161-8
16170	Grounding	16170-1	-	16170-4
16190	Supporting Devices	16190-1	-	16190-6
16195	Electrical Identification	16195-1	-	16195-6
16460	Electric Motors	16460-1	-	16460-8
16476	Low Voltage Circuit Breakers	16476-1	-	16746-2
16477	600 V Fuses	16477-1	-	16477-4
16480	Motor Controllers	16480-1	-	16480-6
16505	Transient Voltage Surge Suppression System	16505-1	-	16505-10
16611	Static Uninterruptible Power Supply	16611-1	-	16611-2
16902	Electrical, Controls, Relays and Alarms	16902-1	-	16902-4
16903	Programmable Logic Controllers	16903-1	-	16903-4
16940	Communication Cabling Systems	16940-1	-	16940-12
16950	Electrical Testing	16950-1	-	16950-12

DIVISION 17 – INSTRUMENTATION AND CONTROLS

17000	Instrumentation	17000-1	-	17000-14
17111	Float Switches	17111-1	-	17111-2
17126	Submersible Level Transmitters	17126-1	-	17126-2
17137	Magnetic Flowmeters	17137-1	-	17137-6
17222	Signal Conditioners	17222-1	-	17222-2
17300	Control Strategies	17300-1	-	17300-6
17301	Pump Control Loop	17301-1	-	17301-2
17700	PLC Programming Standards	17700-1	-	17700-16

Attachment K-1

Waste Excavation and Consolidation

Provided electronically only

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK to be performed under this Contract shall consist of furnishing plant, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the COMPANY.

1.2 PROJECT DESCRIPTION

A. The Midnite Mine was an open-pit, hard rock uranium mine that is located approximately 45 miles northwest of Spokane, Washington and 8 miles northwest of Wellpinit, Washington. The Site is approximately 350 acres in size, and includes areas affected by uranium mining which occurred between 1955 and 1981. The Midnite Mine is located on the Spokane Indian Reservation in Stevens County, Washington at an elevation ranging from approximately 2500 to 3400 feet above mean sea level (amsl). Remedial action activities at the Midnite Mine are being conducted under a Consent Decree between the COMPANY and the U.S. Environmental Protection Agency, Region X (EPA).

B. REMEDY COMPONENTS: A detailed description of the overall remedial action components can be found in the Remedial Action Work Plan. The remedial action will consist of the following components:

1. Mine Waste Excavation and Containment - The Mine Waste Excavation work component includes the excavation and removal of all mine wastes exceeding cleanup levels from the Mined Area (MA) and Mine Affected Area (MAA), with the exception of the material currently located in the Backfilled Pits Area (BPA). Mine waste materials include waste rock, low-grade ore or protore, and contaminated sediments and subsoils. Pits 3 and 4 Reclamation work component includes the consolidation and containment of excavated mine wastes in the existing open Pit 3 and Pit 4, except as directed or otherwise approved by EPA. The containment system shall include a drainage layer, a sub-waste liner, a cover system, and groundwater and surface water collection and diversion facilities in and around each pit. The BPA reclamation work component includes the contouring and consolidation of mine wastes in the BPA. The containment system will include a cover system and surface water and groundwater collection and diversion facilities.

2. Water Collection and Treatment - The Water Collection and Treatment work element includes the continued operation of the existing water treatment plant (WTP) and its replacement with a new WTP. The objective of this work element is to prevent releases of water exceeding discharge limits. The Water Collection and Treatment work element includes the following components: Water Collection and Conveyance, Water Storage and Treatment, and Residuals Management.

3. Institutional Controls and Access Restrictions - The Institutional Controls (ICs) and Access Restrictions (ARs) work element includes implementation of effective

controls that achieve the goals stated in Section 12.2.5 of the ROD and requirements set forth in Section IX of the Consent Decree (CD). The primary objectives of this work element are to ensure long-term protection of human health and the environment and to protect the integrity of the remedy.

4. Long-Term Site Management - The Long-Term Site Management work element includes activities necessary to maintain the integrity and function of the remedy, and to support statutory reviews of remedy protectiveness of human health and the environment. The objective of this work element is to ensure integrity and functionality of the implemented remedy and to provide information required for regulatory reviews of the effectiveness of the remedy.

5. Blue Creek and Delta Sediments Contingent Action - Although the Selected Remedy anticipates that sediments in Blue Creek and Delta will meet cleanup standards through natural recovery within a reasonable timeframe (approximately ten years following waste containment), active sediment remediation may be required under certain conditions. This work element includes assessment and, in accordance with the Selected Remedy, removal of in-stream and riparian sediments in Blue Creek and Delta.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Construction WORK covered by the CONTRACT DOCUMENTS and these Specifications includes the following tasks:

1. Construction Support Facilities – Construction support facilities will be built to support construction activities as well as planned remedial actions at the Site. These facilities include laydown, stockpile and storage areas, construction of maintenance and fueling areas, construction of new access roads, improvement of existing access roads, and construction of loadout areas.

2. Demolition – In preparation for the excavation and containment of waste rock and protore piles and construction of the new mine water treatment plant, several existing structures will be demolished. These include the following buildings and areas: (1) the existing water treatment plant equipment and structures, (2) the existing buildings on the west side of the site, (3) seepage collection facilities in the MA drainages, (4) surface pipelines, (5) buried culverts, (6) overhead power lines, and (7) interim decontamination facilities.

3. Mine Surface Material and Sediment Cleanup - Mine Wastes include above-grade mine wastes, contaminated soil and sediment, mine drainage sediments, and mine access road materials. Mine waste generally will be excavated, transported, and placed in the Mine Waste Containment areas without stockpiling or double-handling excavated material. Mine waste excavation and placement within the Mine Waste Containment Areas is scheduled to be conducted in three phases: Phase 1 – Includes excavation and placement of mine wastes in Pit 4; Phase 2 – Includes regrading the Backfilled Pits Area (BPA) and excavation and placement of mine wastes in Pit 3; Phase 3 – Includes regrading of Area 5 (located between Pit 3 and Pit 4), and excavation and placement of remaining mine wastes in the upper portion of the Pit 3 waste containment area. Demolition and removal of temporary support facilities in the construction support zone and other areas of the site will occur near the end of Phase 3. This element also includes surface water control, storage, treatment and disposal. These phases are described in more detail in Section 1.4.

4. Borrow Area Development – Borrow areas for cover material and topsoil/growth media will be developed at the Rhoads property (Rhoads Borrow Area). Work to develop the borrow area will include site preparation including access and SWPPP controls, excavation and separation of materials, and the set-up and operation of screening or processing facilities as necessary to produce suitable material. Restoration of borrow areas will be completed at the end of borrow area use.

5. Groundwater Controls - Groundwater controls will be installed in the Western, Central, and Far East Drainages at the Site to intercept impacted groundwater in the alluvial and shallow weathered bedrock and convey it for treatment to the existing WTP or the new WTP. Groundwater Controls in each of these drainages will consist of an extraction trench installed immediately upslope of a low-permeability barrier wall. The extraction trench will be excavated through the residual soils to competent bedrock downgradient of the Mine Area. The low-permeability barrier wall will be installed immediately downgradient of the extraction trench to increase capture efficiency.

6. Water Treatment Plant – A new WTP will be constructed as part of the Work. The WTP elements consist of a five-hundred gallon per day capacity, including equalization ponds, influent and effluent pipelines, filtration equipment, ion exchange equipment, ion exchange resin regeneration equipment, ion exchange resin handling facilities, chemical storage facilities, slurry dewatering and dewatered filter cake storage facilities, fiberglass tanks, medium voltage power line extension, electrical system, electrical controls, SCADA system, laboratory, office, pre-engineered metal building, concrete foundation and flatwork and appurtenant work. The new WTP Work is outlined under a separate contract and division of specifications and therefore is NOT included in this scope of work.

7. Water Treatment Plant Effluent Pipeline – A treated water effluent pipeline will be used to convey treated water from the new WTP to the Spokane River Arm of Lake Roosevelt. This pipeline also includes a diffuser that will be constructed at the terminal end of the pipeline to aid with mixing the treated effluent with the lake water. The new WTP effluent pipeline work is outlined under a separate contract and division of specifications and therefore is NOT included in this scope of work.

B. The WORK is located at the Midnite Mine site near the town of Wellpinit, Washington on the Spokane Indian Reservation.

1.4 PHASING OF THE WORK

A. Mine waste excavation and placement within the waste containment areas are divided into three phases:

1. Early Work includes activities to prepare the site for construction, processing of earthen materials for use during the RA, and completion of remedial construction activities associated with Pit 4. The locations of work areas included in the Early Works activities are shown on the Contract Drawings. The following tasks shall be completed during the Early Works of the RA:

a. Topsoil Stockpiles: The existing topsoil stockpiles shall be excavated. Material that meets the cleanup standards shall be temporarily stockpiled in a designated area for future use as cover material. Material failing to meet the cleanup standards shall be temporarily stockpiled in a designated area until it can be placed in the waste containment areas as backfill.

b. Construction Support Zone: The area to be used as the Construction Support Zone shall be prepared for use during the RA. Activities shall include removal of the South topsoil stockpile, screening, removal, and temporary stockpiling of contaminated materials, demolition of existing structures, and general site grading. In addition, perimeter security fencing shall be installed and staging of temporary construction support structures shall be completed.

c. Site Access Road: The permanent site access road from the West End Road to the location of the new WTP and Construction Support Zone shall be constructed. Soils stripped from within the limits of the Site Access Road that meet site cleanup standards shall be temporarily stockpiled in a designated area for future use as cover material.

d. West Access Road Removal: The existing West Access Road shall be removed. In addition, impacted materials within Whitetail Creek shall also be removed. Materials failing to meet the cleanup standards shall be temporarily stockpiled in a designated stockpile area within the MA until it can be placed in the waste containment areas as backfill.

e. Decontamination Zone: The decontamination zone shall be constructed, including vehicle and personnel decontamination facilities.

f. Material Processing and Stockpiling Area: Area 5 shall be prepared for processing and stockpiling of material from the Hillside Waste Rock Pile. Preparation activities shall include well abandonment, safety berm augmentation, relocation of ore stock pile #7, and any necessary grading to facilitate work in this area.

2. Phase 1 – Includes excavation and placement of mine wastes in Pit 4. The locations of work areas included in the Phase 1 activities are shown on the Contract Drawings. The following tasks shall be completed during Phase 1 of the RA:

a. Hillside Waste Rock Pile: A sufficient portion of the Hillside Waste Rock Pile shall be processed to produce drain rock and overliner protection material for Pit 4. Rejected material shall be placed in Pit 4 as low-reactivity or low-activity waste backfill.

b. Preparation of Pit 4: Activities to prepare Pit 4 for waste containment include installation of rockfall hazard mitigation measures, dewatering of the pit, remove existing pit bottom sediments, installation of underdrain system and liner system. Note, underdrain risers shall be installed as necessary during waste placement to allow conveyance of water during the RA.

c. Pit 4 Overburden Pile: Remove mine waste and impacted subgrade material and place in Pit 4 as waste backfill. Following removal, the disturbed area shall be covered with suitable clean soil and revegetated.

d. Ore and Protore Stockpiles: The existing ore and protore stockpiles shall be removed and placed in Pit 4 as waste backfill. Please note, these materials may not be placed within 20 feet of the top, bottom, or sides of backfilled Pit 4.

e. South Pond Construction: A double-lined pond shall be constructed within the South Waste Rock Pile for water storage during Phase 2 construction activities. Excavated materials shall be placed in Pit 4 as waste backfill.

f. Western Drainage Waste Rock: A sufficient quantity of waste rock from the Western Drainage shall be excavated and placed in Pit 4 as waste backfill.

g. Adit Pit and Pit 2 West: Materials present in the Adit Pit and Pit 2 West shall be excavated as part of the Phase 1 Western Drainage Waste Rock removal and placed in Pit 4 as waste backfill.

h. Placement of Stockpiled Material from Early Works: At the contractor's discretion, materials failing to meet cleanup standards that were stockpiled during the early works (i.e., topsoil stockpile rejects, material from the West Access Road, and contaminated materials removed from the Construction Support Zone) shall be placed in Pit 4 as waste backfill.

i. Pit 4 North Area: The Pit 4 North Area shall be regraded and covered. Cut material failing to meet the cleanup standards shall be temporarily stockpiled in a designated area until it can be placed in the waste containment areas as backfill.

j. Borrow Area Haul Road: A haul road to facilitate transportation of cover material from the Rhoads borrow area to the waste containment areas shall be constructed.

k. Borrow Area Development: The approved borrow area within the Rhoads Property shall be developed and sufficient borrow materials shall be removed to cover Pit 4 and other Phase 1 areas that require growth media. Areas that are no longer needed for borrow development shall be reclaimed as needed.

l. Pit 4 Cover: Following completion of waste backfill placement, a geomembrane cap and geocomposite drainage layer (GDL) shall be installed. Once the GDL has been installed, borrow materials shall be hauled and placed over the GDL to complete the 3 foot thick soil cover.

m. Alluvial Groundwater Controls: Alluvial groundwater extraction trenches and barrier walls shall be constructed in the Far East, Central, and Western Drainages.

n. Temporary Influent Pipelines: Temporary pipelines from Pit 4, the alluvial groundwater controls and the BPA to the new South Pond shall be constructed.

3. Phase 2 –Includes regrading the Backfilled Pits Area (BPA) and excavation and placement of mine wastes in Pit 3. Primary objective of the Phase 2 work is to remove all waste from, and meet soil and sediment cleanup standards in the Western and Eastern Drainages so that surface water runoff in these drainage basins can be released to Blue Creek without retention and treatment at the WTP. Demolition of the existing WTP and associated facilities shall occur during Phase 2 provided the NPDES permit is reissued for the new WTP facility. Areas where final grade has been established in the Pit 3 waste containment area, the BPA, and Area 5 shall be capped and revegetated to the extent practical near the end of Phase 2. It is anticipated that demolition of the other existing site facilities (i.e., Blood Pool structures and pipelines) shall occur during Phase 2.The locations of work areas included in the Phase 2 activities are shown on the Contract Documents. The following tasks shall be completed during Phase 2 of the RA:

a. Preparation of Pit 3: Activities to prepare Pit 3 for waste containment include installation of rockfall hazard mitigation measures, dewatering of the pit,

remove existing pit bottom sediments, installation of underdrain system and liner system. Note, underdrain risers shall be installed as necessary during waste placement to allow conveyance of water during the RA.

b. Hillside Waste Rock Pile: Remove and process the remaining Hillside Waste Rock Pile to produce drain rock and overliner protection material for Pit 3. Rejected material shall be placed in Pit 3 as low-reactivity or low-activity waste backfill.

c. Adit Pit and Pit 2 West: This area which was excavated during Phase 1 shall be regraded, covered, and revegetated.

d. Demolition of Existing WTP: The structures and associated facilities shall be demolished. Materials shall be cut to manageable sizes and placed in Pit 3 as waste backfill. This activity shall occur ONLY if the new WTP has been constructed and is operational.

e. East Waste Rock Pile: The East Waste Rock Pile and impacted subgrade shall be excavated and placed in Pit 3 as waste backfill. The disturbed area shall be covered with suitable material as necessary and revegetated.

f. Existing Site Roads: Contaminated material from the internal mine roads and East Access Road shall be excavated. Materials failing to meet the cleanup standards shall be temporarily stockpiled in a designated stockpile area until it can be placed in Pit 3 as waste backfill.

g. Western Drainage Waste Rock: The remaining waste rock and impacted subgrade present in the Western Drainage shall be excavated and placed in Pit 3 as waste backfill.

h. Area 5: Area 5 shall be regraded and covered following completion of processing drain rock from the Hillside Waste Rock Pile.

i. West Pond Construction: The West Pond and surface water controls shall be constructed for water storage during Phase 3 construction activities.

j. Eastern Drainage Sediment Cleanup: Contaminated sediments from the Eastern Drainage shall be excavated and placed in Pit 3 as waste backfill. Disturbed areas shall be reclaimed with suitable soil and revegetated.

k. Western Drainage Sediment Cleanup: Contaminated sediments from the Western Drainage shall be excavated and placed in Pit 3 as waste backfill. Disturbed areas shall be reclaimed with suitable soil and revegetated.

l. Stormwater Attenuation Berms: Construct four stormwater attenuation berms in the Western, Central and Eastern Drainages. Contaminated soils located within the footprint of the berms shall be excavated and placed in Pit 3 as waste backfill.

m. Temporary Influent Pipelines: Following placement of the underdrain system, temporary influent pipelines shall be constructed from Pit 3 to the South Pond. At the completion of the Phase 2 efforts, the temporary influent pipelines from the alluvial groundwater controls, Pit 3 seepage collectors, Pit 3, Pit 4, and the BPA dewatering pipelines shall be redirected to the West Pond.

n. Continued Borrow Area Development: The approved borrow area within the Rhoads Property shall continue to be developed to produce borrow materials in order to cover Area 5, a portion of Pit 3 and the BPA and other Phase 2 areas that require growth media. Areas that are no longer needed for borrow development shall be reclaimed as needed.

o. Partial Pit 3 Cover: A partial cover consisting of a geomembrane cap and geocomposite drainage layer (GDL) shall be installed following completion of Phase 2 waste backfill placement. Once the GDL has been installed, borrow materials shall be hauled and placed over the GDL to complete the 3 foot thick soil cover.

4. Phase 3 – Includes excavation and placement of remaining mine wastes in the upper portion of the Pit 3 waste containment area. During Phase 3, impacted water collected at the Site shall be stored in a lined, temporary storage pond located in the Western Drainage (West Pond). Upon completion of Phase 3, it is anticipated that the only remaining material on Site requiring relocation and containment shall be any impacted sediment that may have accumulated within the West Pond over its relatively short operational life and the West Pond liner materials. These waste materials from the West Pond shall be relocated to a separate waste containment cell located in the Contingency Storage Area in the upper portion of the Area 5/Pit 3 waste containment area as shown on the Contract Drawings. The West Pond shall not be decommissioned until flows at the Site have decreased to the point where the available storage in the permanent equalization ponds at the new WTP can handle the storage requirements of the Site. Phase 3 activities include removal of the PCP, removal of the South Waste Rock Pile, removal of the South Pond, Central Drainage sediment cleanup, final backfilling and covering of Pit 3 and the BPA. The locations of work areas included in the Phase 3 activities are shown on the Contract Drawings. Phase 3 includes the following tasks:

a. Pollution Control Pond: The PCP shall be decommissioned and the material including any impacted subgrade soil shall be placed in Pit 3 as waste backfill.

b. South Pond: The South Pond shall be decommissioned and the material placed in Pit 3 as waste backfill.

c. South Waste Rock Pile: All remaining waste rock and impacted subgrade material from the South Waste Rock Pile shall be excavated and placed in Pit 3 as waste backfill. Disturbed areas shall be reclaimed with suitable soil and revegetated.

d. Central Drainage Sediment Cleanup: Contaminated sediments from the Central Drainage shall be excavated and placed in Pit 3 as waste backfill. Disturbed areas shall be reclaimed with suitable soil and revegetated.

e. Final Pit 3 Cover: Following completion of waste backfill placement in Pit 3, a geomembrane cap and geocomposite drainage layer (GDL) shall be installed. Once the GDL has been installed, borrow materials shall be hauled and placed over the GDL to complete the 3 foot thick soil cover.

f. Continued Borrow Area Development: The approved borrow area within the Rhoads property shall continue to be developed to produce borrow materials in order to cover Area 5, a portion of Pit 3 and the BPA and other Phase 2 areas

that require growth media. Areas that are no longer needed for borrow development and the haul road shall be reclaimed as needed.

g. Permanent Influent Pipelines and Site Maintenance Roads: Following placement of the final Pit 3 cover, permanent WTP influent pipelines and site maintenance roads shall be constructed.

h. Access Controls: Construct final site access controls.

1.5 CONTRACT METHOD

A. Contracting will be done by the COMPANY's contracting department.

1.6 WORK BY OTHERS

A. Where 2 or more contracts are being performed at one time on the same Site or adjacent land in such manner that work under one contract may interfere with work under another, the COMPANY will determine the sequence and order of the Work in either or both contracts. When the Site of one contract is the necessary or convenient means of access for performance of work under another, the COMPANY may grant privilege of access or other reasonable privilege to the contractor so desiring, to the extent, amount, and in manner and at time that the COMPANY may determine. No COMPANY determination of method or time or sequence or order of the work or access privilege shall be the basis for a claim for delay or damage except under provisions of the General Conditions for temporary suspensions of the work. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the work of such other contractors, and shall cooperate fully with such contractors to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.

B. Interference With Work On Utilities: The CONTRACTOR shall cooperate fully with all utility components of the COMPANY or other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.7 SITE ACCESS TIME

A. The CONTRACTOR shall propose working hours and days of operation for review and approval by the COMPANY.

1.8 CONTRACTOR USE OF SITE

A. The CONTRACTOR's use of the Site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.

1.9 OUTAGE PLAN AND REQUESTS

A. Unless the Contract Documents indicate otherwise, the CONTRACTOR shall not remove from service, de-energize, or modify settings for any existing operating tank pipeline, valve, channel, equipment, structure, road, or any other facility without permission from the COMPANY.

B. Where the WORK requires modifications to existing facilities or construction of new facilities and connection of new facilities to existing facilities, the CONTRACTOR shall

submit a detailed outage plan and schedule for the ENGINEER'S approval a minimum of 2 weeks in advance of the time that such outage is planned.

C. A completed System Outage Request form (blank furnished by the ENGINEER) shall accompany each outage plan. The outage plans shall be coordinated with the construction schedule and shall meet the restrictions and conditions of the Contract Documents. The outage plan shall describe the CONTRACTOR's method for preventing bypassing of other treatment units; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring, and alarms for the treatment plant processes; and the manpower, plant, and equipment which the CONTRACTOR will furnish for proper operation of associated treatment units. All costs for preparing and implementing the outage plans shall be at no increase in cost to the COMPANY.

D. The ENGINEER shall be notified in writing at least one week in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required.

E. The CONTRACTOR shall provide written confirmation of the shutdown date and time two working days prior to the actual shutdown.

1.10 COMPANY USE OF THE SITE

A. The COMPANY may utilize all or part of the Site during the entire period of construction for the conduct of the COMPANY's normal operations. The CONTRACTOR shall cooperate and coordinate with the COMPANY to facilitate the COMPANY's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the COMPANY shall be allowed access to the Site during the period of construction.

1.11 PROJECT MEETINGS

A. Project meetings shall be conducted in accordance with Section 01200 – Project Meetings.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01015 – REMEDIAL ACTION WORK PLANS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall review and conduct all work in substantial compliance with COMPANY provided Remedial Action Work Plans (RAWPs) included in the Contract Documents.

B. The RAWPs are part of the many work elements performed by the COMPANY pursuant to the remedial action.

C. The RAWPs present the organization, objectives, and activities associated with the implementation of the Selected Remedy at the Midnite Mine Superfund Site.

1. The objectives of the RAWPs include:

a. Identifying the elements, tasks, activities, and construction sequencing to implement the remedial action

b. Defining the scope of each task and the associated procedures for successful completion of each task

c. Establishing methods and controls for meeting the established remedial action objectives

D. The RAWP's listed in this Section are directly related to WORK conducted by the CONTRACTOR. Individual specification sections, where appropriate, call the CONTRACTOR's attention to the related RAWP's to facilitate compliance. The following RAWP's are included with the Contract Documents:

1. Remedial Action Work Plan (Master Document)

2. Master Stormwater Management Plan (SWMP)

3. Staging/Temporary Stockpiling Plan

4. Analytical Support and Verification Plan for Remediation of Surface Materials and Sediments

5. Construction Quality Assurance Plan (CQAP)

6. Rock Fall Protection Plan

7. Spill Prevention, Control, and Countermeasures (SPCC) Plan

8. Construction Contingency Plan

9. Remedial Action Health and Safety Plan (HASP)

10. Revegetation Plan

11. Institutional Controls, Implementation, and Assurance Plan (ICIAP)

12. Well Decommissioning Plan

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01018 – CONSTRUCTION SURVEYING AND STAKING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary to perform all surveying and staking necessary for the completion of the Project in conformance with the Drawings and Specifications and standard engineering and surveying practices, including all calculations required to accomplish the WORK.

B. Primary grade control for fill placement and cover placement in waste containment areas shall be by GPS guidance systems for the heavy equipment conducting the WORK.

C. The Construction Survey work shall include:

1. Staking, referencing and all other actions as may be required to preserve and restore land monuments and property corners which are situated within the Project area

2. Establishing control points as shown on the Drawings and as otherwise needed to provide adequate staking as to perform the WORK.

3. Performing construction staking.

4. Performing construction as-built surveys.

5. Performing construction quantity surveys.

6. Settlement monitoring shall be conducted in accordance with Specification Section 01535S – Settlement Monitoring.

D. The Construction Staking work shall include slope staking for grading operations and offset staking for grades, structures and alignments and other items shown on the Drawings and as required to perform the WORK.

E. Horizontal survey control is Washington State Plane North Zone, NAD 83 US Feet.

1.2 SUBMITTALS

A. Submit in accordance with Section 01300 – Contractor Submittals.

B. The CONTRACTOR shall submit an electronic copy of all surveyors' notes on a quarterly basis. Surveyor's notes shall be scanned and submitted in Adobe Acrobat PDF format

C. **As-Built Drawings and Survey Data Submittals**

1. Drawings and Survey Data from quarterly and annual as-built surveys conducted in accordance with Paragraph 3.4 of this Section shall be submitted within 30 days of completion of survey. Each As-Built submittal package shall include a CD, DVD or USB drive with the following electronic files:

a. All raw survey data.

b. ACAD Drawings of topographic surfaces (AutoCad 2010 Format)

c. Scanned Adobe Acrobat PDF files of all field/survey notes

d. Photographs, or other field data collected by the survey crew.

D. Unacceptable Drawings

1. As-Built survey shall be reviewed by the ENGINEER and incomplete As-Built Drawings will not be accepted.

2. The CONTRACTOR shall revise rejected drawings and resubmit within 10 Days.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 ACCURACY OF SURVEYS

A. Points for cross sections and topographic surveys shall be located to the nearest 0.1 ft horizontally and vertically.

B. Vertical elevation surveys shall close within 0.01 ft times the square root of the length of the circuit in miles.

C. All grade stakes shall be set to 0.1 ft.

D. Alignment of tangents and curves shall be within 0.1 ft.

E. Points for structures shall be set to the nearest 0.1 ft, except where operational function of special features require closer tolerances.

F. Tolerances for all other Work shall be as shown or specified in the Contract Documents.

G. Survey instruments shall be accurate and shall be subject to inspection by ENGINEER for proper operation.

1. Electronic distance measuring (EDM) instruments used by CONTRACTOR on the Site shall be checked for calibration a minimum of once per month on an established base line approved by ENGINEER. Calibration results shall be kept in a log book, available for ENGINEER’s review, showing the date and distances measured on the base line. An EDM shall not be used if it does not meet the minimum advertised accuracy published by the manufacturer of the EDM.

2. Defective instruments shall be promptly replaced, repaired, or adjusted to operate within the tolerances of the instrument manufacturer.

H. All work not performed with the methods and equipment as submitted by CONTRACTOR and accepted by ENGINEER shall be removed and replaced by CONTRACTOR at his own expense.

I. The ENGINEER may randomly spot-check the CONTRACTOR’S surveys, staking and computations at the ENGINEER'S discretion. After the survey or staking has been completed, the CONTRACTOR shall provide the ENGINEER with a minimum of 24 hours notice prior to performing any WORK, and shall furnish the appropriate data as

required, to allow for such random spot-checking; however, the COMPANY assumes no responsibility for the accuracy of the WORK.

3.2 SURVEY CONTROL

A. All surveying involving property lines or monuments shall be done by, or under the direction of, a Registered Land Surveyor licensed in the State of Washington.

B. The CONTRACTOR shall use competent, qualified personnel and suitable equipment for the layout work required and shall furnish all stakes, templates, straightedges and other devices necessary for establishing, checking and maintaining the required points, lines and grades.

C. The COMPANY shall supply information relative to the approximate locations of monuments and corners, but final responsibility for locations, referencing, and restoration shall rest with the CONTRACTOR.

D. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No excavation or other work shall be started until all survey or other permanent marker points that will be disturbed by the excavation or work have been properly referenced. Survey markers or points disturbed by the CONTRACTOR shall be accurately restored after the work has been completed.

E. In the event the CONTRACTOR does not replace the survey monuments and property corners disturbed by the CONTRACTOR'S operations, the COMPANY may, after first notifying the CONTRACTOR, replace the monuments in question. The cost of such replacements shall be deducted from payments to the CONTRACTOR.

F. The CONTRACTOR shall obtain all information necessary for as-built plan production, from actual measurements and observations made by its own personnel, including Subcontractors.

3.3 CONSTRUCTION STAKING

A. The CONTRACTOR shall perform all staking necessary to delineate clearing and/or grubbing limits; all cross sections necessary for determination of excavation and embankment quantities, including intermediate and/or remeasure cross sections as may be required; all slope staking; all staking of culverts and drainage structures, including the necessary checking to establish the proper location and grade to best fit the conditions on site; the setting of such finishing stakes as may be required; the staking of right-of-way; the taking, reference and other actions as may be required to preserve or restore land monuments and property corners; and all other staking necessary to complete the project.

3.4 ANNUAL AERIAL PHOTOGRAPHY

A. The COMPANY shall perform annual site aerial photography.

3.5 AS-BUILT SURVEYS

A. The CONTRACTOR shall perform and provide annual topographic surveys of all disturbed areas during the WORK. Annual topographic surveys shall be conducted on or about the anniversary of the date of commencement as stated on the Notice-To-Proceed.

B. The CONTRACTOR shall perform and provide topographic surveys of all completed excavations, including stockpiles (all types), overburden piles, pits, mine waste excavation areas, contaminated soil and sediment excavation areas.

C. **Pit 3 and Pit 4 Waste Containment Area (WCAs) and Mine Waste Excavation As-Built Surveys**

1. The CONTRACTOR shall perform and provide as-built surveys of the final excavated surface of the Pit 3 and Pit 4 Waste Containment Areas (WCAs), prior to placement of the underdrain drain gravel. As-builts surveys of excavated WCAs shall include:

   a. Topographic survey of the entire excavated surface;

   b. Detailed survey of underdrain sumps.

2. The CONTRACTOR shall perform an as-built survey of the completed sub-waste liner systems of the Pit 3 and Pit 4 WCAs, before placement of the overliner protection layer. As-builts surveys of the sub-waste liner systems shall include:

   a. Topographic survey of the entire liner system surface;

   b. Detailed survey of dewatering sumps.

3. The CONTRACTOR shall perform quarterly as-built topographic surveys of the Pit 3 and Pit 4 WCAs during placement of mine waste and the associated excavation areas. Quarterly as-built surveys of excavation and disposal shall include:

   a. Topographic surveys of the WCAs.

   b. Topographic surveys of all active excavation areas during the quarterly period between surveys.

   c. Delineation of pit slope drains.

   d. Location and elevation of dewatering riser pipes.

4. The CONTRACTOR shall perform as-built topographic surveys of the geomembrane cover of the WCAs for each phase of construction. Geomembrane cover surveys shall be conducted prior to placement of cover soils.

   a. Topographic surveys of the completed liner surface shall be of sufficient detail to use for GPS guided equipment placement of the soil cover and final cover grading.

5. The CONTRACTOR shall perform as-built topographic surveys of the completed soil cover of the WCAs for each phase of construction.

3.6 QUANTITY SURVEYS

A. As-built surveys required by Paragraph 3.4 shall be used as the basis for verifying final quantities of excavations and fills for the WORK in the subject areas. Calculations and quantities shall be provided to the ENGINEER for review.

B. The CONTRACTOR shall conduct additional quantity surveys as needed of all borrow areas and fill areas not subject to the as-built surveys required by Paragraph 3.4. Quantity surveys shall include topographical surveys of these areas before the WORK commences and upon completion of the construction phase or completion of the WORK in the subject area. Calculations and quantities shall be provided to the ENGINEER for review.

3.7 SURVEY NOTES

A. Field notes shall be kept in standard bound notebooks in a clear, orderly and neat manner, consistent with standard engineering and surveying practices. The CONTRACTOR'S field books shall be available for inspection by the ENGINEER at any time.

B. All field survey notes, including those which become source documentations for which quantities for payment are computed, shall be recorded by a notekeeper furnished by the CONTRACTOR. The notekeeper shall be thoroughly familiar with generally accepted standards of good survey notekeeping practice.

C. The CONTRACTOR shall make all field survey notes available for inspection if requested by the ENGINEER.

D. The CONTRACTOR shall submit copies of all field survey notes on a quarterly basis during the WORK in accordance with Paragraph1.3 of this Section.

- END OF SECTION -

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SECTION 01060 – PERMITS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall comply with the conditions and requirements of all ARARs and substantive requirements of permits that would be required absent CERCLA. If CONTRACTOR fails to comply with the conditions and requirements of any ARARs and substantive requirements of permits that would be required absent CERCLA and such failure to comply results in fines, penalties, and/or suspension of WORK by a regulatory agency, all liability for such fines, penalties and delays shall be the sole responsibility of the CONTRACTOR.

B. The CONTRACTOR shall comply with the EPA-approved ARAR's Compliance Plan when planning for and conducting the WORK.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. CONTRACTOR shall submit all CONTRACTOR obtained permits to the COMPANY and ENGINEER.

1.3 CONTRACTOR OBTAINED PERMITS

A. The CONTRACTOR is responsible for researching and complying with all ARARs and substantive requirements of permits that would be required absent CERCLA and obtaining all permits as may be required by National and local law for performing the WORK. Duly executed copies of all permits obtained by the CONTRACTOR shall be submitted to the COMPANY and ENGINEER for information only.

1.4 RESPONSIBILITY AND COORDINATION

A. The CONTRACTOR shall contact all national and local agencies to obtain permitting requirements for construction related activities and become familiar with permitting requirements that must be met for the performance of the Contract WORK. The CONTRACTOR shall perform all coordination and documentation, as well as all engineering to obtain the required permits.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- PRODUCTS (NOT USED)

- END OF SECTION -

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SECTION 01070 - ABBREVIATIONS

PART 1 -- GENERAL

1.1 GENERAL

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only.

B. As a guide to the user of the Specifications, the following acronyms or abbreviations which may appear shall have the meanings indicated herein.

1.2 ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
BODR	Basis of Design Report
BMP	Best Management Practice
BPA	Backfilled Pit Area
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSPCCP	Construction Spill Prevention Control and Countermeasure Plan,
CSWPPP	Construction Stormwater Pollution Prevention Plan
CQAP	Construction Quality Assurance Plan
CWA	Clean Water Act
Dawn	Dawn Mining Company
DMC	Dawn Mining Company
EAR	East Access Road
HASP	Health and Safety Plan
ICIAP	Institutional Control, Implementation, and Assurance Plan
MA	Mine Area or Mined Area
MAA	Mine Affected Area
MGC	Miller Geotechnical Consulting
MWH	MWH Americas, Inc.
NEPA	National Environmental Policy Act
Newmont	Newmont USA Limited
NPDES	National Pollutant Discharge Elimination System
PCP	Pollution Control Pond
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAC	Remedial Action Contractor
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
Site	Midnite Mine Superfund Site
SOP	Standard Operating Procedure
SOW	Scope of Work or Statement of Work
SMP	Site-Wide Monitoring Plan

SPCCP	Spill Prevention Control and Countermeasure Plan
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRP	South Waste Rock Pile
Tribe	Spokane Tribe of Indians
TERO	Tribal Employment Rights Ordinance
WAR	West Access Road
WCA	Waste Containment Area
WDOH	Washington Department of Health
WME	Worthington Miller Environmental
WTP	Water Treatment Plant

1.3 ABBREVIATIONS OF INSTITUTIONS

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Bearing Manufacturer's Association
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
AF&PA	American Forest and Paper Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AIHA	American Industrial Hygiene Association
AIIM	Association for Information and Image Management
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMA	Acoustical Material Association
AMCA	Air Movement and Control Association International, Inc.
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	The Engineered Wood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARI	Air-Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASQ	American Society for Quality
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWCI	American Wire Cloth Institute
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association

AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CABO	Council of American Building Officials
CDA	Copper Development Association
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CLPCA	California Lathing and Plastering Contractors Association
CMAA	A division/section of the Material Handling Industry of America
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drilling Manufacturer's Association
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOI	United States Department of the Interior
DOJ	United States Department of Justice
EI	Energy Institute
EIA	Electronic Industries Alliance
EPA	Environmental Protection Agency
ETL	Electrical Test Laboratories
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
FEMA	Federal Emergency Management Association
FHWA	Federal Highway Administration
FM	Factory Mutual System
FPL	Forest Products Laboratory
HI	Hydronics Institute, Hydraulic Institute
HSWA	Federal Hazardous and Solid Waste Amendments
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
ICCEC	Electrical Code
ICC-ES	International Code Council Evaluation Service
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFC	International Fire Code
IFGC	International Fuel Gas Code
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code, Association Connecting Electronic Industries
IRC	International Residential Code
ISA	Instrument Society of America
ISDI	Insulated Steel Door Institute
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers

ITU-T	Telecommunications Standardization Sector of the International Telecommunications Union
LPI	Lightning Protection Institute
LRQA	Lloyd's Register Quality Assurance
MBMA	Metal Building Manufacturer's Association
MIL	Military Standards (DoD)
MPTA	Mechanical Power Transmission Association
MSHA	Mine Safety and Health Administration
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
DASMA	Door and Access Systems Manufacturers Association International
NAPF	National Association of Pipe Fabricators
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors
NCCLS	National Committee for Clinical Laboratory Standards
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association or National Fluid Power Association
NISO	National Information Standards Organization
NIST	National Institute of Standards and Technology
NLGI	National Lubricating Grease Institute
NRC	Nuclear Regulatory Commission
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PPI	Plastic Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service, a division of the California Redwood Association, CRA
RMA	Rubber Manufacturers Association
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturers' Association
SAE	Society of Automotive Engineers
SDI	Steel Door Institute, Steel Deck Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPFA	Steel Plate Fabricator's Association
SPIB	Southern Pine Inspection Bureau
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Society for Protective Coating
SSPWC	Standard Specifications for Public Works Construction
STLE	Society of Tribologists and Lubricating Engineers
TAPPI	Technical Association of the Worldwide Pulp, Paper, and Converting Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industries Association
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.

USGS	United States Geological Survey
WCLIB	West Coast Lumber Inspection Bureau
WDMA	National Window and Door Manufacturers Association
WEF	Water Environment Federation
WI	Woodwork Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01090 - REFERENCE STANDARDS

PART 1 -- GENERAL

1.1 GENERAL

A. **Titles of Sections and Paragraphs:** Titles and subtitles accompanying specification sections and paragraphs are for convenience and reference only and do not form a part of the Specifications.

B. **Applicable Publications:** Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is indicated, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Contract is advertised for Bids shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth in the Specifications or shown on the Drawings will be waived because of any provision of or omission from said standards or requirements.

C. **Specialists, Assignments:** In certain instances, specification text requires (or implies) that specific WORK is to be assigned to specialists or expert entities who must be engaged to perform that WORK. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the WORK; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of WORK is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The CONTRACTOR shall construct the WORK in accordance with the Contract Documents and the referenced portions of those referenced codes, standards, and specifications.

B. References to "Building Code" or International Building Code" shall mean International Building Code of the International Code Council (ICC) as amended by the local jurisdiction. "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for Bids shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and direction prior to ordering or providing any materials or furnishing labor. The CONTRACTOR shall bid for the most stringent requirements.

D. References to "OSHA Regulations for Construction" shall mean **Title 29, Part 1926, Construction Safety and Health Regulations,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References to "OSHA Standards" shall mean **Title 29, Part 1910, Occupational Safety and Health Standards,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

F. **Applicable Standard Specifications**: References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction.

G. **Applicable Safety Standards**: References to “Wash-OSHA" shall mean State of Washington, Department of Labor and Industries, as amended to date, and all changes and amendments thereto.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The CONTRACTOR shall be responsible that all WORK included in the Contract Documents, regardless if indicated or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other federal, state, and local regulations governing the storage and conveyance of hazardous materials, including petroleum products.

B. Where no specific regulations exist and the COMPANY has not waived the requirement in writing, chemical, hazardous, and petroleum product piping and storage in underground locations shall be double containment piping and tanks or be installed in separate concrete trenches and vaults with an approved lining that cannot be penetrated by the chemicals.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01200 – PROJECT MEETINGS

PART 1 -- GENERAL

1.1 SUMMARY

A. This Specification Section covers the minimum requirements for meetings between the CONTRACTOR and COMPANY.

1.2 PRECONSTRUCTION CONFERENCE

A. Prior to the commencement of work at the Site, a Preconstruction Conference will be held at a mutually agreed date, time and location. The conference shall be attended by the CONTRACTOR's Project Manager, its superintendent, and its major subcontractors. Other attendees will be:

1. Representatives of COMPANY.

2. ENGINEER.

3. Government and Tribal representatives as appropriate.

4. Others as requested by CONTRACTOR, COMPANY, or ENGINEER.

B. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with Section 01300 - Contractor Submittals.

C. The purpose of the conference is to designate responsible personnel, initiate lines of communication, and establish working relationships. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. However, the CONTRACTOR should be prepared to discuss the items listed below.

1. Status of CONTRACTOR's insurance and bonds.

2. Transmittal, review, and distribution of CONTRACTOR's submittals.

3. Completed Submittal Register.

4. Processing applications for payment.

5. Maintaining record documents.

6. CONTRACTOR’s construction schedule and critical work sequencing.

7. Request for Information (RFIs) requests, field decisions and Change Orders.

8. Use of access roads and Site, office and storage areas, security, housekeeping, and COMPANY's needs.

9. Major material deliveries and priorities and potential Site accessways.

10. CONTRACTOR's assignments for safety, health and first aid.

11. Daily Report Form which the ENGINEER will furnish.

12. Submittal Transmittal Form which the ENGINEER will furnish.

13. Reviewing the Drawings and Specifications.

14. Reviewing work plans and other contract compliance documents.

15. Draft Baseline Construction Schedule

D. The ENGINEER will preside at the Preconstruction Conference and will arrange for keeping and distributing the minutes to all persons in attendance.

E. The CONTRACTOR and its subcontractors should plan on the conference taking no less than 1 full working day. The day will cover the items listed in Paragraph 1.2 C, and on reviewing the Drawings and Specifications, in extensive detail, with the ENGINEER and the COMPANY.

1.3 PROJECT PROGRESS MEETINGS

A. Project Progress Meetings between the ENGINEER, the CONTRACTOR, and all subcontractors active on the Site shall be held weekly at the Site in accordance with a mutually acceptable schedule. More frequent meetings may be called as directed by the ENGINEER as conditions may arise.

B. The Project Progress Meetings shall enable orderly review of progress during construction. The purpose of meetings will be to review the progress of the WORK as compared to the CONTRACTOR’s submitted and approved schedule, discuss changes in scheduling, efforts the CONTRACTOR is taking or will undertake to get WORK back on schedule if activities are behind schedule, maintain coordination of efforts, coordinate issues relative to the work of any other contractors on Site, and resolve other problems which may develop.

C. During each meeting, the CONTRACTOR shall present any issues that may impact its progress with a view to resolving these issues expeditiously. CONTRACTOR is encouraged to submit recommendations for improving safety, efficiency, constructability, and energy reduction for the consideration of the COMPANY and the ENGINEER.

D. Relationships between the CONTRACTOR and its subcontractors and suppliers, are the CONTRACTOR's responsibility. When permitted by the ENGINEER, subcontractors, suppliers, and others may be invited to attend or call in to Project Progress Meetings in which their aspects of the work are involved, but the CONTRACTOR shall remain wholly responsible for obligations under the Contract.

E. Persons designated by the CONTRACTOR to attend and participate in Project Progress Meetings shall have all required authority to commit the CONTRACTOR to any actions as agreed upon in the Project Progress Meetings. To the maximum extent practicable, the CONTRACTOR shall appear in person or assign the same person or persons as representatives at Project Progress Meetings throughout the construction period. The CONTRACTOR's superintendent shall attend each meeting.

F. The ENGINEER will preside at the Project Progress Meetings and will arrange for keeping and distributing the minutes.

1.4 SPECIAL PROJECT MEETINGS

A. The ENGINEER may call special project meetings to be convened during the interim period between regular Project Progress Meetings. The time and place of special project meetings will be established by the ENGINEER. Notice of special meetings will be announced as far in advance as practicable.

B. One such special project meeting shall be held at the completion of each phase of construction to discuss completed construction, lessons learned, each phase punch list, and planned construction schedule and processes for the upcoming construction phase. The meeting will be held at a mutually agreed upon date in the months preceding commencement of the each construction phase. The CONTRACTOR, COMPANY and ENGINEER shall attend.

1.5 MINUTES OF MEETING

A. The ENGINEER will take minutes of each project meeting and these minutes will be issued by the ENGINEER in draft form to the COMPANY and CONTRACTOR. One approved copy will be distributed to each organization that might be concerned with the proceedings.

B. Minutes, when issued, will be considered to be an accurate representation of the proceedings and decisions of the meeting, except as corrected in accordance with Paragraph 1.5.C.

C. Corrections to minutes shall be settled as a priority under old business at the next regularly scheduled meeting.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

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SECTION 01300 - CONTRACTOR SUBMITTALS

PART 1 -- GENERAL

1.1 SUMMARY

A. Wherever submittals are required by the Contract Documents, submit them to the ENGINEER in accordance with the requirements of this Section. The requirements of this Section apply to all Submittals unless specifically noted on the Drawings or in individual specification sections.

B. Several specific work and safety plans are required by the Contract Documents and shall be submitted in accordance with the requirements of this section. These include, but may not be limited to, the following:

1. Construction Storm Water Pollution Prevention Plan (CSWPPP). Refer to Section 01570.

2. Construction Spill Prevention, Control, and Countermeasures Plan. Refer to Section 01575 – Spill Prevention Control and Countermeasures Plan

3. Submittals required by Section 01585 – Green and Sustainable Practices. Refer to Section 01585, Part 1.3.

4. Marine Installation Plan. Refer to Section 01500 – Marine Installation Requirements.

5. Construction Dewatering Plan. Refer to Section 02140 – Dewatering and Control of Water

6. Shoring Plan. Refer to Section 02200 - Earthwork.

7. Rock Fall Protection Plan. Refer to section 02205 – Mine Waste Excavation and Disposal

8. Blasting Plan. Refer to Section 02210 – Blasting.

C. Within 14 days after the date of commencement as stated in the Notice to Proceed, submit the following items for review:

1. Submittal Schedule

a. Submit a preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("or equal") submittals listed in the Bid. Where multiple Submittals are expected under a particular specification section each package should be identified in the Submittal Schedule.

b. Base the schedule of submittals on CONTRACTOR's priority, planned construction sequence and schedule, long-lead items, and size of submittal package.

c. Allow time for resubmittals.

2. Submit a list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. At the preconstruction conference of Section 01200 Project Meetings, submit the following items to the ENGINEER for review:

1. Revised schedule of Shop Drawings, Samples, and proposed Substitution ("or-equal") submittals listed in the Bid;

2. List of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit (Refer to Specification Section 01060 - Permits;

3. Preliminary Schedule of Values in accordance with Section 01301 – Schedule of Values;

4. a 120-day bar chart plan of operation schedule in accordance with Section 01310 – Construction Schedule; and,

5. a project overview bar chart in accordance with Section 01310 – Construction Schedule;

6. Submittal Register

1.3 SHOP DRAWINGS AND GENERAL SUBMITTALS

A. Wherever called for in the Contract Documents or where required by the ENGINEER, furnish an email electronic copy of each Submittal. Electronic submittals shall be in Adobe Acrobat portable document format (pdf) and shall be printed directly from the software generating the information. Illegible pdf documents made by scanning of hard copies, and which are not easily readable, shall be rejected.

B. Shop Drawings include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items.

C. CONTRACTOR shall provide at least one full size, hard copy of each final, approved, reinforcing steel submittal to the ENGINEER.

D. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the State of Washington, unless otherwise indicated.

E. Transmittal Form

1. Shop drawing submittals shall be accompanied by the ENGINEER's standard submittal transmittal form, a reproducible copy of which is available from the ENGINEER.

2. A submittal without the form, or where applicable items on the form have not been completed, will be returned for resubmittal.

F. Organization

1. Use a single submittal transmittal form for each technical specification Section or item or class of material or equipment for which a submittal is required.

2. A single submittal covering multiple Sections will not be accepted, unless the primary specification references other Sections for components: For example, if a pump Section references other Sections for the motor, shop-applied protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be accepted, whereas a single submittal covering vertical turbine pumps and horizontal split-case pumps would not be accepted.

3. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components.

4. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title, room number, or building name, as applicable.

5. Unless otherwise indicated, match terminology and equipment names and numbers used in the submittals with those used in the Contract Documents.

G. Format

1. Minimum sheet size shall be 8-1/2 inches by 11 inches, and maximum sheet size shall be 24 inches by 36 inches.

2. Number every page in a submittal in sequence.

3. Collate and staple or bind, as appropriate, each copy of a submittal; the ENGINEER will not collate sheets or copies.

4. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports.

5. Present a sufficient level of detail for assessment of compliance with the Contract Documents.

6. Numbering

   a. Assign to each Submittal a unique number as follows:

      1) five-digit number corresponding to the Specification Section to which the Submittal is responding,

      2) followed by a two-digit submittal number in sequential order,

      3) followed by a two-digit submittal number in sequential order to distinguish between the original Submittal and each resubmittal.

   b. For example, 03300-03.01 indicates that the Submittal responds to the requirements of Section 03300 – Cast-In-Place Concrete (03300), is the third (03) Submittal under that section and is the first (01) resubmittal of the product(s) of the unique Submittal.

c. Number the Submittals sequentially for each Specification section, with the submittal numbers clearly noted on the transmittal.

H. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

I. ENGINEER's Review

1. Except as otherwise indicated, the ENGINEER will return prints of each submittal to the CONTRACTOR with comments noted thereon, within 21 Days following receipt by the ENGINEER.

2. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the first resubmittal on an item.

3. The COMPANY reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the first resubmittal.

4. The ENGINEER'S maximum review period for each submittal or resubmittal will be 21 Days; thus, for a submittal that requires 2 resubmittals before it is complete, the maximum review period could be 63 Days.

J. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.

K. If a submittal is returned marked "MAKE CORRECTIONS NOTED," the CONTRACTOR shall make the corrections on the submittal, but formal revision and resubmission will not be required.

L. Resubmittals

1. If a submittal is returned marked "AMEND-RESUBMIT," the CONTRACTOR shall revise the submittal and resubmit the required number of copies.

2. Resubmittal of portions of multi-page or multi-drawing submittals will not be accepted: For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND-RESUBMIT," the submittal as a whole is deemed "AMEND-RESUBMIT," and 10 drawings are required to be resubmitted.

3. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

M. Rejected Submittals

1. If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either that the proposed material or product:

a. does not satisfy the Specification,

b. the Submittal is so incomplete that it cannot be reviewed,

c. is disorganized,

d. is illegible, or

e. is a substitution request not submitted in accordance with Section 01600 – Products, Materials, Equipment, and Substitutions.

2. In the first four cases, the CONTRACTOR shall prepare a new submittal and shall submit the required number of copies.

3. In the latter case, the CONTRACTOR shall submit the substitution request according to the requirements of Section 01600 – Products, Materials, Equipment, and Substitutions.

4. The resubmittal of rejected portions of a previous submittal will not be accepted.

N. Construction, fabrication or procurement of an item may commence only after the ENGINEER has reviewed the pertinent Submittals and returned the Submittal to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Starting construction, fabrication or procurement of an item marked as "MAKE CORRECTIONS NOTED" may commence only if the CONTRACTOR accepts all corrections noted, otherwise further discussion and resubmittal is required. Commencing construction, fabrication or procurement of items of Submittals marked as "MAKE CORRECTIONS NOTED" and not accepted by the CONTRACTOR, "AMEND-RESUBMIT" or "REJECTED-RESUBMIT" shall be at the sole risk of the CONTRACTOR.

O. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

P. Review by CONTRACTOR

1. Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission to the ENGINEER.

2. Each submittal shall be dated and signed by the CONTRACTOR as being correct and in strict conformance with the Contract Documents.

3. In the case of Shop Drawings, each sheet shall be so dated and signed.

4. Any deviations from the Contract Documents shall be noted on the transmittal sheet.

5. The ENGINEER will only review submittals that have been so verified by the CONTRACTOR.

6. Non-verified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

Q. Conformance

1. Corrections or comments made on the CONTRACTOR's Shop Drawings during review shall not relieve the CONTRACTOR from compliance with Contract Drawings and Specifications.

2. Review is for conformance to the design concept and general compliance with the Contract Documents only.

3. The CONTRACTOR shall be responsible for confirming and correlating quantities and dimensions, fabrication processes and techniques, coordinating WORK with the trades, and satisfactory and safe performance of the WORK.

1.4 SAMPLES

A. Quantity

1. The CONTRACTOR shall submit the number of samples indicated by the Specifications.

2. If the number is not indicated, submit not less than 3 samples.

3. Where the quantity of each sample is not indicated, submit such quantity as necessary for proper examination and testing by the methods indicated.

B. Identification and Distribution

1. Individually and indelibly label or tag each sample, indicating the salient physical characteristics and the manufacturer's name.

2. Upon acceptance by the ENGINEER, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set of samples will be retained by the ENGINEER, and one set shall remain at the Site in the ENGINEER's field office until completion of the WORK.

C. Selection

1. Unless otherwise indicated, the ENGINEER will select colors and textures from the manufacturer's standard colors and standard materials, products, or equipment lines.

2. If certain samples represent non-standard colors, materials, products, or equipment lines that will require an increase in Contract Times or Price, the CONTRACTOR shall clearly state so on the transmittal page of the submittal.

D. The CONTRACTOR shall schedule sample submittals such that:

1. Sample submittals for color and texture selection are complete so the ENGINEER has 30-Days to assemble color panels and select color- and texture-dependent products and materials without delay to the construction schedule; and,

2. After the ENGINEER selects colors and textures, the CONTRACTOR has sufficient time to provide the products or materials without delay to the construction schedule.

3. The Contract Times will not be extended for the CONTRACTOR's failure to allow enough review and approval or selection time, failure to submit complete samples requiring color or texture selection, or failure to submit complete or approvable samples.

1.5 TECHNICAL MANUAL

A. The CONTRACTOR shall submit technical operation and maintenance information for each item of mechanical, electrical, and instrumentation equipment in an organized manner in the Technical Manual.

B. The manual shall be written such that it can be used and understood by the COMPANY's operation and maintenance staff.

C. Technical Manual(s) shall contain all information which may be needed or useful for operation, maintenance, repair, dismantling or assembling, and for identification of parts for ordering replacements. The manual will be subject to ENGINEER's approval.

D. Categories

1. The Technical Manual shall be subdivided first by Specification Section number; second, by equipment item; and last, by "Category." The following "Categories" shall be addressed (as applicable):

a. Category 1 - Equipment Summary

1) Summary: A table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.

2) Form: The ENGINEER will supply an Equipment Summary Form for each item of mechanical, electrical, and instrumentation equipment in the WORK. The CONTRACTOR shall fill in the relevant information on the form and include it in Part 1.

b. Category 2 - Operational Procedures

1) Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:

Installation
Adjustment
Startup
Location of controls, special tools, equipment required, or related instrumentation needed for operation
Operation procedures
Load changes
Calibration
Shutdown
Troubleshooting
Disassembly
Reassembly
Realignment
Testing to determine performance efficiency
Tabulation of proper settings for pressure relief valves, low and high pressure switches, and other protection devices
List of all electrical relay settings including alarm and contact settings

c. Category 3 - Preventive Maintenance Procedures

1) Procedures: Preventive maintenance procedures shall include manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by maintaining the equipment in place.

2) Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

d. Category 4 - Parts List

1) Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.

2) Drawings: Cross-sectional or exploded view drawings shall accompany the parts list. Part numbers shall appear on the drawings with arrows to the corresponding part.

e. Category 5 - Wiring Diagrams

1) Diagrams: Category 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

f. Category 6 - Shop Drawings

1) Drawings: This category includes approved shop or fabrication drawings with ENGINEER comments and corrections incorporated, complete with dimensions.

g. Category 7 - Safety

1) Procedures: This category describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

h. Category 8 - Documentation:

1) Equipment warranties, affidavits, certifications, calibrations, laboratory test results, etc. required by the Technical Specifications shall be placed in this category.

E. Format

1. Bind each Technical Manual in standard size 3-ring hardcover binders, labeled on the spine and cover with Project name, COMPANY's project number, Specification Section number, equipment name, and equipment identification number

2. Each Binder shall contain its own detailed table of contents at the front, plus a summary level table of contents information for the other binders in a multi-binder set.

3. Documents in binders shall be 3-hole punched, with no text punched out, and pages larger than 8-1/2 by 11 shall be folded to 8-1/2 by 11 size.

4. Provide a CD with electronic files with each part of the O&M Manual in clearly legible Adobe Acrobat pdf format.

F. Review Process

1. Furnish 3 draft Technical Manuals for each Specification Section that requires a manual.

2. The ENGINEER will retain one copy, will forward one copy to the COMPANY, and will return one copy to the CONTRACTOR with review comments.

3. Incorporate comments and submit six identical hard copies of the final manual plus one electronic copy in Adobe Acrobat pdf format for acceptance. The pdf copy shall be provided in unprotected mode so it can be modified and added to as may become necessary.

G. Submittal and Corrections

1. Except as otherwise indicated, submit the manuals in final form to the ENGINEER not later than the 75 percent of construction completion time.

2. Discrepancies found by the ENGINEER shall be corrected within 30 Days from the Date of written notification by the ENGINEER.

H. Manuals that are incomplete or unacceptable at the schedule criterion above will constitute sufficient justification for the COMPANY to retain the amount in Paragraph "Technical Manual Submittals" of Section 01700 – Project Closeout, from any monies due the CONTRACTOR.

1.6 SPARE PARTS LIST

A. General

1. Furnish to the ENGINEER 5 identical sets of spare parts information for mechanical, electrical, and instrumentation equipment.

2. The spare parts list shall include those spare parts that each manufacturer recommends to be maintained by the COMPANY in inventory.

B. Sources and Pricing

1. The spare parts list shall include a current list price of each spare part.

2. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts, to assist the COMPANY in ordering.

C. Format

1. Cross-reference the spare parts lists to the equipment numbers designated in the Contract Documents.

2. The spare parts lists shall be bound in standard-size, 3-ring, loose-leaf, vinyl plastic, hard-cover binders suitable for bookshelf storage.

3. The binder ring size shall not exceed 2-1/2 inches.

4. Each copy of the spare parts lists shall be accompanied by a CD containing the lists in electronic format, in files created under Microsoft Office 2010.

1.7 CONTRACTOR RED-LINE DRAWINGS

A. Maintain one set of full-size Contract Drawings at the Site for the preparation of Redline Drawings.

1. On this set, mark changes to location, configuration, material, dimension, and any other change or deviation to the drawing details, cross-sections and plan views which may differ from the Contract Drawings at the time of award except as noted below.

a. Grading changes do not require recording on Redline Drawings.

b. Contaminated soil and sediment excavation limits do not require recording on Redline Drawings.

c. Give special attention to recording the horizontal and vertical location of the following:

1) Buried utilities that differ from the locations indicated, or that were not indicated on the Contract Drawings.

2) Depths and locations of sumps.

3) Pipelines and pipe appurtenances.

2. Supplement the Redline Drawings with any detailed sketches as necessary or as directed, in order to fully indicate the WORK as actually constructed.

3. Use red ink or pencil for alterations and notes.

4. Notes shall identify relevant Change Orders, Substitutions, and RFI’s by number and date.

B. The Redline Drawings are the CONTRACTOR's representation of as-built conditions, shall include revisions made by addenda and change orders, and shall be maintained up-to-date during the progress of the WORK.

C. On-site Redline Drawings shall be accessible to the ENGINEER during the construction period for review.

D. Information submitted by the CONTRACTOR will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information.

E. Final Payment

1. Final payment will not be acted upon until the Redline Drawings and supplemental information has been completed, verified and submitted to the ENGINEER.

2. Redline Drawings are subject to review by the ENGINEER. CONTRACTOR shall revise and resubmit Redline Drawings based upon the ENGINEER’S review.

1.8 AS-BUILT SURVEYS

A. As-Built Surveys shall be conducted and submitted in accordance with Specification Section 01018 – Construction Survey and Staking.

1.9 QUALITY CONTROL (QC) SUBMITTALS

A. Quality control submittals are defined as those required by the Specifications to present documentary evidence to the ENGINEER that the CONTRACTOR has satisfied certain requirements of the Contract Documents.

B. Unless otherwise indicated, QC submittals shall be submitted:

1. Before delivery and unloading, for the following types of submittals:

a. Manufacturers' installation instructions

b. Manufacturers' and Installers' experience qualifications

c. Ready mix concrete delivery tickets

d. Design calculations

e. Affidavits and manufacturers' certification of compliance with indicated product requirements

f. Laboratory analysis results

g. Factory test reports

2. Within 30 Days of the event documented for the following types of submittals:

a. Manufacturers' field representative certification of proper installation

b. Field measurement

c. Field test reports

d. Receipt of permit

e. Receipt of regulatory approval

C. The ENGINEER will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01301 - SCHEDULE OF VALUES

PART 1 -- GENERAL

1.1 SUMMARY

A. This Section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed. Monthly progress payment amounts will be determined from the monthly progress updates of the CPM Schedule activities.

B. Develop the Schedule of Values independent of, but simultaneous with, the development of the CPM Schedule activities and logic.

1.2 DETAILED SCHEDULE OF VALUES

A. Prepare and submit a detailed Schedule of Values for every lump sum bid item to the ENGINEER within 30 Days from the date of Notice to Proceed.

B. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, furnish a sufficiently detailed breakdown in order to meet this requirement.

C. The ENGINEER will be the sole judge of acceptable numbers, details and description of values established.

D. If, in the opinion of the ENGINEER, a greater number of Schedule of Values items than proposed is necessary, add the additional items so identified by the ENGINEER.

E. Adjustments and Acceptance

1. The CONTRACTOR and ENGINEER shall meet and jointly review the detailed Schedule of Values within 7 Days from the receipt of the Schedule of Values by the ENGINEER, at which time the value allocations and extent of detail shall be reviewed in order to determine if necessary adjustments to the values are required, and to determine if sufficient detail has been proposed in order to allow acceptable cost loading of the CPM Schedule activities.

2. Make necessary adjustments to the value allocation or level of detail, and submit a revised detailed Schedule of Values within 7 Days from the date of meeting with the ENGINEER to discuss the initial submittal of the Schedule of Values.

3. Following acceptance of the detailed Schedule of Values, incorporate the values into the cost loading portion of the CPM Schedule.

4. Concurrently develop the CPM activities and logic with the development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities.

5. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these two documents will require changes to each document.

6. Schedule activities may need to be added to accommodate the detail of the Schedule of Values, and Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities.

7. Where such instances arise, propose changes to the Schedule of Values and to the CPM Schedule activities in order to satisfy the CPM Schedule cost loading requirements.

1.3 CROSS-REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, provide a cross-reference listing to be furnished in 2 parts:

1. In the first part, list each scheduled activity with the breakdown of the respective valued items making up the total cost of the activity; and,

2. In the second part, list the valued item with the respective schedule activity or activities that make up the total indicated cost.

B. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values), indicate the total cost for each Schedule of Value item.

C. Update and submit these listings in conjunction with the CPM monthly submittals.

D. Incorporate approved Change Orders reflected in the CPM Schedule into the Schedule of Values as a single unit identified by the Change Order number.

1.4 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Schedule which additional activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the ENGINEER.

B. Reduce other activity values in order to provide equal value adjustment increases for added activities, as approved by the ENGINEER.

C. In the event that the CONTRACTOR and ENGINEER agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01310 – CONSTRUCTION SCHEDULE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall schedule the Work in accordance with the contract documents.

B. Where submittals are indicated, submit 6 copies of each item.

1.2 PLAN OF OPERATION SCHEDULE

A. The CONTRACTOR shall prepare a work plan to complete the Work within the Contract Time. The CONTRACTOR shall generate a computerized Critical Path Method (CPM) schedule in the Precedence Diagram Method (PDM) format for the Work. The computerized format shall be generated with a current version of Primavera or other scheduling software as approved by the ENGINEER In addition to the construction activities, the schedule shall include activities for furnishing all required submittals. The Construction Schedule and supporting narrative shall be submitted for approval within ten (10) calendar days after Award of Contract. Failure of the CONTRACTOR to have a Contract Schedule approved by the COMPANY will be considered cause for withholding progress payment.

B. To the extent that the Construction Schedule or any revisions thereof contains anything not jointly agreed upon in writing, or fails to show anything jointly agreed upon in writing, it shall not be considered to have the approval of the COMPANY. Failure to include any work item required for performance of this contract shall not excuse the CONTRACTOR from completion of all work within applicable completion dates, regardless of the COMPANY's approval of the schedule.

C. Float is not for the exclusive use of either the COMPANY or the CONTRACTOR, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet contract milestones and the contract completion date.

D. The COMPANY reserves the right to rely on the accuracy of completed, current, and future activities depicted in the Construction Schedule.

E. Failure of the CONTRACTOR to comply with schedule requirements contained in this section will be considered cause for withholding progress payment or termination for default.

1.3 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit 2 schedule documents at the preconstruction meeting that shall serve as the CONTRACTOR's plan of operation for the contract time and shall identify the manner in which the CONTRACTOR intends to complete the Work within the contract time. The CONTRACTOR shall submit the applicable schedule-related reports and requests listed in Section 1.3.B.

B. Submit the following as indicated:

1. Construction Schedule (with narrative)

2. Monthly Progress Report

3. Construction Schedule Change Request

4. “As-Built” Construction Schedule

5. Two-week look ahead schedule with narrative

1.4 PRODUCT

A. Plot and Report Format

1. All plots and reports shall contain the project name, CONTRACTOR name, update number and data date, and scheduled finish date.

2. All plots shall be 11x17. Color plots are preferred, but not required.

3. All plots shall be time-scaled, with a time-line at the top of each page.

4. All reports shall be produced on 8-1/2X11 in. paper.

5. The initial schedule plots shall contain the following minimum information: activity number, activity description, original duration, early start, early finish, total float and the graphical depiction of the schedule.

1.5 EXECUTION

A. The Construction Schedule shall be a computerized CPM schedule in PDM format that includes the following:

1. The description, order, sequence, and interdependence of all significant WORK items (activities) including construction; procurement, testing, and inspection and delivery of critical or special materials and equipment; submittals and approvals of procedures, or other documents that could have a schedule impact. Tasks shall be limited to not more than fifteen working day durations unless otherwise agreed upon by the COMPANY, and shall identify specific tasks for assessing actual progress of the work. The schedule will include progress milestones which conform to the milestone summary schedule provided by the COMPANY to denote completion of individual work packages.

2. Work items that will be performed by subcontractors, utilities, and other third parties that may affect or be affected by CONTRACTOR’s activities.

3. Activities organized according to Work Breakdown Structure provided by the COMPANY. Proper referencing/coding of all WORK items to identify applicable geographical work areas, responsibilities such as subcontractors or other performing parties, type of work, and any other project-specific codes mutually agreed to between the COMPANY and the CONTRACTOR.

4. Resource quantities and cost for all estimated labor, equipment and material quantities assigned the individual work items which will require the resource.

5. A narrative that explains the basis for the CONTRACTOR’s determination of construction logic and estimated duration and man-hours. It shall include estimated quantities and production rates, hours per shift, work days per week, weather allowances, planned holidays, and types, number, and capacities of major construction equipment to be used.

B. The Construction Schedule shall be prepared to include the total duration, from Notice to Proceed through Final Completion, and the critical path shall be identified. No activity other than these milestones will be open-ended. Each activity will have predecessor and successor ties.

C. The CONTRACTOR shall submit the following documents upon completion of preparation of the Construction Schedule to the COMPANY and the ENGINEER:

1. A plotted bar chart, with time scale, of the CPM schedule network in PDM format. The WORK items shall be organized by Work Breakdown Structure.

2. A time-scaled plot of the CPM schedule network in PDM format showing all logic ties. The network shall be sorted by “Early Start” date and shall show a continuous flow from left to right, with no logic ties running from right to left.

3. Various computer generated Schedule Reports that contain the following data for each WORK item: identification, description, responsibility, duration, early start and early finish, late start and late finish, and total float. The WORK items shall be sorted by float, early start, project area, Subcontractor, or other sorts mutually agreed to. The reports shall also show the logic ties of successor and predecessor WORK items.

4. An electronic version of the deliverable shall be submitted.

5. The narrative described in Section 1.5.A.5.

1.6 PROGRESS REPORTING

A. At the end of each month, the CONTRACTOR and COMPANY shall agree on the progress of the Work and the CONTRACTOR shall update the Schedule accordingly. The updated Schedule is a prerequisite to the submittal of the CONTRACTOR’s Application for Progress Payment. The schedule shall be made in accordance with Section 1.5.

B. The CONTRACTOR shall send paper or electronic copies of the monthly Progress Report consisting of a written narrative and various schedule reports and plotted charts. This Report will be reviewed in a meeting between the CONTRACTOR, ENGINEER, COMPANY and Subcontractors.

1. The narrative report shall describe overall progress of the Work, the percentage completion status based upon actual physical work completed, and provide a critical path analysis. The narrative report shall also discuss significant problems including current and anticipated delaying factors and proposed corrective actions. In addition, the report shall describe all revisions to schedule logic, sequence, and activity duration, with reasons/justification for each change.

2. The schedule reports shall include reports as outlined in Section 1.3.B.

3. Plotted charts shall be provided showing CONTRACTOR’s project status. Show progress on each WORK item.

4. Electronic copies shall be provided as described in Section 1.5.

C. The CONTRACTOR shall provide a short-term, two-week look ahead bar chart and narrative. The two-week look ahead shall cover three weeks in total – activities that were

completed in the one week preceding, and activities that are active in the two weeks following the week ending data date. The narrative will provide clarification of planned or completed work (actual dates) dates of the start or completion of planned activities. The CONTRACTOR will include the mobilization and demobilization of each piece of equipment and a weekly summary of the workforce by supervisory position or craft. The two-week look ahead schedule is to be updated weekly and revised as necessary and be resubmitted to the ENGINEER and COMPANY.

D. If the latest completion time for any significant work item does not fall within the time allowed by the Contract Schedule, the sequence of WORK and/or duration shall be revised by the CONTRACTOR through concurrent operations, additional manpower, additional shifts, or overtime, additional equipment or alternative construction method until the schedule produced indicates that all significant contract completion, occupancy dates, and milestones will be met. No additional costs will be allowed if such expediting measures are necessary to meet the agreed completion date or dates, except as provided elsewhere in the Contract Documents.

E. After the updated schedule is approved by the COMPANY, it will become the approved contract Construction Schedule.

1.7 SCHEDULE CHANGES

A. The CONTRACTOR's request for Construction Schedule changes shall be made on the latest approved construction schedule and be accompanied by a narrative description and justification for the change. Minor revisions submitted at monthly progress review meetings are not considered as changes in this context.

B. The Construction Schedule may be changed when one or more of the following occur:

1. When a Change Order significantly affects the Contract Completion date or sequence of WORK items.

2. When the CONTRACTOR changes the sequence or duration of WORK items affecting the critical path, such changes will require prior approval of the CONTRACTOR, ENGINEER, and COMPANY.

3. When the COMPANY directs a change that alters the length of a critical path.

1.8 CONTRACT EXTENSIONS

A. Any determination of a time extension will be based upon analysis of the schedule current at the time the impacting event occurs, and upon all relevant data. If the COMPANY grants the CONTRACTOR an extension of time for Contract completion under the provisions of the Contract, the extension and relevant data shall be incorporated into the next monthly update of the schedule.

B. The CONTRACTOR acknowledges and agrees that delays in WORK items which, according to the schedule analysis, do not in fact actually affect the Contract completion date shown on the CPM network at the time of the delay, will not be the basis for a contract extension or for a compensable delay or other compensation adjustment.

1.9 DOCUMENTATION

A. After all Contract Work items are complete, the CONTRACTOR shall submit along with final application for payment, an “as-built” Contract Schedule showing actual start and finish dates for all WORK items.

1.10 PAYMENT

A. No separate payment will be made for WORK under this Section. The cost of the WORK described in this Section shall be included in the applicable bid item or lump sum contract price.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- PRODUCTS (NOT USED)

- END OF SECTION –

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SECTION 01400 - QUALITY CONTROL

PART 1 -- GENERAL

1.1 SUMMARY

A. CONTRACTOR shall establish a Quality Control (QC) system to perform sufficient inspection and tests of all work, including that of subcontractors, to ensure conformance with the Contract Documents.

B. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The term "Quality Control" includes inspection, sampling and testing, and associated requirements of the Specifications.

1.2 CONTRACTOR QUALITY CONTROL REQUIREMENTS

A. CONTRACTOR shall review and comply with the Remedial Action Construction Quality Assurance Plan (CQAP), included with the Contract Documents.

B. **QC Personnel:** CONTRACTOR shall provide a Quality Control Manager (CQM), responsible for coordinating the CONTRACTOR'S QC system and coordinating QC activities with the ENGINEER. The CQM shall be a member of the CONTRACTOR'S daily on-site staff. The CQM shall be responsible for:

1. Ensuring all CONTRACTOR performed tests and inspections are performed in accordance with the Technical Specifications.

2. Reviewing CONTRACTOR QC reports, tests, and inspection results to determine compliance with design plans and Technical Specifications, and other contractual documents.

3. Participating in the COMPANY'S four-phase inspection program (refer to the CQAP).

4. Documenting all CONTRACTOR performed QC activities, and submitting this documentation to the ENGINEER.

5. Rectifying nonconformances in a timely fashion.

6. Ensuring that CONTRACTOR personnel conducting inspections are adequately trained and understand assignment limits and time frames.

C. **Documentation**: The CONTRACTOR'S CQM shall manage CONTRACTOR'S QC documentation. Sufficient records shall be prepared and maintained as WORK is performed to furnish documentary evidence of the quality of construction and laboratory analysis.

1. QC documentation shall include, at a minimum, the following:

a. Description or title of the inspection activity

b. Location of the inspection activity or location from which the sample was obtained

c. Recorded observation or test data

d. Results of the inspection activity

e. Personnel involved in the inspection activity

f. Indication of compliance or non-compliance with the Contract Documents

g. Signature of the responsible QC Technician and the QCM.

D. **Submittals:** Submit an electronic copy of CONTRACTOR QC documentation to the ENGINEER within 2 days of the generation of such documentation.

E. **Control of Records**: CONTRACTOR shall furnish and maintain a fire-resistant file box at the Project site for storage of CONTRACTOR QC documentation for the duration of the WORK.

F. **CONTRACTOR Inspection and Testing**:

1. The CONTRACTOR shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation, and reject damaged and defective items.

2. The CONTRACTOR shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

3. Where installations include manufactured products, the CONTRACTOR shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

4. Reports of testing shall be submitted to the ENGINEER in accordance with Paragraph 1.2 D.

5. For samples and tests required for CONTRACTOR'S use, the CONTRACTOR shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the CONTRACTOR'S use shall be the CONTRACTOR'S responsibility.

G. **Notifications:** The CONTRACTOR shall notify ENGINEER a minimum of 24 hours prior to the expected time for operations requiring inspection and laboratory testing services so that technicians can be mobilized to the site.

1. However, Work requiring inspection and laboratory services may be suspended by the ENGINEER for a period of up to 24 hours at the CONTRACTOR’S expense if such notification as require by Paragraph 1.2 G was not proved to the ENGINEER and technicians are not available.

1.3 INSPECTION AT PLACE OF MANUFACTURE

A. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by the ENGINEER at the place of manufacture.

B. The presence of the ENGINEER at the place of manufacturer, however, shall not relieve the CONTRACTOR of the responsibility for providing products, materials, and equipment

which comply with all requirements of the Contract Documents. Compliance is a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of the ENGINEER.

1.4 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the COMPANY reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the ENGINEER will assure the COMPANY that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by the COMPANY of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the testing or other quality assurance requirements originally indicated, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial WORK, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the ENGINEER reserves the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the ENGINEER to require the removal or correction and reconstruction of any such WORK in accordance with the General Conditions.

1.5 COMPANY'S INSPECTION AND TESTING SERVICE

A. Inspection and testing laboratory service shall comply with the following:

1. Unless indicated otherwise by the Technical Specifications, the COMPANY will appoint, employ, and pay for services of an independent firm to perform inspection and testing or will perform inspection and testing itself.

2. The COMPANY or independent firm will perform inspections, testings, and other services as required by the ENGINEER under Paragraph 1.4C above.

3. The CONTRACTOR shall cooperate with the COMPANY or independent firm and furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.

4. Retesting required because of non-conformance to requirements shall be performed by the same independent firm on instructions by the ENGINEER. The CONTRACTOR shall bear all costs from such retesting.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01500 – MARINE INSTALLATION REQUIREMENTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all plant, labor, material and equipment for marine work as required by these specifications. The marine work shall include, but not be limited to, the following:

1. Installation of the effluent pipeline outfall in Lake Roosevelt.

2. Pre- and post-construction inspections of marine installations.

B. The CONTRACTOR shall provide all equipment and labor necessary to conduct the WORK. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment and machinery. Adequate standby equipment shall be kept available at all times to insure efficient operation in the event of a primary system failure.

1.2 REFERENCES

A. Association of Dive Contractors (ADC)

1. ADC Standards. Consensus Standards for Commercial Diving Operations, Fifth Edition, 2004.

1.3 QUALIFICATIONS

A. Dive Company shall have a minimum of five years of recent experience performing similar underwater construction.

1.4 SUBMITTALS

A. Submit for ENGINEER review in accordance with Section 01300 – Contractor Submittals and as specifically noted below.

B. CONTRACTOR shall prepare and submit a **Marine Installation Plan:**

1. The intent of the Marine Installation Plan submittal is for the CONTRACTOR to clearly communicate the CONTRACTOR's plan for executing all activities of the WORK to the OWNER and ENGINEER. The Marine Installation Plan shall include sufficient detail to convey that the WORK will be conducted in such a manner as to ensure the safety of workers, and the WORK will be conducted in accordance with the requirements of the permits and Contract Documents.

2. The CONTRACTOR's Marine Installation Plan is subject to review by the ENGINEER. The CONTRACTOR shall submit the Marine Installation Plan at least 60 Days prior to commencement of any excavation or work adjacent too, or within Lake Roosevelt.

3. The Marine Installation Plan shall include at a minimum:

   a. Complete description of construction methods and equipment for in-water/underwater work. The Marine Installation Plan shall specifically address methods and procedures to be used for submerging or installing the effluent pipeline without kinking or other damage, and to establish the correct orientation and location of the effluent pipeline diffuser and shown on the Drawings.

   b. Final detailed plans and operation schedule for establishment of cofferdams or other water control system for in-water work areas including the care and disposal of the water and sediment and construction and removal techniques. The CONTRACTOR will be required to demonstrate the system proposed and to verify that adequate equipment, personnel and materials are provided to maintain the integrity and performance of any cofferdam at all required locations and times.

   c. Drawings showing locations, dimensions, and relationships of all cofferdams or other water control facilities and elements of each system. Drawings shall reflect all phases of construction and revisions to the system as work progresses.

   d. Design calculations demonstrating adequacy of proposed cofferdam or other water control system.

   e. Back-up provisions for the event of power or equipment failure.

   f. Bar chart type schedule demonstrating the following activities:

      1) Permit Acquisition

      2) Mobilization

      3) Site Preparation

      4) Installation

      5) Construction, use, and removal of cofferdams and water control facilities

      6) Restoration/Demobilization

      7) In-water work windows

C. CONTRACTOR shall submit the following dive safety information:

   1. Dive company resume of similar projects performed in the past 5 years.

   2. Description of diving equipment, procedures, and work sequence for underwater work.

   3. Company safe diving practices manual.

   4. Project-specific dive plan.

D. CONTRACTOR shall submit information packages on each diving crew member assigned to the project. Information packages shall be provided for any additional crew

members brought in during the course of the WORK. Any changes to the diving crew shall be subject to ENGINEER approval. The information packages shall include:

1. Qualifications of all dive crew members in accordance with ANSI/ACDE-01-1998, Minimum Standards for Commercial Diver Training (Commercial Certification), or Association of Diving Contractors (ADC) Consensus Standards.

2. A current resume.

3. A copy of the individual's commercial diving school diploma.

4. Copies of current first aid and CPR certificate.

5. A copy of the individual's current (within 12 months) diving physical.

E. CONTRACTOR shall submit DVD format color video documentation of pre- and post-construction condition of the construction areas and features shall be submitted upon completion of underwater work in accordance with Paragraph 3.1.

1. Clarity and detail of the video documentation shall be subject to approval. The DVD label shall include the following:

a. Contract number and title; Contractor name; Date DVD was made.

2. If the pre-construction video documentation does not produce satisfactory results due to visibility conditions beyond the CONTRACTOR'S control, an alternate method of pre- and post-construction dive inspection shall be proposed by the CONTRACTOR for consideration by the ENGINEER. Acceptance of any alternate method of dive inspection shall be at the sole discretion of the ENGINEER.

1.5 SITE CONDITIONS

A. General site conditions are as follows:

1. Location: Wellpinit, WA

2. Project Waterway: Lake Roosevelt.

3. Working Water Depth: 0 to 75 feet.

4. Visibility: Poor.

5. Flow Conditions. Lake environment with wind-driven waves.

1.6 DIVING REQUIREMENTS

A. All underwater work shall be carried out with the use of electronic diver/surface communications.

B. All underwater work shall be carried out with the use of real time video. Real time video shall be available to view on Site at any time by the ENGINEER.

C. All diving crew members shall have been formally trained in a school sanctioned by the ADC, or approved equal. Sport SCUBA certification will not be acceptable.

D. All underwater operations shall meet, or exceed, the requirements of OSHA Commercial Diving Regulations, Part 1910, Subpart T.

1.7 DIVING INSPECTION

A. Prior to commencement of the work, the CONTRACTOR shall perform an inspection of the underwater work areas to establish safety procedures, verify existing conditions and assess potential problem areas associated with the installations. The work shall include a determination of the extent, if any, of underwater obstructions that may interfere with the installations to allow for relocation as may be necessary.

B. The CONTRACTOR shall perform video inspections of the fully constructed submerged installations in the presence of the ENGINEER immediately upon installation. The purpose of the inspections will be to verify proper installation. The inspections shall be documented on DVD.

C. The CONTRACTOR shall perform a video inspection of the fully constructed submerged diversion outfall pipeline in operation in the presence of the ENGINEER to ensure stability of the pipeline under operating conditions. This purpose of the inspection will be to verify proper installation and stability of the pipeline. The inspection shall be documented on DVD.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

-END OF SECTION-

SECTION 01505 - MOBILIZATION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. CONTRACTOR shall mobilize as required for the proper performance and completion of the WORK and in accordance with the Contract Documents.

B. Mobilization shall include at least the following items:

1. Moving onto the Site of CONTRACTOR's plant and equipment necessary for the implementation of the remedial action.

2. Installing temporary construction power, wiring, and lighting facilities.

3. Establishing fire protection system.

4. Developing construction water supply.

5. Providing field offices complete with furnishings, equipment, and utility services.

6. Providing on-site sanitary facilities and potable water facilities.

7. Arranging for and erection of CONTRACTOR's WORK and storage yards.

8. Constructing and implementing security features and requirements complying with Section 01520 - Security.

9. Obtaining required permits.

10. Having OSHA required notices and establishing safety programs.

11. Having the CONTRACTOR's superintendent at the Site full time.

12. Submitting initial submittals

.

C. Mobilization for construction shall include all additional or replacement equipment, plant, camp, materials and supplies required for completion of the WORK in accordance with the Contract Documents.

D. At the conclusion of each construction phase, the CONTRACTOR shall remove all equipment, plant and materials from the site that are not required for future phases of the WORK.

E. At the conclusion of the final remedial phase, all equipment, plant, camp, materials, and supplies shall be removed from the Site and the Site left in its pre-existing condition, except for constructed features. All rubbish shall be removed from the site.

1.2 SUBMITTALS

A. Submittals indicated below shall conform to Section 01300 - Contractor Submittals.

B. As soon as practicable after receipt of the Notice to Proceed, the CONTRACTOR shall submit a breakdown to the ENGINEER for approval, which shall show the estimated value of each major component of mobilization. When approved by the ENGINEER, the breakdown will be the basis for initial progress payments in which mobilization is included.

1.3 PAYMENT FOR MOBILIZATION

A. The CONTRACTOR's attention is directed to the condition that two percent of the Contract Price will be deducted from any money due the CONTRACTOR as progress payments until mobilization items listed in Paragraph 1.1 B above have been completed. The aforementioned amount will be retained by the COMPANY as the agreed, estimated value of completing the mobilization items listed. Any such retention of money for failure to complete such mobilization items shall be in addition to the retention from any payments due to the CONTRACTOR in accordance with the General Conditions.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01510 - TEMPORARY UTILITIES

PART 1 -- GENERAL

1.1 GENERAL

A. The types of utility services required for general temporary use at the Site include the following:

1. Water service (potable and non-potable)

2. Electric power service

3. Communications service

1.2 JOB CONDITIONS

A. **Scheduled Uses**: The CONTRACTOR, in conjunction with establishing the progress schedule, shall establish a schedule for implementation and termination of service for each temporary utility at the earliest feasible time, and when acceptable to the COMPANY, change over from temporary utility service to permanent service.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. The CONTRACTOR shall provide either new or used materials and equipment, that are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry by compliance with appropriate standards, as being suitable for intended use in each case. Where a portion of temporary utility is provided by utility company, the CONTRACTOR shall provide the remaining portion with matching and compatible materials and equipment and shall comply with recommendations and requirements of the utility company.

PART 3 -- EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. **General**: Wherever feasible, the CONTRACTOR shall engage the utility company to install temporary service to the Site, or as a minimum, to make connection to existing utility service; locate services where they will not interfere with WORK, including installation of permanent utility services; and maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate WORK in progress.

B. **Approval of Electrical Connections:** Temporary connections for electricity shall be subject to approval of the power company representative, and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the WORK.

C. **Separation of Circuits:** Circuits used for power purposes shall be separate from lighting circuits.

D. **Construction Wiring:** Wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. Electrical facilities shall conform to the requirements of Electrical Safety Standards, Administration, and Installation WAC 296-46B, Washington State Department of Labor and Industries; and Subpart K of the OSHA Safety and Health Standards for Construction.

3.2 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. **Power:** The CONTRACTOR shall provide power required for its operations under the Contract and shall provide and maintain temporary power lines required to perform the WORK in a safe and satisfactory manner.

B. **Temporary Power Distribution**: Temporary power distribution shall be in accordance with Specification Section 01515 – Temporary Distribution Line.

C. **Generators**: Generators shall be model year 2011 or newer and shall be compliant with 40 CFR Part 1039 - CONTROL OF EMISSIONS FROM NEW AND IN-USE NONROAD COMPRESSION-IGNITION ENGINES. Generators shall comply with the applicable portions of Specification Section 01585 – Green and Sustainable Practices.

3.3 INSTALLATION OF LIGHTING

A. **Construction Lighting:** WORK conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper performance and to afford adequate facilities for inspection and safe working conditions.

B. **Temporary Lighting**: The CONTRACTOR shall provide a general, weatherproof, grounded temporary lighting system in every area of construction as soon as overhead floor/roof deck structure has been installed to provide sufficient illumination for safe working and traffic conditions. Run circuit wiring generally overhead, and rise vertically in locations where it will be least exposed to possible damage from construction operations on grade, floors, decks, or other areas of possible damage or abuse.

3.4 WATER SUPPLY

A. **General:** The CONTRACTOR shall provide an adequate supply of water of a quality suitable for all domestic and construction purposes.

B. The CONTRACTOR shall provide and operate pumping facilities, pipelines, valves, hydrants, storage tanks, and other equipment necessary for the adequate development and operation of the water supply system. Water used for domestic purposes shall be free of contamination and shall conform to the requirements of the State and local authorities for potable water. The CONTRACTOR shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water therefrom.

C. **Water Connections**: The CONTRACTOR shall not make connection to or draw water from on-site wells or any other water supply source without gaining permission from the COMPANY.

3.5 INSTALLATION OF SANITARY FACILITIES

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of CONTRACTOR's employees. Toilets at construction sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for

Construction. Provide separate field office and Construction Support Zone facilities in conformance with Section 01525 – Construction Support Zone Temporary Facilities.

B. **Sanitary and Other Organic Wastes**: The CONTRACTOR shall establish a regular collection of sanitary and organic wastes. Wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the Site in accordance with laws and regulations pertaining thereto.

3.6 INSTALLATION OF FIRE PROTECTION

A. **Fire Protection:** The construction plant and the WORK shall be connected with the CONTRACTOR's temporary water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the WORK, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's Fire Suppression and Mitigation Plan shall conform to the requirements of Fire Suppression Equipment WAC 296-24 Part G-3, Washington State Department of Labor and Industries, and Subpart F of the OSHA Standards for Construction.

B. CONTRACTOR shall furnish, install and maintain a minimum of 10,000 gallons of temporary water storage, and appropriate distribution equipment, for fire suppression water storage. Fire suppression water storage shall be in a temporary tank or water tower or other storage method as approved by the ENGINEER and shall be placed in a location designated by the ENGINEER.

C. The water storage facility for fire suppression shall not be used for construction water unless a minimum volume of 10,000 gallons is maintained at all times.

3.7 INSTALLATION OF COMMUNICATIONS

A. **Cellular Telephone Services:** The CONTRACTOR shall provide and maintain during the progress of the WORK cellular booster equipment and services for primary off-site communications.

3.8 **Internet Services:** The CONTRACTOR shall provide and maintain during the progress of the WORK internet service with not less than 10 mbps download speed and not less than 2 mbps upload speed, and not less than 60 MB monthly data usage allowance. The CONTRACTOR shall provide and maintain a wireless network for use by the COMPANY to access internet services. OPERATIONS AND TERMINATIONS

A. **Inspections**: Prior to placing temporary utility services into use, the CONTRACTOR shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

B. **Protection**: The CONTRACTOR shall maintain distinct markers for underground lines, and protect from damage during excavating operations.

C. **Termination and Removal**: When need for a temporary utility service or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the CONTRACTOR shall promptly remove installation unless requested by ENGINEER to retain it for a longer period. The CONTRACTOR shall complete and restore WORK which may have been

delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

D. **Removal of Water Connections:** Before final acceptance of the WORK on the project, temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and affected improvements shall be restored to original condition or better, to the satisfaction of the ENGINEER and to the agency owning the affected utility.

- END OF SECTION –

SECTION 01515 – TEMPORARY DISTRIBUTION LINE

PART 1 -- GENERAL

1.1 INTRODUCTION

A. Temporary power lines shall be constructed at the Midnite Mine Site to provide electricity to the existing WTP and outbuildings where needed, associated dewatering pumps and controls, and the construction support zone throughout all phases until the permanent power system is available. Temporary power line shall be used instead of generators wherever feasible. The capacity of the existing power lines shall be verified by CONTRACTOR to be sufficient to meet the demand of the temporary power line powered equipment prior to use.

B. This specification contains references to standards, codes, best practices and industry specific requirements which shall be applied in conjunction with the project specific details and requirements described in this specification.

C. **Attachment A - Temporary Power Line Performance Specification, appended hereto, contains the specific CONTRACTOR performance requirements for the temporary power lines.**

D. These specifications shall form the technical basis for the design, material procurement and construction of the temporary power distribution lines.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AEIC CS8	(2007) Specifications for Extruded Dielectric Shielded Power Cable Rated 5 kV through 46 kV
ATIS ANSI O5.1	(2008) Wood Poles -- Specifications & Dimensions

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C135.14	(1979) Staples with Rolled or Slash Points for Overhead Line Construction
ANSI C29.1	(2002) Test Methods for Electric Power Insulators

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA A3	(2005) Standard Method for Determining Penetration of Preservatives and Fire Retardants
AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C4	(2003) Poles - Preservative Treatment by Pressure Processes
AWPA T1	(2009) Use Category System: Processing and Treatment Standard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM INTERNATIONAL)

ASTM A123	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A475	(2003; R 2009e1) Standard Specification for Zinc-Coated Steel Wire Strand
ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B2	(2008) Standard Specification for Medium-Hard-Drawn Copper Wire
ASTM B231	(2012) Standard Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors
ASTM B232/B232M	(2009) Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
ASTM B3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 117	(2010) Standard Guide for Sampling, Test Methods, Specifications and Guide for Electrical Insulating Oils of Petroleum Origin
ASTM D 1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2275	(2008) Standard Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface
ASTM D 3487	(2009) Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus
ASTM D 877	(2002; R 2007) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D 92	(2005a; R 2010) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D 97	(2011) Pour Point of Petroleum Products

ASTM B609	(2012) Standard Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE Manual No. 104	(2003) Recommended Practice for Fiber-Reinforced Polymer Products for Overhead Utility Services
FM APP GUIDE	http://www.approvalguide.com/

INTERNATIONAL CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA-S-94-649	(2013) Concentric Neutral Cables Rated 5 kV through 46 kV
ICEA-T-31-610	(2007) Water Penetration Resistance Test, Sealed Conductor

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 8	(2002) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE 48	(2011) Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
IEEE 141	(2002) IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants
IEEE 386	(2002) Standard for Separable Insulated Connector Systems for Power Distribution Systems above 600V
IEEE 400.2	(2005) Guide for Field Testing of Shielded Power cable Systems Using Very Low Frequency (VLF)
IEEE 1235	(2002) IEEE Guide for the Properties of Identifiable Jackets for Underground Power Cables and Jackets
IEEE C37.42	(2009) Standard Specifications for High-Voltage (> 1000 V) Expulsion-Type Distribution-Class Fuses, Fuse and Disconnecting Cutouts, Fuse Disconnecting Switches, and Fuse Links, and Accessories Used with These Devices
IEEE C62.11	(2005; Amd 1 2008) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE C135.1	(1999) Standard for Zinc-Coated Steel Bolts and Nuts for Overhead Line Construction
IEEE C135.2	(1999) Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction

IEEE C135.22	(1988) Standard for Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction
IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
IEEE C2	(2012) National Electrical Safety Code
IEEE C37.41	(2008; Errata 2009) Standard Design Tests for High-Voltage (>1000 V) Fuses, Fuse and Disconnecting Cutouts, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories Used with These Devices
IEEE C37.42	(2009) Standard Specifications for High-Voltage (> 1000 V) Expulsion-Type Distribution-Class Fuses, Fuse and Disconnecting Cutouts, Fuse Disconnecting Switches, and Fuse Links, and Accessories Used with These Devices
IEEE C57.12.20	(2005; INT 1-3 2008) Standard for Overhead Type Distribution Transformers, 500 KVA and Smaller: High Voltage 34 500 Volts and Below: Low Voltage, 7970/13,800 Y Volts and Below
IEEE C57.12.28	(2005) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C62.11	(2005; Amd 1 2008) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE Std. Dictionary 100	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 62271-111	(2005) High Voltage Switchgear and Control gear - Part 111: Overhead, Pad-Mounted, Dry Vault, and Submersible Automatic Circuit Reclosers and Fault Interrupters for Alternating Current Systems Up To 38 kV; Ed 1.0

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB1	(2012) Standard for Fittings, Cast, Metal Boxes and Conduit bodies for Conduit, Electrical Metal Tubing and Cable
NEMA C135.4	(1987) Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction

NEMA ICS 6	(1993; R 2006) Enclosures
NEMA TC 2	(2003) Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WC 74/ICEA S-93-639	(2006) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy
NEMA WC26	(2008) Binational Wire and Cable Packaging Standard

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

OCCUPATIONAL SAFETY AND HEALTH STANDARDS (OSHA)

OSHA Std 1910.333	Electrical

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 202-1	(2004) List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers
RUS 1728F-806	(2000) Specifications and Drawings for Underground Electrical Distribution

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 651	(2005) Schedule 40 and 80 Rigid PVC Conduit and Fittings

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – Contractor Submittals.

B. CONTRACTOR shall prepare and submit a power distribution plan and schedule package (Construction Package) in accordance with Attachment A - Temporary Power Line Performance Specification, Paragraph 3.1 A of this specification.

C. <u>Overhead Power:</u>

1. Pole-mounted equipment information (surge arrester, cable termination, fuse cut-off switch):

a) A certification from the manufacturer, that the technical requirements of this specification are met.

b) Field test reports

2. Product Data:

a) Conductors

b) Insulators

c) Wood poles

d) Cutouts

e) Surge arresters

f) Guy strand

g) Anchors

h) Line hardware

i) Transformers

3. Ground Resistance Test Reports:

a) Submit the measured ground resistance of grounding system. When testing grounding electrodes and grounding systems, identify each grounding electrode and each grounding system for testing. Include the test method and test setup (i.e. pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

4. Certificates:

a) Wood poles

D. Underground Power:

1. Shop Drawings:

a) CONTRACTOR shall submit detailed termination diagrams, documents and shop drawings. Documents shall include detailed descriptions, step-by-step procedures, and pictures describing the method of termination at the structure and method of underground installation.

b) A complete set of physical outline shop drawings detailing all installation procedures, termination components and accessories for the termination shall be submitted to the ENGINEER for review and approval. Upon “Approval” by the ENGINEER, these shop drawings will be utilized as “For Construction” drawings by the CONTRACTOR to complete all terminations and install the 15 kV cable.

2. Product Data: Product data on all components utilized for the terminations shall be submitted to the ENGINEER for review and approval. Product data shall include

but are not limited to items such as cables, cable terminations, bushings, cable supports, method of shield connections or earthling methods, conduits and etc.

3. Certified Test Reports: CONTRACTOR shall provide certified copies of all the test reports.

4. Test Data and Calculations: CONTRACTOR shall supply test data and calculations supporting the cable system design and reliability requirements as supplied by the cable manufacturer.

5. Pulling Plan: CONTRACTOR shall provide pulling plan for the direct buried cable.

6. Earthwork Plan: CONTRACTOR shall submit excavation method plan and fill method plan.

1.4 REGULATORY REQUIREMENTS

A. In each of the publications referred to herein, consider the advisory provisions to be mandatory. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the COMPANY/ ENGINEER. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of NFPA 70 and IEEE C2 unless more stringent requirements are specified or indicated.

1.5 DELIVERY, STORAGE AND HANDLING

A. Visually inspect devices and equipment when received and prior to acceptance from conveyance. Protect stored items from the environment in accordance with the manufacturer's published instructions. Replace damaged items. Store surge arrester, cable terminations and fused cut-off switches in accordance with the manufacturer's requirements. Handle and store wood poles in accordance with the manufacturer's instructions.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Standard Products

1. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Provide products that have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period includes applications of equipment and materials under similar circumstances and of similar size. Provide a product that has been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, provide items that are products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

B. Alternative Qualifications

1. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

C. Material and Equipment Manufacturing Date

1. Do not use products manufactured more than 3 years prior to date of delivery to site, unless specified otherwise.

2.2 OVERHEAD PRODUCTS

A. MATERIALS

1. Consider materials specified herein which are identical to materials listed in RUS 202-1 as conforming to requirements.

B. POLES

1. Wood Poles

a) Wood poles machine trimmed by turning, [Douglas Fir] conforming to ATIS ANSI O5.1 and RUS Bulletin 1728E-700. Wood poles shall not be gained. Ensure the quality of each pole with "WQC" (wood quality control) brand on each piece, or by an approved inspection agency report.

2. Storage

a) For poles stored for any reason more than 2 weeks, stack them on decay-resistant skids of such dimensions and so arranged as to support the poles without producing noticeable distortion. Stack poles in a manner that permits free circulation of air; with the bottom poles of the stacks at least 1-foot above ground level or any vegetation growing thereon. No decayed or decaying wood is permitted to remain underneath stored poles. Store the poles in accordance with manufacturer’s instructions.

3. Preservative

a) Treat wood poles with waterborne preservatives conforming to AWPA T1. The preservative shall be EPA approved and meets FIFRA.

4. Treatment

a) Poles shall be full-length pressure treated. All poles in the treating vessel shall be exclusively Douglas fir and have similar pole volume (size). All poles not conforming to the specified minimum treatment requirements shall be rejected or retreated. Only one retreat is permitted. Any pole not passing, after a second treatment, is unacceptable.

5. Penetration

a) Compliance, regardless of actual pole size, shall be verified in accordance with AWPA C4 for Group B poles. Minimum depth of penetration shall be as follows, determined by vision examination, enhanced with dye, or the Bill Stein flame method as necessary or as required by AWPA.

Location	Penetration
Near the pole brand	0.75" and 100% of the sapwood (Whichever is greater)
Groundline (deep incised zone)	100% entire cross-section*

* Skips in penetration are allowed in three (3) or less consecutive annual rings as long as the skips are located in the innermost 1/3 of the core sample.

6. Butt Treatment

   a) Poles shall be butt treated according to AWPA Standards U1, T1, M1 and M4.

7. Preservative Treatment for Field-Drilled Holes

   a) All field-drilled holes shall be treated with a preservative compound. Unused holes shall be plugged with treated wood dowel pins 3 inch in length.

8. Handling

   a) Do not drag treated poles along the ground. Do not use pole tongs, cant hooks, and other pointed tools capable of producing indentations more than 1 inch in depth, in handling the poles. Poles shall be lifted and supported as per manufacturer's instructions. Do not apply tools to the groundline section of any pole. Groundline section is that portion between 1 foot above and 2 feet below the ground line.

C. CROSSARMS AND BRACKETS

1. Fiberglass Crossarms

   a) Provide cross-sectional area dimensions of 4-5/8 inches in height by 3-5/8 inches in depth in accordance with IEEE C2. Provide crossarms that are 10 feet in length. Provide required climbing space and wire clearances by drilling.

2. Armless Construction

   a) Provide brackets either integrally as part of an insulator or attached to an insulator with a suitable stud. Provide bracket mounting surface suitable for the shape of the pole. Provide pole top brackets that conform to IEEE C135.22. Provide brackets that have a strength exceeding that of the required insulator strength, but in no case less than a 2800 pound cantilever strength.

D. HARDWARE

1. Provide hot-dip galvanized hardware in accordance with ASTM A153 and ASTM A123. Provide zinc-coated hardware that complies with IEEE C135.1, IEEE C135.2, NEMA C135.4, ANSI C135.14 IEEE C135.22. Provide steel hardware that complies with ASTM A575 and ASTM A576. Install washers under bolt heads and nuts as required. Make the diameter of holes in washers the correct standard size for the bolt on which a washer is used. Provide washers for use under heads of carriage-bolts, of the proper size to fit over square shanks of bolts. Use eye bolts, bolt eyes, eye nuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises wherever required to support and to protect poles, brackets, crossarms, guy wires, and insulators.

E. TRANSFORMERS – POLE-MOUNTED AND PAD-MOUNTED

1. CONTRACTOR shall properly size and specify the pole-mounted and pad-mounted transformers per the relevant requirements contained in the following documents: ANSI 70, ANSI/IEEE C57.12.00, ANSI C57.12.26, ANSI C57.12.70-1978, ANSI C57.12.00-1987, ANSI C62.11-1987, ANSI C57.12.90-1987, ANSI C57.12.20-1988, ANSI C57.12.28-1988, ANSI C57.12.25-1990, ANSI C57.12.26-1992, ANSI C57.12.00-1993, ANSI C57.12.90-1993, ANSI C57.12.90-1999, ANSI C57.12.35-2007, ANSI C26.11-Draft 1, ASTM D2161-1987, ASTM D877-1987, ASTM D445-1988, ASTM D92-1990, IEEE 386-1985, IEEE 386-1995, NEMA 260-1982, FMERC P7825, AIM X5-2, and AIM X5-4.

2. CONTRACTOR also shall coordinate with the utility company to ensure compliance with their transformer specifications and associated requirements.

3. The transformer selection criteria and transformer cut sheets shall be reviewed by ENGINEER prior to procurement.

F. INSULATOR

1. Provide polymer insulators which are radio interference free.

b) Suspension insulators: ANSI Class DS-15

c) Spool insulators: ANSI C29.3

d) Guy strain insulators: ANSI C29.4

e) Pin insulators: ANSI C29.5

G. OVERHEAD CONDUCTORS, CONNECTORS AND SPLICES

1. Use conductors of aluminum conductor steel reinforced (ACSR). Where aluminum conductors are connected to dissimilar metal, use fittings conforming to UL 486A-486B.

a) Solid Copper

i. ASTM B1, ASTM B2, and ASTM B3, hard-drawn, medium-hard-drawn, and soft-drawn, respectively. ASTM B8, stranded.

2. Aluminum Conductor Steel Reinforced (ACSR)

a) The conductor shall be Class AA concentric-lay-stranded H-19 (hard-drawn) alloy 1350. The outer layer of strands of the conductor shall have a right-hand lay.

b) Aluminum – The electrical resistivity of selected samples shall conform to the latest revision of ASTM Specification B230 and shall not exceed 17.002 ohms–circular-mil/foot at 20°C for distribution conductors. (Standard Conductivity - equivalent to 61.2% material with a 61.0% minimum conductivity.)

c) Steel – The coated steel core wires shall conform to the latest revision of ASTM Specification B498 (Class A, Galvanized) or B802 (Aluminum-Mischmetal Alloy).

d) Zinc – The zinc or zinc-alloy coating shall conform to the latest revision of ASTM Specification B498 or B802, respectively.

e) The conductor as received shall be clean and free of imperfections not consistent with good commercial practice per ASTM B232. In addition, the following visual imperfections observed as the conductor is wound onto or off from the shipping reel, shall be cause for rejection:

i. Splaying that exceeds the following limits: (Splaying is defined as the spreading of the peripheral strands of the conductor that potentially weakens the conductor.

- Gaps between outer strands of more than 1/2 the strand diameter,
- Any raised strands that cannot be pressed back into its position with the normal force of one finger

ii. Crossovers: Any strand that is popped out of position and lying over another stand

iii. Excessive scuffing: This is characterized as multiple scrapes on the surface and along the length of the conductor with associated burrs of aluminum protruding from the strand. Characterized as more than just a dent or dimple. It is recognized that, in the manufacturing of twisted pair conductor, there is rubbing between the sub-conductors that would not be detrimental to the performance of the conductor.

3. Connectors and Splices

a) Provide connectors and splices of copper alloys for copper conductors and copper-to-copper that complies with UL 486A-486B.

H. GUY STRAND

1. ASTM A475, extra high-strength, Class A, galvanized strand steel cable. Provide guy terminations designed for use with the particular strand and developing at least the ultimate breaking strength of the strand.

I. ANCHOR AND ANCHOR RODS

1. Site Conditions

a) Local variations in the characteristics of the subsurface materials shall be anticipated and are not justification for contract changes. The CONTRACTOR is responsible for verifying the location of all utilities that may be affected by construction of the installation of the anchors. Any difficulties encountered in the installation of the specified anchor, due to changed or unforeseen conditions in the field, shall be referred to COMPANY/ ENGINEER for analysis and recommendation.

J. GROUNDING AND BONDING

1. Driven Ground Rods

a) Provide copper-clad steel ground rods conforming to UL 467 not less than 5/8 inch in diameter by 8 feet in length.

2. Grounding Conductors

a) ASTM B8. Provide soft drawn copper wire ground conductors a minimum No. 4 AWG.

3. Grounding Connections

a) UL 467. Compression and bolted connectors.

K. SURGE ARRESTERS

1. IEEE C62.11, metal oxide, polymeric-housed, surge arresters arranged for crossarm mounting. Provide 9 kV RMS voltage rating. Provide Distribution class arresters. The surge arrester shall be Hubbell Power Systems or equal #213715-7324.

L. FUSED CUTOUTS

1. Type K fuses conforming to IEEE C37.42 with ampere ratings equal to 150 percent of the transformer full load rating. Open link type fuse cutouts are not acceptable. Fuse cutouts shall be Hubbell Power Systems or equal # C7101142.14

M. CALKING COMPOUND

1. Provide compound for sealing of conduit risers that is of a puttylike consistency workable with hands at temperatures as low as 35 degrees F, that does not slump at a temperature of 300 degrees F, and that does not harden materially when exposed to air. Provide compound that readily caulks or adheres to clean surfaces of the materials with which it is designed to be used. Provide compound that has no injurious effects upon the workmen or upon the materials.

N. NAMEPLATES

1. Manufacturer's Nameplate

a) Provide each item of equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable. Provide equipment containing liquid-dielectrics with the type of dielectric on the nameplate.

2. Field Fabricated Nameplates

a) ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device. Identify the function and, when applicable, the position with each nameplate inscription. Provide melamine plastic, 0.125 inch thick nameplates, white with black center core. Provide matte finish surface. Provide square corners. Accurately align lettering and engrave into

the core. Minimum size of nameplates is one by 2.5 inches. Minimum size of lettering is 0.25 inch high normal block style.

2.3 UNDERGROUND PRODUCTS

A. ACCEPTABLE SUPPLIER

1. The supplier of the 15 kV cables, the pad-mounted transformer terminations, and outdoor terminations shall be Southwire cables, or equal. Conduits, as needed, shall be supplied by CONTRACTOR as approved by COMPANY's ENGINEER.

B. MATERIALS

1. The CONTRACTOR shall furnish all material required for the completion of the work as shown on the drawings and/or listed in the specifications.

   a) 15 kV Cable

      i. 15kV medium voltage cables shall have the following characteristics

System line voltage	13.2 kV
Rated cable voltage	15 kV
Phase to ground rated voltage (Vg)	9 kV
BIL	110 kV
Max. conductor temp. under normal operation	90°C

      ii. The cable shall be polymer insulated moisture blocked concentrically stranded-dielectric cable rated for service at 15 kV. The conductor shall be aluminum 1/0 with 19 strands rated at 100% insulation level, with semi-conducting cross-linked polyethylene strand shield, a tree-retardant cross-linked polyethylene primary insulation, and a semi-conducting cross-linked polyethylene insulation shield. A concentric neutral of bare copper wires and semi-conducting polyethylene jacket applied over the insulation shield shall be supplied.

      iii. The cable shall conform to the following requirements:

- Length: Cable shall be furnished in reels containing cable lengths such that all individual cable runs can be made without splices. No splices shall be allowed in the cable runs.

- Conductor: Conductor shall be aluminum alloy 1350 concentric-lay stranded, Class B conductors with circular cross-section and free from any metallic or foreign particles that may contaminate the insulation. The conductor shall have smooth interface with no intermediate joint and well compacted.

- Semi-Conducting XLPE Strand Shield: Cable shall have semi-conducting XLPE strand shield.

- Tree-Retardant XLPE Insulation: Main insulation shall be tree-retardant cross linked polyethylene insulation, at least 30 mils

thickness, and as described in ICEA-S-93-639 and NEC. It shall be free from void and contaminants. The minimum thickness at any point shall not be less than 90% of the specified thickness. The void, contaminant and amber limits for XLPE insulated cables shall be as described in the relevant standard. The insulation thickness shall comply with the ICEA S-96-659.

- XLPE Insulation Shield: A semi-conducting shield shall be provided. Triple head extrusion process shall be used to firmly bond the conductor, insulation and insulation shield together. The three layers shall be cross-linked in a dry curing process.

- Neutral: Concentric neutral conductors shall be copper suitable for use in the three phase circuit. The concentric neutral shall consist of #14AWG, uncoated bare annealed copper wires per ICEA Standards. The concentric neutral strands shall be smooth and free from corrosion, oil.

- Jacket: Cable shall have an overall semi-conducting polyethylene jacket suitable for the direct burial.

iv. Each cable length shall be furnished with a watertight pulling socket eye which shall be fitted to the pulling end. Pulling socket eye shall be able to withstand the pulling force.

v. The cable system shall be suitable for installation in direct burial, conduits, and in open air.

vi. The cable system shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.

vii. A distinctive marking including the following details shall be identified continuously on the jacket. The semi-conducting layer marking and method of marking shall comply with the standard. The following marking shall be subjected to the ENGINEER's approval.

- Rated Voltage (15 kV)

- Type of main insulation (XLPE)

- Conductor material and size

- Supplier's Name

- Year of manufacture

- Sequential marking of length of cable

viii. The jacket shall be marked with three red stripes.

ix. Packing: The finished cable shall be wound on steel or wooden reels. It shall be suitably packed and protected against water so that it shall not be damaged during transportation. The CONTRACTOR shall be responsible for the disposal of empty reels from the Site.

b) Terminations

i. All terminations to be rated for 15kV, 60 Hz, suitable for pad-mounted transformer cables. The terminations shall comply with IEEE 48, Class 1 and shall be suitable for use with the type of the cable supplied.

ii. Each termination shall be packaged as a self-sufficient kit including: skirts, stress control terminator, ground clamp, connectors, and lugs. It shall contain packing kits, instructions as required for the installation and testing.

iii. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor.

iv. Terminations shall be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

v. Cold-Shrink Type: Terminator shall be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination shall not require heat or flame for installation. Termination kit shall contain all necessary materials (except for the lugs). Termination shall be designed for installation in low or highly contaminated indoor and outdoor locations and shall resist ultraviolet rays and oxidative decomposition.

vi. Termination mounted on the structure shall be Tyco Electronics #TF-151E, or equal. Brackets/ supports to support the bushings and facilitate cable entrance to the bushings from the bottom shall be provided by the CONTRACTOR.

vii. 200 Ampere loadbreak connector with optional jacket seal ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 10,000 rms symmetrical amperes. The connector shall be Cooper Power Systems or equal, #LEJ215CCACC2CT. Two load break bushing inserts – one with latch indicator ring and one without latch indicator ring Cooper Power Systems or equal, # LBI215 shall be provided. An insulated bushing well plugs Cooper Power Systems or equal, #IBWP225 shall also be provided.

viii. All clamps, ground sheaths, supporting brackets and insulators, cable guides, etc. as required to furnish an integral MV cable system which runs from the deadend riser pole to the pad-mounted transformer shall be furnished and installed by the CONTRACTOR. All tools and equipment required for terminating of 15 kV cables shall be supplied by the CONTRACTOR. The termination and jointing kits shall be suitable for the cable and complete with all the accessories including crimping type cable lugs, jointing materials and consumables.

ix. Tests shall be carried out on the cable termination components of each type and rating being furnished in accordance with IEEE 48. Cable test shall be in accordance with AEIC CS8.

c) Load-Break Elbows

i. The cable/elbow interface is sealed by pulling the integral jacket seal over the joint.

ii. Elbows should be installed with enough slack for hot-stick operations including switching and grounding.

iii. The load current carrying rating of an elbow is effected by load and internal cabinet temperature. For areas that experience high temperature and excessive loads, the area ENGINEER must be contacted for derating of elbows in order to reduce failures.

d) Cable Testing Capabilities

i. The cable end unit design for each termination shall include the capability for high voltage testing of the connected power cable on site.

e) Buried Warning and Identification Tape

i. CONTRACTOR shall provide detectable tape from Grainger or equal.

f) Grounding Systems

i. CONTRACTOR shall provide grounding system as indicated on the project drawing

C. SPECIFIED SPARE PARTS

1. The following spare parts shall be furnished with the cable and three-phase terminations:

a) One (1) complete cable termination for the three-phase pad-mounted transformer.

b) One (1) complete outdoor cable to air termination.

D. FACTORY TESTS

1. The tests shall be in accordance with AEIC CS8. A certified test report showing test results shall be submitted for ENGINEER's review and approval.

2. The production tests shall include partial discharge, high voltage DC withstand test, jacket test and neutral indent test on jacket in accordance with AEIC CS8.

3. Terminations, including bushings and component parts, shall be tested in accordance with IEEE 48.

PART 3 -- EXECUTION

3.1 GENERAL

A. In accordance with the specifications contained in this section and/ or as directed, the CONTRACTOR shall furnish all labor, materials, and equipment required to procure (including factory test), deliver to site, route and install, field test and commission the overhead power lines and/ or underground cables. The CONTRACTOR shall also be responsible for material and labor required for trenching, excavation and backfill. The CONTRACTOR shall be solely responsible for procuring any applicable permits and for all construction means, methods, techniques, sequences, procedures, and safety and compliance programs in connection with the performance of the work. The CONTRACTOR shall determine the locations of all existing power, communication and pipeline facilities that might interfere with the overhead power line and underground cable in accordance with the applicable rules and regulations.

3.2 OVERHEAD EXECUTION

A. Provide overhead pole line installation conforming to requirements of IEEE C2 overhead lines in heavy loading districts and NFPA 70 for overhead services.

B. TREE TRIMMING

1. Where lines pass through trees, trim trees at least 15 feet clear on both sides horizontally and below for medium-voltage lines, and 5 feet clear on both sides horizontally and below for other lines. Do not allow a branch to overhang horizontal clearances.

C. WOOD POLE INSTALLATION

1. Provide pole holes at least as large at the top as at the bottom and large enough to provide 4 inch clearance between the pole and side of the hole. Provide a 6 inch band of soil around and down to the base of the pole treated with 2 to 3 gallons of a one percent dursban TC termiticide solution.

2. Setting

a) Pole holes must be a minimum of 8 inches wider than the butt diameter of the pole. When pole bearing plates are used, pole holes must be the minimum diameter necessary for installation of the pole. The excavated hole must be at least as large at the bottom as at the top.

b) Accumulated water must be removed from the hole prior to setting the pole. Any soil added to level the bottom of the holes must be tamped before the pole is set in the hole.

3. Bedrock Excavation

a) When shallow bedrock is encountered, the CONTRACTOR shall provide special drilling equipment, including but not limited to: rock core barrels, rock tools, air tools, and other equipment as necessary to construct the excavation to the size and depth required.

4. Backfill

a) If Engineered backfill becomes required, the ideal mix shall be free of organic material and conform to the requirements for Type I, Gradation C, surface-course materials, ANSI/ASTM D1241, except that one hundred percent (100%) shall pass the one and one half (1-1/2) inch screen and that a minimum of eight percent (8%) shall pass the No. 200 screen in lieu of the minimum percentage shown in Table I for Gradation C.

b) Percentages by sieve size for the engineered backfill are as follows:

GRADATION REQUIREMENTS FOR ENGINEERED BACKFILL	
SIEVE SIZE (SQUARE OPENINGS)	**PERCENT PASSING SIEVE (BY WEIGHT)**
1-1/2”	100
3/8”	50 - 85
NO. 4	35 - 65
NO. 10	25 - 50
NO. 40	15 - 30
NO. 200	8 - 15

c) If material conforming to this gradation is costly to provide and/or difficult to locate, the ENGINEER will review samples of road mix which may be locally available and inform the CONTRACTOR of suitability of proposed material. For bid purposes, the CONTRACTOR shall assume that local material can be used without screening for an acceptable gradation, provided that the materials consistency allows compaction to act as a firm base and that it contains no aggregate larger than two (2) inches.

d) Backfill must be placed around the pole in layers not exceeding 6 inches in depth, with each layer mechanically tamped before the next layer is added. The backfill must be compacted to a density equal to or greater than that of the surrounding undisturbed soil. Backfill shall be free of large rocks, organic material or other low density, unsuitable soils and shall be banked and tamped twelve inches above the natural ground surface. If satisfactory backfill material is not available from the excavation or within the immediate vicinity of the structure, the CONTRACTOR would import any additional material required for setting of structures, as approved by the Project ENGINEER. All additional backfill shall be provided by the CONTRACTOR.

e) Upon completion of stringing operations, the CONTRACTOR shall inspect structure compaction at each location for settlement. The CONTRACTOR shall re-tamp poles where necessary due to settlement, mounding up engineered backfill around poles to an elevation of twelve inches above the natural grade, and must be sloped away from pole.

5. Setting Poles

   a) Set poles so that alternate crossarm gains face in opposite directions, except at terminals and dead ends where gains of last two poles are on side facing terminal or dead end. On unusually long spans, set poles so that crossarm comes on side of pole away from long span. Where pole top pins are used, place on opposite side of pole from gain, with flat side against pole.

6. Alignment of Poles

   a) Poles shall be raked, as required so that they shall remain plumb at the corner, angle and terminal structures after conductors are installed to required tension.

7. Marking

   a) Mark each pole in accordance with the requirements of ATIS ANSI O5.1. Mark each pole with height, class, etc. 5 ft above groundline. Mark on the face of the pole at other locations standard with the pole manufacturer, where approved by the COMPANY/ ENGINEER.

D. ANCHOR AND GUY INSTALLATION

1. Place anchors in line with strain. Provide indicated length of the guy lead (distance from base of pole to the top of the anchor rod). Anchors shall be placed in the proper depth excavation to allow a minimum of six inches of rod extension after the guy tension has been applied. Native soils obtained from the excavation should be used to backfill and compact the anchor as necessary.

   a) Setting Anchors

      i. Set anchors in place with anchor rod aligned with, and pointing directly at, guy attachment on the pole with the anchor rod projecting 6 to 9 inches out of ground to prevent burial of rod eye.

   b) Backfilling Near [Plate] Anchors

      i. Backfill plate, expanding, concrete, or cone type anchors with tightly tamped coarse rock 2 feet immediately above anchor and then with tightly tamped earth filling remainder of hole. Backfill plate anchors with tightly tamped earth for full depth of hole.

   c) Screw Anchors

      i. Power installed screw anchors must be installed with the appropriate size and type of equipment in accordance with the ENGINEER's requirements and manufacturer's recommendations. Screw anchors must not be reversed to meet the requirements of project of the rods above the ground. All installations must be witnessed by the COMPANY's representative.

   d) Guy Installation

      i. Securely clamp plastic guy marker to the guy or anchor at the bottom and top of marker. Complete anchor and guy installation, dead end to dead end, and tighten guy before wire stringing and sagging is begun on that

line section. Provide strain insulators at a point on guy strand 8 feet minimum from the ground and 6 feet minimum from the surface of pole. Effectively ground and bond guys to the system neutral.

ii. Each guy must be pretensioned to remove any slack in the guy. Guys must be retensioned after the conductors and overhead ground wires are installed to plumb the poles and to equalize tensions in the guys. If slack guys are found, they must be readjusted so that all guys in any structure have approximately equal tension. The final tension in the guys and the plumb of the poles must meet the approval of the ENGINEER.

e) Proof Tests

i. All anchors are to be proof-tested by the application of a 20,000 lb. load for the duration of three minutes.

E. HARDWARE

1. Provide hardware with washer against wood and with nuts and lock nuts applied wrench tight. Provide locknuts on threaded hardware connections. Provide M-F style locknuts and not palnut style.

F. GROUNDING

1. Unless otherwise indicated, provide grounding that conforms to IEEE C2 and NFPA 70. Provide pole grounding electrodes with a resistance to ground not exceeding 25 ohms.

a) Ground Rod Installation

i. Step 1: Install eight (8) feet of ground rod and measure the ground resistance using a COMPANY-approved testing procedure and instrument(s). If the structure footing resistance is twenty-five (25) ohms or less, record the structure number and structure footing resistance. If the structure footing resistance is greater than twenty-five (25) ohms go to Step 2.

ii. Step 2: Install additional eight (8) foot rod sections until a footing resistance of twenty-five (25) ohms or less is achieved or until the rod has either been driven thirty-two (32) feet or can be driven no further. If the structure footing resistance is twenty-five (25) ohms or less, record the structure number, structure footing resistance and number of ground rods driven. If the structure footing resistance is greater than twenty-five (25) ohms go to Step 3.

iii. Step 3: Install a second ground rod at a new location and repeat Step 2. If the structure footing resistance is still greater than twenty-five (25) ohms after a maximum of four (4) ground rods have been driven at four (4) separate locations then record the structure number, structure footing resistance, number of ground rods driven and contact the ENGINEER of COMPANY's representative so that alternative grounding procedures can be issued if required.

b) If ground rod cannot be installed properly due to presence of bedrock, contact the ENGINEER or COMPANY's representative so that alternative grounding procedures can be issued.

2. Grounding Electrode Conductors

a) On multi-grounded circuits, as defined in IEEE C2, provide a single continuous vertical grounding electrode conductor. Bond neutrals, surge arresters, and equipment grounding conductors to this conductor. For single-grounded or ungrounded systems, provide a grounding electrode conductor for the surge arrester and equipment grounding conductors and a separate grounding electrode conductor for the secondary neutrals. Staple grounding electrode conductors to wood poles at intervals not exceeding 2 feet. Size grounding electrode conductors as indicated. Connect secondary system neutral conductors directly to the transformer neutral bushings, then connect with a neutral bonding jumper between the transformer neutral bushing and the vertical grounding electrode conductor as indicated. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3. Grounding Electrode Connections

a) Make above grade grounding connections on pole lines by exothermic weld or by using a compression connector. Make exothermic welds strictly in accordance with manufacturer's written recommendations. Welds which have puffed up or which show convex surfaces indicating improper cleaning, are not acceptable. No mechanical connectors are required at exothermic weldments. Provide compression connectors that are the type that uses a hydraulic compression tool to provide correct pressure. Provide tools and dies recommended by compression connector manufacturer. Provide an embossing die code or similar method as visible indication that a connector has been fully compressed on ground wire.

4. Grounding and Grounded Connections

a) Where no primary or common neutral exists, bond together surge arresters and frames of equipment operating at over 750 volts and connect to a dedicated primary grounding electrode.

b) Where no primary or common neutral exists, transformer secondary neutral bushing, secondary neutral conductor, and bond together frames of equipment operating at under 750 volts and connect to a dedicated secondary grounding electrode.

c) When a primary or common neutral exists, connect all grounding and grounded conductors to a common grounding electrode.

G. CONDUCTOR INSTALLATION

1. Line Conductors

a) Handle conductors with care necessary to prevent nicking, kinking, gouging, abrasions, sharp bends, cuts, flattening, or otherwise deforming or weakening conductor or any damage to insulation or impairing its conductivity. Remove damaged sections of conductor and splice conductor. Provide conductors that are paid out with the free end of conductors fixed and cable reels portable,

except where terrain or obstructions make this method unfeasible. Make the bend radius for any insulated conductor not less than the applicable NEMA specification recommendation. Do not draw conductors over rough or rocky ground or around sharp bends. When installed by machine power, provide conductors that are drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions. Check the initial sag and tension, in accordance with the manufacturer's approved sag and tension charts, within an elapsed time after installation as recommended by the manufacturer.

2. Connectors and Splices

a) Provide conductor splices, as installed, that exceed ultimate rated strength of conductor and are of the type recommended by conductor manufacturer. No splices are permitted within 25 feet of a support. Provide connectors and splices that are mechanically and electrically secure under tension and are of the non-bolted compression type. Make splices have a tensile strength of not less than the rated breaking strength of the conductor. Provide splice materials, sleeves, fittings, and connectors that are noncorrosive and that do not adversely affect conductors. Wire brush and apply an oxide inhibitor to aluminum-composition conductors before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Provide types of inhibitors and compression tools recommended by the connector manufacturer. Provide solderless pressure type low-voltage connectors for copper conductors. Smoothly tape noninsulated connectors to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, install the aluminum above the copper.

3. Ties

a) Provide ties on pin insulators tight against conductor and insulator and ends turned down flat against conductor so that no wire ends project.

4. Guard Structures

a) Guard structures must be furnished and installed by the CONTRACTOR, where required, to prevent the conductor or overhead ground wires which are being pulled from coming into contact with existing overhead electric supply lines, communication lines, roads, highways, and railroads crossed by the line. All labor and materials required must be furnished by the CONTRACTOR and included in the cost for conductor.

b) After completion of all wire work, the CONTRACTOR shall remove the guard structures, fill and tamp all pole holes, and restore the right-of-way and access to its original condition.

5. Reinstalling Conductors

a) When splicing wire into existing spans the existing wire tension shall be determined prior to cutting into existing wire. After splicing in new wire the span wires shall be re-sagged to the same condition as existing.

6. New Conductor Installation

a) The CONTRACTOR shall perform stringing in accordance with IEEE Publication 524, "Guide to the Installation of Overhead Transmission Line Conductors", subject to the conductor manufacturer's concurrence.

b) The precise stringing procedures which include equipment to be used, number of crews, composition, and responsibilities of each crew, proposed equipment set-up, locations of all splices, and locations and descriptions of temporary snubs and anchors shall be submitted to the ENGINEER or COMPANY's representative for review and approval prior to any stringing operations.

c) The CONTRACTOR shall take extreme care during the conductor stringing operation to avoid damage to conductor or overhead ground wire strands. This damage can be defined as any deformity on the wire which can be detected by sight or touch. Kinked, twisted, abraded, "bird-caged", or flattened wire will not be allowed to remain on the line. If damage is found, the stringing operation shall be halted. Any conductor found to be damaged as described above shall be replaced or repaired by the CONTRACTOR at his own expense, and to the satisfaction of the ENGINEER or the COMPANY's representative.

d) The stringing tension shall be high enough to ensure that the conductor does not drag across the ground, trees, underbrush, fences, guard structures, towers, or any other surface other than the stringing sheaves. The CONTRACTOR shall continuously inspect the conductor as it leaves the reels. If the conductor has an accumulation of grease, oil, dirt or any other foreign substance, such substance shall be removed as the wire leaves the reels by a method approved by the ENGINEER or the COMPANY's representative.

e) No more than one splice shall be allowed in each phase of a tension section consisting of more than one span. No splices are allowed in single span tension sections.

f) Not more than two (2) reels of conductor per phase may be pulled at one time. Full tension compression splices shall not be pulled through the stringing blocks.

g) During stringing operations, the CONTRACTOR shall ensure that the conductor will not be dragged on the ground, driven over with vehicles, or allowed to come into contact with any fences or other structures. Fences and small structures should be removed or well covered during the stringing operation. The CONTRACTOR shall not begin stringing operations unless weather reports indicate that wind and weather will allow adequate time to sag and clip in all structures.

h) All conductors shall be sagged to the proper tensions in accordance with the initial stringing sag and tension data charts provided by the ENGINEER. All sagging shall be checked by dynamometer or by sighting with a target and transit as indicated in the IEEE Publication 524. CONTRACTOR shall ensure that all sags shall be within a tolerance of +3 and -0 inches of the specified values in the stringing charts.

i) The CONTRACTOR shall select the length of each sag and the sag-checking spans subject to the review and approval of the ENGINEER. Regardless of the

CONTRACTOR's sagging method, the CONTRACTOR shall ensure that uniform tensions are realized throughout the sag and that the allowable sag and tolerances are not exceeded.

j) The CONTRACTOR shall make any and all necessary adjustments in the conductor or hardware at any time during the construction period to ensure that the conductor is at the proper tension, sags are within tolerance, and suspension insulators and overhead ground wire assemblies hang plumb. These ongoing adjustments will be furnished by the CONTRACTOR at no additional cost to the COMPANY.

k) The CONTRACTOR shall ensure that each reel of wire is sagged within seventy-two (72) hours after the start of the stringing operation.

7. Fittings

a) Provide dead end fittings [clamp or compression type] that conform to written recommendations of ENGINEER of record and that develop full ultimate strength of conductor.

8. Aluminum Connections

a) Make aluminum connections to copper or other material using only splices, connectors, lugs, or fittings designed for that specific purpose. Keep a copy of manufacturer's instructions for applying these fittings at job site for use of the inspector.

H. JUMPERS

1. All jumpers must be installed in accordance with the manufacturer's recommendations. Jumper wire loops must be of sufficient length to present a smooth, uniformly curving appearance, and which do not put the jumper string of insulators in compression. Excess length of conductor from the wire stringing operation may be used to make up the jumper loops.

I. REELS AND EXCESS CONDUCTOR

1. CONTRACTORs shall be responsible for salvaging the wire reels and all excess conductor and overhead ground wire. All such wire must be inventoried, placed on reels, and returned to the client or disposed of as directed by the ENGINEER. Returnable reels must be shipped back to the wire fabricators in accordance with the ENGINEER's instruction. Nonreturnable wood reels must be disposed of in a manner meeting the approval of the ENGINEER. All costs associated with the receiving, handling, shipping, or disposal of excess wire and reels must be in the labor costs for installation of wire units.

J. RISER

1. Secure galvanized steel conduits on riser pole by galvanized steel pipe straps spaced no more than four feet as indicated and within 3 feet of any outlet or termination. Ground metallic conduits. Secure steel riser shields on poles as indicated.

K. CROSSARM MOUNTING

1. Extend bolts not less than 1/8 inch or more than 2 inches beyond nuts. On single crossarm construction, install the bolt head on the crossarm side of the pole. Provide fiberglass crossarm braces on crossarms.

2. Line Arms and Buck Arms

   a) Provide line arms and buck arms that are set at right angles to lines for straight runs and for angles 45 degrees and greater; and line arms that bisect angles of turns of less than 45 degrees. Use dead-end assemblies for turns where shown. Install buck arms, as shown, at corners and junction poles. Provide double crossarms at ends of joint use or conflict sections, at dead-ends, and at angles and corners to provide adequate vertical and longitudinal strength. Provide double crossarms at each line-crossing structure and where lines not attached to the same pole cross each other.

3. Equipment Arms

   a) Set equipment arms parallel or at right angles to lines as required to provide climbing space. Locate equipment arms below line construction to provide necessary wire and equipment clearances.

L. FIELD QUALITY CONTROL

1. Perform field testing in the presence of the COMPANY/ ENGINEER. Notify the COMPANY/ ENGINEER prior to conducting tests. Furnish materials, labor, and equipment necessary to conduct field tests. Perform tests and inspections recommended by the manufacturer unless specifically waived by the COMPANY/ ENGINEER. Maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Sign and date field reports.

   a) Safety

      i. Provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. Replace any devices or equipment which are damaged due to improper test procedures or handling.

   b) Sag and Tension Test

      i. Give the COMPANY/ ENGINEER prior notice of the time schedule for stringing conductors or cables serving overhead medium-voltage circuits. The COMPANY/ ENGINEER reserves the right to witness the procedures used for ascertaining that initial stringing sags and tensions are in compliance with requirements for the applicable loading district and cable weight.

   c) Pre-Energization Services

      i. Perform the following services on the equipment listed below. Perform these services subsequent to testing but prior to the initial energization. Inspect the equipment to insure that installation is in compliance with the recommendations of the manufacturer. Inspect terminations of

conductors at major equipment to ensure the adequacy of connections. Inspect bare and insulated conductors between such terminations to detect possible damage during installation. If factory tests were not performed on completed assemblies, perform tests after the installation of completed assemblies. Inspect components for damage caused during installation or shipment and to ensure that packaging materials have been removed.

d) Performance of Acceptance Checks and Tests

i. Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

- Grounding System

  - o Visual and mechanical inspection: Inspect ground system for compliance with contract plans and specifications.

- Electrical tests

  - o Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. Provide an instrument that is equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

ii. Devices Subject to Manual Operation

- Operate each device subject to manual operation at least three times, demonstrating satisfactory operation each time.

e) Follow-Up Verification

i. Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, give the COMPANY/ ENGINEER 5 working days advance notice of the dates and times of checking and testing.

3.3 UNDERGROUND EXECUTION

A. GENERAL

1. SHIPPING

a) In general, dusty conditions will exist at the site and hence wherever possible, the cable ends, bushings, and terminating materials shall be well protected

during transport. Cable ends shall be kept sealed by heat shrinkable PVC or polyethylene caps to prevent damage and ingress of moisture.

B. CONTRACTOR'S RESPONSIBILITY

1. CONTRACTOR shall install all materials, connected, erected, cleaned and conditioned in accordance with the manufacturer's instructions, except as otherwise provided in the specifications.

2. CONTRACTOR shall determine the locations of all existing power, communication and pipeline facilities within the project areas in accordance with applicable laws and regulations. CONTRACTOR shall bring to COMPANY and ENGINEER any interference and make provisions subject to ENGINEER approval to avoid interference with the operation and maintenance of such facilities.

3. CONTRACTOR shall provide indoor weather proof storage suitable for storing cable splicing and terminating materials and other weather sensitive equipment. The storage shall be adequately sized to contain and allow the inspection of the material and equipment.

4. CONTRACTOR shall provide all tools and equipment required for the complete installation.

5. CONTRACTOR shall do all grubbing, soil and rock excavation, drilling, forming, sheathing, pumping and draining required for proper installation of the work.

6. The CONTRACTOR shall interface and coordinate terminations and the methods of terminations with the transformer supplier to ensure no major problems occur during installation.

C. TRENCHING

1. Trenches for direct-burial cables shall be excavated to depths required to provide the minimum necessary cable cover. When rock is encountered, remove to a depth of at least 3 inches below the cable and fill the space with sand.

2. Bottoms of trenches shall be smooth and free of stones and sharp objects. Where materials in bottoms of trenches are other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil.

3. Trenches shall be not less than 15 inches wide, and shall be in straight lines between cable markers. Cable plows shall not be used.

4. Bends in trenches shall have a radius consistent with the cable manufacturer's published minimum cable bending radius for the cable installed.

5. Cables shall be directly buried in earth below the frost line per IEEE C2 and NEC. Minimum depth of burial shall not be less than 36 inches.

D. CABLE INSPECTION

1. Prior to installation, each cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable prior to installation in accordance with the cable manufacturer's recommendations.

E. CABLE INSTALLATION PLAN AND PROCEDURE FROM MANUFACTURER

1. The CONTRACTOR shall obtain from the manufacturer an installation manual or set of instructions that address such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. CONTRACTOR shall then prepare a checklist of significant requirements, perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturer’s instructions in accordance with submittals. Cable shall be installed strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

2. Calculations and pulling plan shall include:

   a) Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

   b) List of cable installation equipment.

   c) Lubricant manufacturer's application instructions.

   d) Procedure for resealing cable ends to prevent moisture from entering cable.

   e) Cable pulling tension calculations of all cable pulls.

   f) Cable sidewall bearing pressure.

   g) Cable minimum bend radius and minimum diameter of pulling wheels used.

   h) Cable jam ratio.

   i) Maximum allowable pulling tension on each different type and size of conductor.

   j) Maximum allowable pulling tension on pulling device.

F. CABLE INSTALLATION

1. The cables shall be unreeled along the sides of or in trenches and carefully placed on sand or earth bottoms. Pulling cables into direct-burial trenches from a fixed reel position will not be permitted, except as required to pull cables through conduits under paving or railroad tracks and through conduits at overhead line structure and pad mounted transformer.

2. Cable placement shall be done under constant ENGINEER’s supervision.

3. Where two or more cables are laid parallel in the same trench, space cables laterally at not less than 3 inches apart.

4. Where direct burial cable transitions to duct-enclosed cable, direct-burial cables shall be centered in duct entrances, and a waterproof nonhardening mastic compound shall be used to facilitate such centering.

5. Sufficient slack, and in no case less than 24 inches, must be left at riser structure and transformer pads so that movements of the cable after backfilling will not damage or strain the cable. Riser conduit shall extend at least 18 inches below grade at riser poles.

6. Bends in cables shall have an inner radius not less than those specified per manufacturer's recommendation. Cable bends must not be made within 6 inches of the cable terminal base.

G. BACKFILL AND COMPACTING

1. The first six inches of trench backfill shall be free from rock, gravel or other material which will damage the cable jacket.

2. The CONTRACTOR shall place a 2 inch bed of clean sand under the cable and 4 inches of clean sand above the cable. This soil layer shall be carefully compacted so that the cable is not damaged. The remainder of trench backfill shall be compacted to a density not less than the natural in-place dry density of the surrounding earth. Backfill shall be free of large rocks (>0.75''), organic material or other low density, unsuitable soils.

3. Backfilling shall be completed in such a manner that voids will be minimized. Excess soil shall be piled on top and must be well tamped.

4. Restore to their original elevation and condition unpaved surfaces disturbed during installation of direct burial cable.

5. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed.

H. ALUMINUM CONDUCTOR TERMINATION

1. Use particular care in making up joints and terminations. Remove surface oxides by cleaning with a wire brush or emery cloth. Apply joint compound to conductors, and use UL-listed solid aluminum connectors for connecting aluminum conductors. When connecting aluminum to copper conductors, use connectors specifically designed for this purpose.

2. Terminate aluminum conductors at cable terminators on the riser structure by using all-aluminum nuts, bolts, washers, and lugs, or as directed by cable terminator manufacturer.

3. Connect the load-break elbow connector, bushing well to pad-mounted transformer.

I. GROUNDING

1. Ground concentric neutral wires of each phase conductor and bond with a ground wire at each termination at the riser structure and pad-mounted transformer.

J. SEALING AND FIELD TESTS

1. When the installation is complete, CONTRACTOR shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals

shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

2. After installation of the 15 kV cable and all terminations are complete, field acceptance tests as identified below shall be performed. The Supplier's site representative and the ENGINEER shall sign-off on the individual certified test forms.

3. Visual and mechanical inspections include the following:

   a) Inspect exposed cable sections for physical damage.

   b) Verify that cable is supplied and connected in accordance with contract plans and specifications

   c) Inspect for proper shield grounding, cable support, and cable termination

   d) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius

   e) Visually inspect jacket and insulation condition

   f) Inspect for proper phase identification and arrangement

4. Measurement of electrical resistance shall be conducted between ends of each complete conductor and termination.

5. The following electrical tests shall be conducted:

   a) Perform a shield continuity test on each power cable by ohmmeter method. Record Ohmic value, resistance values in excess of 1 ohms per 100 feet of cable shall be investigated and justified.

   b) Perform high potential test on cable.

6. Commissioning: After all tests have been completed, commissioning of the complete system shall be performed.

- END OF SECTION -

ATTACHMENT A

TEMPORARY POWER LINE PERFORMANCE SPECIFICATION

PART 1 – GENERAL

1.1 INTRODUCTION

A. Temporary power lines shall be constructed at the Midnite Mine Site to provide electricity to the existing WTP and outbuildings where needed, associated dewatering pumps and controls, and the construction support zone throughout all phases until the permanent power system is available. Temporary power line shall be used instead of generators wherever feasible. The capacity of the existing power lines shall be verified by CONTRACTOR to be sufficient to meet the demand of the temporary power line powered equipment prior to use.

B. It is intended that this attachment contain the specific requirements for the temporary power lines. The Temporary Distribution Line specification contains references to standards, codes, best practices and industry specific requirements which shall be applied in conjunction with the project specific details and requirements described in this specification. The specifications shall form the technical basis for the design, material procurement and construction of the temporary power lines.

C. CONTRACTOR is responsible for coordination, design and installation of an electrical distribution system at the site. System changes needed to accommodate CONTRACTOR's remediation Work will be performed by the CONTRACTOR to meet the CONTRACTOR's schedule and the project's powered equipment needs.

1.2 POWER LINE ENGINEERING AND DESIGN

A. LOAD AND WEATHER CASES

1. The required load and weather cases are described in the following tables, which the CONTRACTOR shall use to design the power line and the supporting structures.

Table 1. Loads Cases

Description	Weather case	Cable condition	Wire Vert. Load Factor	Wire and Struct. Wind Load Factor	Wire Tension Load Factor	Struct. Weight Load Factor	Strength Factor Steel Poles Tubular-Arms	Strength Factor Wood Poles	Strength Factor Concrete Poles Ultimate	Strength Factor Guys	Strength Factor Non- Tubular Arms	Strength Factor Braces	Strength Factor Insulators	Strength Factor Foundation
RULE 250B	NESC Heavy District Loading (250B)	Initial RS	1.5	2.5	1.65	1.5	1	0.65	1	0.9	0.65	0.65	1	1
RULE 250B Uplift	NESC Heavy District Loading (250B)	Initial RS	1	2.5	1.65	1	1	0.65	1	0.9	0.65	0.65	1	1
RULE 250C	NESC Extreme Wind (250C)	Initial RS	1	1	1	1	1	0.75	1	0.9	0.75	0.75	1	1
RULE 250D	NESC Concurrent Ice and Wind (250D)	Initial RS	1	1	1	1	1	0.75	1	0.9	0.75	0.75	1	1
RULE 277 Insulators	NESC Heavy District Loading (250B)	Initial RS	1	1	1	1							1	1
Extreme Ice	Extreme Ice	Initial RS	1	1	1	1	1	1	1	1	1	1	1	1
Uplift	Cold Uplift	Initial RS	1	1	1	1	1	1	1	1	1	1	1	1
RULE 261A	NESC Extreme Wind (250C)	Initial RS	1	1	1	1	1	0.75	1	0.9	0.75	0.75	1	1
RULE 250B (Broken Wire)	NESC Heavy District Loading (250B)	Initial RS	1.5	2.5	1.65	1.5	1	0.65	1	0.9	0.65	0.65	1	1
RULE 250C (Broken Wire)	NESC Extreme Wind (250C)	Initial RS	1	1	1	1	1	0.75	1	0.9	0.75	0.75	1	1
RULE 250D (Broken Wire)	NESC Concurrent Ice and Wind (250D)	Initial RS	1	1	1	1	1	0.75	1	0.9	0.75	0.75	1	1
Extreme Ice (Broken Wire)	Extreme Ice	Initial RS	1	1	1	1	1	1	1	1	1	1	1	1

Table 2. Weather Cases

Description	Air Density Factor (Q) (psf/mph^2)	Wind Velocity (mph)	Wind Pressure (psf)	Wire Ice Thickness (in)	Wire Ice Density (lbs/ft^3)	Wire Temp. (deg F)	Weather Load Factor	NESC Constant (lbs/ft)	Wire Wind Height Adjust Model	Wire Gust Response Factor
NESC Heavy District Loading (250B)	0.00256	39.5	4	0.5	57	0	1	0.3	None	1
NESC Extreme Wind (250C)	0.00256	90	20.7	0	0	60	1	0	NESC 2012	NESC 2012
NESC Concurrent Ice and Wind (250D)	0.00256	40	4.1	0.5	57	15	1	0	None	1
Extreme Ice	0.00256	0	0	0.5	57	30	1	0	None	1
Cold Uplift	0.00256	0	0	0	0	-20	1	0	None	1
Maximum Operating	0.00256	0	0	0	0	212	1	0	None	1
NESC Tension Limit (261H1b)	0.00256	0	0	0	0	0	1	0	None	1
NESC Blowout 6PSF	0.00256	48.4	6	0	0	60	1	0	None	1
No Wind (SWING 1)	0.00256	0	0	0	0	60	1	0	None	1
Moderate Wind (SWING 2)	0.00256	48.4	6	0	0	32	1	0	None	1
Moderate Wind (SWING 3)	0.00256	48.4	6	0	0	60	1	0	None	1
High Wind (SWING 4)	0.00256	90	20.7	0	0	60	1	0	None	1
GALLOPING (SWING)	0.00256	28.0	2	0.5	57	32	1	0	None	1
GALLOPING (SAG)	0.00256	0	0	0.5	57	32	1	0	None	1
-20 Deg F	0.00256	0	0	0	0	-20	1	0	None	1
0 Deg F	0.00256	0	0	0	0	0	1	0	None	1
30 Deg F	0.00256	0	0	0	0	30	1	0	None	1
32 Deg F & 1/2 Inch Ice	0.00256	0	0	0.5	57	32	1	0	None	1
60 Deg F	0.00256	0	0	0	0	60	1	0	None	1
90 Deg F	0.00256	0	0	0	0	90	1	0	None	1
120 Deg F	0.00256	0	0	0	0	120	1	0	None	1
167 Deg F	0.00256	0	0	0	0	167	1	0	None	1
212 Deg F	0.00256	0	0	0	0	212	1	0	None	1

B. WIRE TENSION LIMITS

1. Power line design shall be in conformity with the wire tension limits requirements shown in the table below.

Table 3. Wire Tension Limits

Weather case	Cable condition	% of Ultimate
NESC Heavy District Loading (250B)	Initial RS	60
NESC Extreme Wind (250C)	Initial RS	80
NESC Concurrent Ice and Wind (250D)	Initial RS	80
NESC Tension Limit (261H1b)	Initial RS	35
NESC Tension Limit (261H1b)	Creep RS	25
0 Deg F	Creep RS	14

C. PERMANENT STRETCH DUE TO CREEP AND LOAD

1. Weather cases are listed in the following table for calculating the permanent stretches due to creep and short term exposure to extreme loads.

Table 4. Weather Cases for Final after Creep and Load

Weather Case for Final after Creep
60 Deg F

Weather Cases for Final after Load
NESC Heavy District Loading (250B)
NESC Extreme Wind (250C)
NESC Concurrent Ice and Wind (250D)
Extreme Ice

D. CLEARANCES

1. CONTRACTOR shall be responsible for designing and constructing the power lines to the NESC minimum clearance requirements including but not limited to the vertical clearances above ground and other obstacles, horizontal clearances from line conductors to objects, clearances between conductors and between conductors and overhead ground wire, and clearances of conductors from supporting structures.

E. STRUCTURE TYPES AND CONFIGURATIONS

1. CONTRACTOR shall be responsible for establishing the detailed configuration, design, and detailing of all structures in the structure family following the general configuration guidelines as described in the Midnite Temporary Power Line Technical Specification.

2. CONTRACTOR shall submit structure design calculations and drawings, fabrication details, alignment drawing and fabrication drawings for review by ENGINEER.

F. FOUNDATION

1. Wood pole structures may be direct embedded using native backfill where applicable. CONTRACTOR shall determine the required embedment depth using accepted design and analysis methods. When the required depth becomes greater than ten percent (10%) plus four (4) feet using the average embedded diameter of the pole only, a combination of increased hole diameter and engineered backfill shall be used to determine an appropriate embedment.

2. CONTRACTOR shall coordinate with COMPANY/ Supervising CONTRACTOR to conduct Geotechnical field investigation to assist in the foundation design.

G. SPOTTING

1. Structures shall be spotted to maintain the NESC minimum clearance requirements. In addition, spotting shall be compliant with clearances to edge of established right-of-way.

H. POWER LINE INTERFACE

1. CONTRACTOR shall be responsible for coordinating with COMPANY to assure integrated construction schedules and design compatibility between newly constructed and existing power lines.

I. RE-USE OF POLES

1. In order to re-use some of the existing poles installed during the previous construction phase(s), the third party pole inspection company like Osmose Utilities Services, Inc. or equal shall be involved to perform the inspection and/ or testing of the strength and conditions of the poles. CONTRACTOR shall also ensure the reused poles meet the design criteria and requirements contained in the power line specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 POWER LINE CONSTRUCTION

A. GENERAL REQUIREMENTS

1. CONTRACTOR shall prepare a complete power distribution plan and schedule package (Construction Package) to be submitted no later than thirty (60) days prior to construction mobilization. Unless otherwise specified, CONTRACTOR shall provide three (3) paper copies and two (2) digital copies of the Construction Package. The Construction Package shall be bookmarked, on ANSI "B" paper (11"x17"), as applicable in three-ring binders with sections labeled and ordered, including, but not limited to the following:

- Location Map
- Plan & Profile Drawings
- Outage Constraints with Complete Schedule
- Right-of-Way Constraints
- Geotechnical Reports
- Staking Sheets
- Structure Drawings
- Structure Foundation Drawings
- Structure Erection Drawings
- Conductor Installation and Handling
- Insulator and Hardware Assembly Drawings
- Initial and Final Sag Charts

B. CONTRACTOR'S SAFETY ASSURANCE PROGRAM

1. CONTRACTOR shall establish and document as a plan a project-specific electrical power system safety assurance program, which is owned by CONTRACTOR and is project-wide in scope and has jurisdiction over all activities of the CONTRACTOR and all sub-CONTRACTORs. The safety assurance program shall include the identification of a safety assurance officer who shall have authority over the entire project for health and safety issues consistent with the safety assurance program. The safety assurance program will be submitted with CONTRACTOR's bid and be incorporated into the Contract.

C. CONTRACTOR'S QUALITY ASSURANCE PROGRAM

1. CONTRACTOR shall prepare and submit a project-specific quality assurance program. The quality assurance program will be submitted with CONTRACTOR's bid carrying the expectation that the CONTRACTOR will eventually establish a project-specific quality assurance program which will be incorporated into the Contract.

D. TEMPORARY WORK AND OUTAGES

1. To enable the installation of the foundations and/or structures setting or to avoid extended outages, temporary electrical connections may have to be installed so the existing circuits can be returned to service. CONTRACTOR shall comply with the COMPANY's general requirements for outages for energized facilities and equipment and for working in the vicinity of energized facilities and equipment. CONTRACTOR shall be responsible for damages and downtime as a result of downtime in excess of requirements. CONTRACTOR shall prepare a detailed work plan for each location where temporary Work is required or requested. The work plan shall detail the labor, equipment and material required, a detailed description and sequence of construction activities, outage procedures and safety procedures. The extent of all temporary line Work shall be determined by CONTRACTOR and reviewed by ENGINEER fourteen (14) days before Work is to be performed.

E. LINE CROSSINGS

1. CONTRACTOR shall be responsible for ensuring that all potential power line crossings are identified through engineering analysis and field survey. CONTRACTOR shall be responsible for all work associated with any line crossings.

2. CONTRACTOR shall install guard structures as determined by engineering and field analysis for power line crossings to assure required clearance can be maintained during construction and after final completion of temporary power lines.

3. Where proper clearance cannot be maintained either during construction, or after final completion of temporary power lines, and modifications to COMPANY or other facilities is required, CONTRACTOR shall be responsible for the costs to relocate such facilities including the coordination and costs associated with other third party facility COMPANYs.

4. CONTRACTOR shall be responsible for ensuring all necessary permits are obtained for the work described in this section.

F. ACCEPTANCE REQUIREMENTS

1. Upon completion of temporary construction activities, CONTRACTOR shall undertake, perform to satisfactory completion, and document all to COMPANY's satisfaction the following Acceptance Requirements:

2. Third-Party Inspection Report. CONTRACTOR shall employ an independent third-party inspector to perform an inspection focusing on (i) compliance with specifications and codes; (ii) insulator assemblies installed on each structure;(iii) shield wire/OPGW hardware assemblies; and (iv) rights of way conditions. Inspection shall be completed at the request of the ENGINEER not to exceed 2 times per year. The inspection report shall contain a summary analysis of the

actual findings, as compared to the Contract requirements and Specifications for each of the aforementioned items. Additionally, the inspection report shall contain the inspector's observation report. Non-conformances identified by the visual inspections shall be included in the Punchlist and shall be repaired. COMPANY shall have fifteen (15) Business Days after receipt of the completed inspection report to review and provide any comment, as appropriate.

3. Power Line Clearance Verification. CONTRACTOR shall verify that all clearances for the power line are in accordance with the design drawings and the NESC minimum clearance requirements.

- END OF SECTION -

SECTION 01520 - SECURITY

PART 1 -- GENERAL

1.1 SECURITY PROGRAM

A. The CONTRACTOR shall:

1. Protect WORK, existing premises COMPANY'S operations from theft, vandalism, and unauthorized entry.

2. Initiate program in coordination with COMPANY'S existing security system at mobilization.

3. Maintain program throughout construction period until COMPANY'S occupancy.

1.2 ENTRY CONTROL

A. The CONTRACTOR shall:

1. Restrict entry of persons and vehicles into Site.

2. Allow entry only to authorized persons with proper identification.

3. Maintain log of workmen and visitors and make log available to COMPANY on request.

B. COMPANY will control entrance of persons and vehicles related to COMPANY'S operations.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01525 – CONSTRUCTION SUPPORT ZONE TEMPORARY FACILITIES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide labor, equipment, and materials to construct the temporary facilities in the Construction Support Zone as shown on the Drawings.

B. The CONTRACTOR shall furnish, install and service the ENGINEER'S field office at the Site, including connection to the CONTRACTOR's temporary power system as indicated in Section 01510 – Temporary Utilities. The ENGINEERS's office shall be located in a location designated by the ENGINEER.

1.2 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Remedial Action Work Plan, Appendix B, Construction Support Facilities and Early Works

a. Special consideration shall be given to the Performance Standards listed in the above referenced work plan. CONTRACTOR provided facilities shall comply with these standards.

1.3 CSZ REQUIREMENTS

A. A general layout and grading plan for the CSZ is shown on the Drawings. The CONTRACTOR may elect to configure the facilities differently to suit its operations. Any reconfiguration or deviation from that shown on the plans shall meet the requirements of this specification, and shall be submitted to the ENGINEER for review and approval. Expansion of the CSZ beyond the limits shown on the Drawings requires AGENCY approval in addition to ENGINEER approval.

B. A list of Construction Support Zone areas and uses are provided in the table below for the CONTRACTOR'S reference.

Area Designation	Function/Use
Construction Management Area and Site Sign-In	Construction offices, parking, visitor control.
Safety/Emergency Services Area	Medical/safety office, carport for on-site ambulance, 80' x 80' helipad.
Contractor Lay-Down and Storage Area	Clean material laydown area.
Fuel Farm Area	Bulk fuel storage. Located within the CSZ to facilitate deliveries without decontamination of delivery trucks.
Crew Drop-Off/Pick up and Lunch Area	Area for: (1) Construction crew to be dropped off and picked up by shuttle vehicles, (2) Contractor trailers for crew lunches, safety meetings, etc. , and (3) Portable restrooms.
Construction Personnel Decontamination Area	Decontamination trailers and laundry facilities. Construction crew sign in/sign out.

Area Designation	Function/Use
Vehicle and Equipment Decontamination Area	Area for scanning and decontamination of vehicles and equipment leaving the MA. Will include area for vehicle/equipment decontamination activities, a geomembrane lined sump for collecting impacted water, a sediment trap to separate the sediment from impacted water, heated building for housing decontamination equipment.
MA Vehicle Parking Area	Within the MA, adjacent to the Personnel Decontamination Area to promote efficient flow of Site Contractor personnel to and from on-site vehicles in the MA.
Contractor Maintenance/ Electrical Area	Area within the MA for the Contractor's use.
On-Site Mobile Laboratory Area	Within the MA. To be used for the On-Site Mobile Laboratory and associated storage and parking.

1.4 SUBMITTALS

A. CONTRACTOR shall submit the following for ENGINEER review and approval in accordance with Section 01300 - Contractor Submittals:

1. Plan layout and grading of proposed CSZ facilities

2. Description of facilities and list of all equipment to be provided for each area listed in the table in Part 1.3 of this Section.

3. List of proposed deviations or modifications from the Drawings and Specifications.

4. Any other information required to demonstrate compliance with applicable performance standards (see Part 1.2 of this Section).

B. To the extent practical, the submittal listed above shall be compiled in a single comprehensive submittal.

1.5 ENGINEER'S FIELD OFFICE SCHEDULE

A. The ENGINEER's field office shall be for exclusive use by the ENGINEER and the COMPANY's representative and staff and shall be furnished and setup by the CONTRACTOR within 14 Days after the commencement date stated in the Notice-to-Proceed or other time as mutually agreed with the ENGINEER.

B. The CONTRACTOR's attention is directed to the condition that no payment for that portion of the Contract Price designated for mobilization, or any part thereof, will be approved for payment until the field office facilities indicated herein have been set up. Separate payment will be made for set up and servicing of the ENGINEER's field office.

C. Unless released earlier by the ENGINEER in writing, the field office shall be maintained in full operation at the Site with all utilities connected and operable until the Notice of Completion has been executed or recorded. Upon execution or recordation of the Notice of Completion, or upon early release of the field office by the ENGINEER, the CONTRACTOR shall disconnect and remove the office, and the CONTRACTOR shall restore the Site occupied by the field office according to the requirements of the Contract Documents.

PART 2 -- PRODUCTS

2.1 OFFICE FACILITIES

A. **General:** The CONTRACTOR shall provide necessary electrical wiring, plumbing, toilet and lavatory fixtures, air conditioning and heating equipment, and shelving, and shall furnish light, heat, water, and daily janitorial services in connection with the field office.

B. **Primary Field Office:** The office shall be one separate, well lighted, air conditioned, electrically-heated field office with a toilet room containing a water closet and lavatory partitioned off from the working area. The water closet may be of the chemical type provided that it is a flush type with an approved holding tank. The toilet room door shall be provided with a latch set. Water efficient fixtures shall be provided. The office shall have an outside door lock. Area of the field office shall not be less than 896 square feet, excluding toilet room area. Office shall be of the portable trailer type unless otherwise specifically authorized by the ENGINEER in writing and shall be a separate unit, not attached or connected to any other structures. The office shall have as minimum 3 private offices, one conference room, and one common area that can accommodate at least 2 desks, 4 filing cabinets, 1 plan table, and 2 bookcases.

2.2 FIELD OFFICE FURNISHINGS

A. The CONTRACTOR shall furnish the following items in good condition in the primary field office:

[[[ ]]] each	Standard 30- by 60-inch desks with not less than 3 drawers each
[[[ ]]] each	Plan table 36- by 72-inch top; 36-inches tall
[[[ ]]] each	Plan rack (all metal plan-hold type) capable of holding 6 sets of plans, complete with 6 standard all metal plan-hold clamps
[[[ ]]] each	File cabinet, legal size, 4 or 5 drawer with lock and 3 keys, double suspension, complete.
[[[ ]]] each	Office chairs, standard armrest type, adjustable, swivel, tilt-back with casters
[[[ ]]] each	Office chairs, stiff-leg type, no armrest
[[[ ]]] each	Waste baskets
[[[ ]]] each	White Board, 36- by 42-inches
[[[ ]]] each	[[[4]]] [[[5]]] shelf bookshelves
[[[ ]]] each	Bottled water dispenser unit (supplying both hot and cold water) and bottled water service and supply of paper cups
[[[ ]]] each	Recycling receptacles; including individual receptacles for aluminum, plastic, paper & cardboard.
	Energy efficient fluorescent or LED lighting fixtures and bulbs
	Thermal window coverings

2.3 FIELD OFFICE SERVICES

A. Each field office shall be provided with sufficient lighting to produce not less than 50 foot-candles at desktop height at each desk location. Exterior lighting shall be provided over the entrance door. Lighting fixtures and bulbs shall be energy-efficient fluorescent or LED.

B. A minimum of four 110 VAC duplex grounded electric convenience outlets shall be provided in each office and in the conference room and common area. At least one such outlet shall be located on each wall. The electric distribution panel shall service not less than two 110 VAC circuits.

C. Where inside toilet facilities are not connected to outside plumbing, a flush-type chemical toilet with a holding tank shall be provided. Sanitary waste material shall be regularly pumped out and the chemicals recharged. Toilet paper and paper towels shall be furnished for each toilet facility.

D. Regular daily janitorial services shall be furnished during working hours each Day. Offices shall be swept, dusted, and waste receptacles and recycling receptacles emptied. Toilet facilities shall be sanitized and cleaned daily, and paper supplies shall be replenished.

2.4 COMMUNICATIONS

A. Communications shall be provided in accordance with Specification Section 01510 - Temporary Utilities.

2.5 DECONTAMINATION FACILITIES

A. The Decontamination Facilities shall contain (1) a vehicle decontamination area, and (2) a personnel decontamination area. As shown on the Drawings, these decontamination areas will be adjacent to one another, but separate to isolate personnel traffic from vehicular traffic and to minimize the potential for accidents.

B. **Vehicle Decontamination Area:** Vehicle decontamination facilities shall be located in the northwest corner of the fenced-in support corridor as shown on the Drawings. The vehicle decontamination area shall be paved with concrete and shall drain to a geomembrane-lined sump. The collection sump will collect impacted water from the vehicle decontamination procedures, and stormwater runoff from a portion of the Site Access Road and other nearby areas within the CSZ. Impacted water collected in the sump will pass by gravity to the existing seep collection system in the Western Drainage, where it will be pumped to the Water Treatment system. A heated structure shall be provided for screening equipment storage.

C. **Personnel Decontamination Area:** Personnel decontamination facilities shall be located as depicted on the Drawings. The facilities in this area shall include: scanning equipment, showers, lockers (for changing from civilian clothes into work clothes and vice versa), restroom, and laundry facilities.

2.6 FIRE SUPPRESSION

A. CONTRACTOR shall furnish, install and maintain a temporary 10,000 gallon water storage tank for fire suppression water storage in accordance with Section 01510 – Temporary Utilities.

PART 3 -- EXECUTION

3.1 GENERAL

A. Clearing, grubbing, or grading in the CSZ performed by the CONTRACTOR for setting up and maintaining this area shall be approved by the ENGINEER, and shall be performed in accordance with and Section 02100 – Site Preparation.

B. Fill placement, gravel surfacing, drainage work shall be performed in accordance with Section 02200 – Earthwork.

C. Asphalt paving shall be performed in accordance with Section 02460 – Hot Mix Asphalt and Base

D. Concrete pavement shall be performed in accordance with Section 03300 – Cast-In-Place Concrete.

E. Geomembranes shall be installed in accordance with Section 02272 – Geomembranes.

- END OF SECTION –

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SECTION 01530 – PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.

B. Any damage to the COMPANYs' facilities caused by the CONTRACTOR's activities shall be repaired by the CONTRACTOR. Any resulting financial loss to the COMPANY shall be reimbursed by the CONTRACTOR.

1.2 RIGHTS-OF-WAY

A. The CONTRACTOR shall not do any WORK that would affect any water pipeline; any telephone, or electric transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way, permitted land-use area, or area otherwise defined by an access agreement, involved until notified that the COMPANY has secured authority therefore from the proper party.

B. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.

1.3 PROTECTION OF SURVEY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No excavation or other work shall be started until all survey or other permanent marker points that will be disturbed by the excavation or work have been properly referenced. Survey markers or points disturbed by the CONTRACTOR shall be accurately restored after the work has been completed.

1.4 EXISTING UTILITIES AND IMPROVEMENTS

A. **General:** The CONTRACTOR shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the utilities are indicated on the Drawings. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

1. Except where the Drawings indicate utilities have been field located during design or where certain utility locations shall be exposed as part of the WORK, the CONTRACTOR shall be responsible for exploratory excavations as it deems necessary to determine the exact locations and depths of utilities which may interfere with its work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's progress. When such exploratory excavations show the utility location as shown on the Drawings to be in error, the CONTRACTOR shall so notify the ENGINEER.

2. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

B. **Utilities to be Moved:** In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder shall, upon request of the CONTRACTOR, be notified by the COMPANY to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

C. **Utilities to be Removed:** Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such Utility or improvement in a manner satisfactory to the ENGINEER and the COMPANY of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the CONTRACTOR in a manner that shall restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. **COMPANY's Right of Access:** The right is reserved to the COMPANY and to the COMPANIES of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

E. **Underground Utilities Indicated:** Existing utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the CONTRACTOR, unless otherwise repaired by the COMPANY of the damaged utility. If the COMPANY of the damaged facility performs its own repairs, the CONTRACTOR shall reimburse said COMPANY for the costs of repair.

F. **Underground Utilities Not Indicated:** In the event that the CONTRACTOR damages existing utility lines that are not indicated or the locations of which are not made known to the CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to the ENGINEER and a written report thereof shall be made promptly thereafter. The ENGINEER shall immediately notify the COMPANY of the damaged Utility. If the ENGINEER is not immediately available, the CONTRACTOR shall notify the utility COMPANY of the damage.

1. Costs of locating and repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such Utility facilities not indicated in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the WORK which was interrupted or idled by removal or relocation of such Utility facilities, and which was necessarily idled during such work shall be paid for as extra work in accordance with the Contract Documents.

G. **Approval of Repairs:** All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement COMPANY before being concealed by backfill or other work.

H. **Maintaining in Service:** Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the ENGINEER are made with the COMPANY of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.5 TREES WITHIN PROJECT LIMITS

A. General: Except where clearing is indicated, the CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees, including those lying within rights-of-way and Project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the ENGINEER.

B. Trimming: Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1-1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosenes, coal tar, creosote, or other material injurious to the life of the tree.

1.6 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the CONTRACTOR shall notify the respective authorities representing the COMPANIES or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative of said COMPANIES or agencies can be present during such work if they so desire.

1.7 FIRE HAZARD REDUCTION MEASURES

A. **Welding**: Welding, cutting, or drilling of metal components shall only be conducted in staging areas, or within areas where vegetation has been cleared to a minimum distance of 30 feet around the center of the work area unless the area has been watered to eliminate the fire danger.

B. **Parking and Staging Areas**: Parking and staging shall be in areas that have been cleared and graded. Any such area, as well as small stationary engine sites shall be cleared of all extraneous flammable materials.

C. **Spark Arrestors and Mufflers**: Each internal combustion engine shall be equipped with a spark arrester, qualified and rated under USDA – Forest Service, Standard 5100-1, unless it is:

1. Equipped with a turbine-driven exhaust supercharger such as the turbocharger. There shall be no exhaust bypass.

2. A multi-position engine, such as on chainsaws, which is equipped with a screen arrester.

3. A passenger-carrying vehicle or light truck intended primarily for use on roads, and equipped with a factory designed muffler and exhaust system.

4. A heavy duty truck, such as a dump or log truck, or other vehicle used for commercial hauling, used only on roads and equipped with a factory designed muffler and with a vertical stack exhaust system extending above the cab.

5. Exhaust equipment described in this subsection, including spark arresters and mufflers, shall be properly installed and consequently maintained in serviceable condition.

D. **Fueling Areas:** Mobile refueling shall only occur in designated staging areas, or in areas that have been cleared of vegetation. All fuel trucks shall be equipped with a 35-pound minimum ABC fire extinguisher.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION –.

SECTION 01532 - SITE CONDITIONS SURVEYS

PART 1 -- GENERAL

1.1 SUMMARY

A. CONTRACTOR, as a minimum, shall document pre- and post-construction conditions by preparing video surveys of the following:

1. Ford-Wellpinit Road and West End Road from Ford, WA to the Site Permanent Access Road.

2. Blue Creek Road.

3. Roadways used to access the Site or haul materials and equipment to the Site, including the East and West Access Roads.

4. Access corridors, drainages subject to contaminated soil and sediment removal; drainages along the southern boundary of the Rhoads Borrow Area; , and off-site staging and parking areas.

5. Any work completed by other contractors at the Site that will be connected to or otherwise affected by the WORK.

6. Driveways, sidewalks, culverts, bridges, and buildings which might be affected by the WORK or by construction traffic accessing the Site.

B. Site condition surveys shall be performed by competent personnel that are qualified and experienced in this work. The personnel performing these surveys shall be approved by the ENGINEER before conducting the survey.

C. Site conditions surveys shall consist of video recordings, photographs, notes, measurements, and other data as may be required.

D. Video shall be taken at slow speeds and submitted to the ENGINEER in DVD format or other digital format as approved by the ENGINEER.

E. Construction Surveying, including as-built topographic mapping, is addressed in Section 01018 – Construction Surveying and Staking.

1.2 CONTRACTOR SUBMITTALS

A. Video surveys, photographs, and other data of the preconstruction conditions shall be submitted to the ENGINEER for record purposes prior to, but not more than three weeks before, commencement of any construction activities.

B. Video surveys, photographs, and other data of the post-construction conditions shall be completed and submitted prior to final inspection by the COMPANY and ENGINEER.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01551 – CONSTRUCTION ACCESS ROADS

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK.

B. CONTRACTOR shall provide and maintain construction access roads and haul roads as required for the use by the CONTRACTOR and as indicated on the Drawings.

C. The CONTRACTOR, utilizing CONTRACTOR labor and CONTRACTOR-provided equipment and materials shall plan, manage, supervise and perform all temporary traffic control activities needed to support the Work of the Contract. The CONTRACTOR shall provide flaggers, spotters and all other personnel required for traffic control activities and not otherwise specified.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. The CONTRACTOR shall conduct and submit site conditions surveys of construction access roads in accordance with Section 01532 - Site Conditions Surveys.

C. The CONTRACTOR shall submit a Traffic Control Plan (TCP) showing all pertinent traffic control for construction traffic or work which interferes with use of public roads. The CONTRACTOR's TCP shall be reviewed by the ENGINEER and then submitted, after subsequent revision(s) if any, for approval to the TRIBE and Stevens County. The ENGINEER shall review the TCP and return comments within 7 Days.

1.3 USE OF EXISTING ACCESS ROADS:

A. CONTRACTOR shall be allowed to use public existing roads upon obtaining all required haul permits and approval of the Traffic Control Plans. CONTRACTOR shall abide by all rules, regulations and plan requirements in using these public roads.

B. CONTRACTOR shall not interrupt public traffic on any public road unless the interruption is included in the approved Traffic Control Plan.

C. Prevent interference with traffic on existing roads and parking areas. At all times, keep access roads and entrances serving the Site clear and available to ENGINEER, emergency vehicles, and other subcontractors. Do not use these areas for parking or storage of materials.

D. CONTRACTOR shall indemnify and hold harmless COMPANY from expenses caused by CONTRACTOR’S operations over existing roads and parking areas.

E. Schedule deliveries to minimize use of driveways and entrances.

1.4 TRAFFIC CONTROL

A. The CONTRACTOR shall provide signs and other traffic control devices complying with national Standards as contained in the Manual of Uniform Traffic Control Devices

(MUTCD). The CONTRACTOR shall erect and maintain all construction signs, warning signs, detour signs, and other traffic control devices necessary to warn and protect the public at all times from injury or damage as a result of the CONTRACTOR's operations, which may occur on or adjacent to highways and roads. No Work shall be done on or adjacent to any traveled way until all necessary signs and traffic control devices are in place.

B. The CONTRACTOR shall be responsible for providing adequate labor, sufficient signs, and other traffic control devices, and for performing traffic control procedures needed for the protection of the Work and the public at all times regardless of whether or not the labor, devices or procedures have been ordered by the COMPANY or the ENGINEER.

C. Wherever possible when performing Contract Work, the CONTRACTOR's equipment shall follow normal and legal traffic movements. The CONTRACTOR's ingress and egress of the Work area shall be accomplished with as little disruption to traffic as possible. Traffic control devices shall be removed by picking up the devices in a reverse sequence to that used for installation. This may require moving backwards through the work zone. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

D. The CONTRACTOR shall comply with the conditions and requirements of all permits required by National and local governing agencies in the performance of this Contract. If CONTRACTOR fails to comply with the conditions and requirements of any permit and such failure to comply results in fines, penalties, and/or suspension of work by a regulatory agency, all liability for such fines, penalties and delays shall be the sole responsibility of the CONTRACTOR.

E. Warning signs shall be used to control traffic approaching the Work area from either direction and also from side accesses having standard Government rectangular or trapezoidal-shaped route markers with horizontal numbering. Standards MUTCD shapes, colors, sizes and legends should be used.

F. Hazards incidental to the Work within or on the traveled way, shoulders, or turnouts shall be marked with hazard identification markers, illuminated beacons, and other MUTCD devices to safely guide road users through the area. The CONTRACTOR shall also mark work segments not completed on a daily basis appropriately for night travel. Proper authorization should be obtained before commencing Work at night.

G. Advisory speed plates may be used to control traffic through the Work area.

1.5 ONE WAY TRAFFIC CONTROL

A. The project Work may require that traffic be maintained on a portion of the Roadway during the progress of the Work using one-way traffic control. If this is the case, the CONTRACTOR's operation shall be confined to one-half of the roadway, permitting traffic on the other half. If shown on an approved traffic control plan or directed by the Engineer, one-way traffic control, in accordance with the Manual of Uniform Traffic Control Devices (MUTCD), shall be provided and shall also conform to the following requirements:

B. In any one-way traffic control configuration, side roads and approaches shall be closed or controlled by a flagger or by appropriate approved signing. A side road flagger shall coordinate with end flaggers where there is line of sight and with the pilot car where the end flaggers cannot be seen. Properly equipped, trained, and certified flaggers should be used where the traffic is required to stop before proceeding. When flag control is used, advance warning signs are required.

C. Queues of vehicles shall be allowed to take turns passing through the work zone in the single open lane. When one-way traffic control is in effect, Contractor vehicles shall not use the open traffic lane except while following the same rules and routes required of the public traffic.

D. As conditions permit, the CONTRACTOR shall, at the end of each day, leave the Work area in such condition that it can be traveled without damage to the Work, without danger to traffic, and without one-way traffic control. If, in the opinion of the ENGINEER, one-way traffic control cannot be dispensed with after working hours, then the operation shall be continued throughout the non-working hours.

1.6 CONSTRUCTION SIGNS

A. All construction signs required by approved traffic control plans, as well as any other appropriate signs directed by the ENGINEER or COMPANY shall be furnished by the CONTRACTOR. The CONTRACTOR shall provide the posts or supports and erect and maintain the signs in a clean, neat, and presentable condition until the need for them has ended. Post mounted signs shall be installed as shown in Standard Plans. When the need for construction signs has ended, the CONTRACTOR, upon approval of the ENGINEER, shall remove all signs, posts, and supports from the project and they shall remain the property of the CONTRACTOR.

B. No passing zones on the existing Roadway that are marked with paint striping and which striping is to be obliterated by construction operations shall be replaced by “Do Not Pass” and “Pass With Care” signs. The CONTRACTOR shall provide and install the posts and signs. The signs shall be maintained by the CONTRACTOR until they are removed or until the Contract is Physically Completed. When the project includes striping by the CONTRACTOR, the signs and posts shall be removed by the CONTRACTOR when the no passing zones are reestablished by striping. The signs and posts shall become the property of the CONTRACTOR.

C. All existing signs, new permanent signs installed under this Contract, and construction signs installed under this Contract that are inappropriate for the traffic configuration at a given time shall be removed or completely covered. Construction signs shall be divided into two classes. Class A construction signs are those signs that remain in service throughout the construction or during a major phase of the Work. They are mounted on posts, existing fixed Structures, or substantial supports of a semi-permanent nature. Class A signs shall be designated as such on the approved Traffic Control Plan. “Do Not Pass” and “Pass With Care” signs are classified as Class A construction signs. Sign and support installation for Class A signs shall be in accordance with the Contract Plans or the Standard Plans. Class B construction signs are those signs that are placed and removed daily, or are used for short durations which may extend for 1 to 3-days. They are mounted on portable or temporary mountings. Tripod-mounted signs in place more than 3-days in any one location, unless approved by the Project Engineer, shall be required to be post-mounted and shall be classified as Class A construction signs.

D. Where it is necessary to add weight to signs for stability, sand bags or other similar ballast may be used, but the height shall not be more than 4-inches above the Roadway surface, and shall not interfere with the breakaway features of the device. The CONTRACTOR shall follow the manufacturer’s recommendations for sign ballasting.

E. Signs, posts, or supports that are lost, stolen, damaged, destroyed, or which the ENGINEER deems to be unacceptable while their use is required on the project shall be replaced by the CONTRACTOR.

F. Equipment

1. All vehicles and machinery operating on or from the traveled way or road shoulder shall be equipped with flashing lights, strobes, or rotary beacons operated continuously while Work is in progress. Headlights shall be used at all times when trucks are operating. Backup horns are required on all self-propelled equipment in excess of 5 metric tons (5½ tons).

2. Vehicles and machinery not used in maintenance operation shall be parked off the traveled way at approved locations to minimize interference with normal use.

1.7 PROTECTION OF EXISTING ROADS

A. The CONTRACTOR shall not be responsible for damage to existing public roads as long as all permits are obtained and CONTRACTOR abides by all rules and regulations that govern these roads.

B. The CONTRACTOR shall be responsible for any damage to private existing roads resulting from their construction activities. The CONTRACTOR shall repair all damages to the roads in accordance with the requirements of the ENGINEER.

C. Before using any existing roads for construction access, the CONTRACTOR shall perform a condition survey of the roads in accordance with Specification Section 01532 – Site Conditions Surveys

D. Any damage to public or private culverts, headwalls or other ancillary roadway structures caused by construction activity shall be repaired by the CONTRACTOR to the satisfaction of the ENGINEER at no extra cost.

1.8 TEMPORARY CONSTRUCTION ACCESS ROADS

A. The CONTRACTOR may be allowed to construct temporary access roads not indicated on the Drawings for their operations, if written approval is obtained from the ENGINEER.

B. If temporary access roads are approved and constructed, then the CONTRACTOR is required to maintain these roads throughout construction.

C. Construction, maintenance, removal, and reclamation of temporary construction access roads shall be at the CONTRACTOR'S expense.

1.9 REMOVALS AND RESTORATION

A. Roads that are installed or existing roads that are improved for construction access or other remedial action work shall be removed and restored as directed by the ENGINEER. A Removal and Restoration Plan shall be developed, reviewed, and approved by the Agencies for each road to be removed. This may include sections and components of the West-End Road. The CONTRACTOR shall conduct all such removal and restoration work according to the restoration plan approved for each area.

B. Each temporary access road shall be winterized prior to demobilization for a temporary shutdown. Winterization methods shall incorporate the use of BMPs as defined in the CSWPPP.

C. **Removals**

1. Remove temporary roads, walks, and parking areas that are not intended for, or acceptable for, integration into the permanent landscaping. Return areas of temporary roads, walks, and parking to pre-construction condition unless otherwise required by the Contract Documents. Remove temporary gates, fencing, and traffic controls associated with temporary roads and parking areas.

2. Where areas of temporary roads and parking shall be permanently landscaped, remove gravel surfacing aggregate, soil and other material that does not comply with requirements for fill or subsoil and landscaping. Remove and properly dispose of materials contaminated with oil, bitumen, and other petrochemical compounds, and other substances that might impair growth of plants.

D. **Restoration**

1. Repair or replace drainage paths and other landscaping items affected by temporary roads and parking, and restore to required conditions. All restoration shall be approved by the ENGINEER.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

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SECTION 01552 – STAGING AND STOCKPILE AREAS

PART 1 -- GENERAL

1.1 SUMMARY

A. CONTRACTOR shall furnish staging and stockpile areas as required by the Contract or as required to perform the WORK.

1.2 STAGING AREAS

A. The CONTRACTOR shall establish their staging area, including any temporary shop and office facilities, as required by the Contract Drawings or as approved by the ENGINEER.

B. Staging areas for the use by the CONTRACTOR and Subcontractors are as shown on the Drawings. Other staging areas not shown shall be allowed only as approved by the ENGINEER.

C. CONTRACTOR shall provide gravel surfacing and drainage at staging areas to be used for equipment and vehicle parking in accordance with Section 02120 – Road and Staging Area Maintenance.

D. Any clearing, grubbing, or grading in the staging, stockpile, borrow, and disposal areas performed by the CONTRACTOR for setting up and maintaining this area shall be approved by the ENGINEER, and shall be performed in accordance with and Section 02100 – Site Preparation.

E. Stripping and stockpiling surface soils from staging and stockpile areas shall be in accordance with Section 02100 – Site Preparation.

F. The CONTRACTOR shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the work.

1.3 STOCKPILE AREAS

A. The CONTRACTOR shall establish their stockpile areas as required in the Drawings or as approved by the ENGINEER.

1. Major stockpiling areas used for long-term storage shall be established at the locations shown on the Drawings.

2. Minor or short-term stockpiling areas may be used by the CONTRACTOR under the following conditions:

a. Areas shall not extend disturbance areas beyond limits shown on the Drawings, unless approved by the ENGINEER.

b. Areas shall not block, constrict or otherwise limit the flow of traffic on public roads unless approved by the ENGINEER and coordinated as required by the Traffic Control Plan.

c. Areas shall not block, constrict or otherwise limit the flow of surface waters. Drainages shall not be blocked.

B. Any clearing, grubbing, or grading in the staging and stockpile areas performed by the CONTRACTOR for setting up and maintaining this area shall be approved by the ENGINEER, and shall be performed in accordance with Section 02100 – Site Preparation.

C. Stripping and stockpiling surface soils from staging and stockpile areas shall be in accordance with Section 02100 – Site Preparation.

D. Stockpiles shall be constructed in accordance with Section 02200 – Earthwork.

E. Stockpile removal and restoration shall be in accordance with Section 02200 – Earthwork.

1.4 SECURITY

A. The CONTRACTOR is responsible for securing staging and stockpile areas. The CONTRACTOR shall provide any security measures they deem necessary to protect these WORK areas. All security fences and gates, if used by the CONTRACTOR, shall be removed by the CONTRACTOR at the end of construction. The CONTRACTOR shall provide keys for any locks used to the ENGINEER, or access to allow the ENGINEER to place its own padlock on a chain. In any case, the CONTRACTOR shall provide means for ENGINEER access at all times.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01560 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers environmental controls and procedures required to be put in place and followed by the CONTRACTOR including hauling requirements, dust abatement, storm water pollution prevention, water pollution prevention, use of herbicides and pesticides, control of rubbish, noise abatement, and procedures for dealing with cultural resources if such are discovered in the course of the WORK.

1.2 REFERENCES

A. Code of Federal Regulations 40 CFR 49.126(d)

B. Washington Administrative Code WAC 173-400-040(9)

1.3 ABATEMENT OF AIR POLLUTION

A. The CONTRACTOR shall comply with the COMPANY'S Air Quality Control and Monitoring Plan provided with the Contract Documents.

B. The CONTRACTOR shall comply with all ARARs and substantive requirements of permits that would otherwise be required absent CERCLA. These shall include all applicable National and local laws and ordinances and regulations concerning the prevention and control of air pollution.

C. In conducting construction activities and operation of equipment, the CONTRACTOR shall utilize such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants.

D. The CONTRACTOR shall avoid engine idling and use machinery with automatic idle-shutdown devices. Additional requirements for the reduction of air emissions shall be in accordance with Section 01585 – Green and Sustainable Practices.

1.4 DUST ABATEMENT

A. The emission of dust into the atmosphere shall be minimized during hauling, processing, handling and storage of construction materials, and the CONTRACTOR shall use such methods and equipment as are necessary to minimize or prevent dust during these operations to levels consistent with project permit requirements.

B. **Storage Piles**: Enclose, cover, water (as needed), or apply non-toxic soil binders according to manufacturer's specifications on material piles (i.e. gravel, sand, dirt) with a silt content of 5 percent or greater.

C. **Active Areas of Site**: Water active construction areas and unpaved roads as needed and as requested by ENGINEER.

D. **Inactive Areas of Site**: Apply non-toxic soil stabilizers according to manufacturer's specifications to inactive construction areas, or water as needed to maintain adequate dust control.

E. **Vehicle Loads**: Vehicles carrying materials on, to, or from the site shall be secured and covered in compliance with 40 CFR 49.126(d) and WAC 173-400-040(9).

F. **Roads**: When there is visible track-out onto a paved public road, install wheel washers where the vehicles exit and enter onto the paved roads and wash the undercarriage of trucks and any equipment leaving the Site on each trip. Sweep the paved road at the end of each shift with a **Mobil Athey** or similar water spray pick-up broom-type street sweeper as necessary or as directed by ENGINEER.

1. Haul Road speed limits shall be 20 mph or as otherwise required by the ENGINEER to effectively abate dust.

G. **Dust Suppression Water**: Utilize treated effluent water from the on-site water treatment plant for on-site areas. Dust suppression water for use at off-site areas, including off-site borrow areas and haul roads, shall meet National Primary Drinking Water Standards.

1.5 STORMWATER POLLUTION PREVENTION

A. CONTRACTOR shall prepare, implement and maintain a Storm Water Pollution Prevention Plan (SWPPP) in accordance with Section 01570 – Storm Water Pollution Prevention Plan.

B. BMP installation shall be in compliance with the CSWPPP and Specification Section 02270 – Temporary Erosion Control.

C. If storm water discharges threaten water quality, take immediate suitable action to preclude erosion and pollution.

D. BMPs that have been damaged or undercut shall be repaired or replaced. If maintenance or modifications to existing BMPs are necessary following a storm or inspection, complete implementation as soon as possible and before the next storm event whenever practicable.

E. Maintain BMPs in accordance with the CSWPPP and Specification Section 02270 – Temporary Erosion Control. Maintain temporary and permanent erosion and sediment control measures in effective operating condition. Coordinate BMPs with subcontractors and utility companies doing Work in the Project area.

1.6 PREVENTION OF WATER POLLUTION

A. The CONTRACTOR shall prepare, implement, and comply with a Spill Prevention Control and Counter Measure Plan (SPCCP) in compliance with Specification Section 01575 - Spill Prevention Control and Counter Measure Plan.

B. The CONTRACTOR's construction activities shall be performed by methods that shall prevent entrance or accidental spillage of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry water courses, lakes, and underground water sources.

C. Such pollutants and wastes include, but are not restricted to, refuse, garbage, sediment from erosion of construction areas, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

D. Wastewater from construction operations shall not enter streams or water courses, without passing through suitable sedimentation removal structures or treatment facilities approved by the ENGINEER. Sediment removal structures shall reduce sediment loads to no more than 5 NTU above background at the point where wastewater is discharged from sedimentation removal structures.

E. The CONTRACTOR shall comply with all project permit requirements, and all other applicable National and local laws, orders, regulations, permits, and water quality standards concerning the control and abatement of water pollution.

1.7 RUBBISH CONTROL

A. During the progress of the WORK, the CONTRACTOR shall keep the Site and other areas for which it is responsible in a neat and clean condition and free from any accumulation of rubbish. The CONTRACTOR shall dispose of rubbish and waste materials in accordance with Paragraph 1.7.

1.8 WASTE DISPOSAL

A. **Contractor Generated Waste:**

1. The CONTRACTOR is responsible for proper disposal of all construction waste generated by the CONTRACTOR'S operations.

2. **Clean (uncontaminated) Areas of the Construction Support Zone ("Outside the Fence")**:

a. All CONTRACTOR generated waste shall be disposed of in a proper manner via the use of onsite dumpsters supplied by the CONTRACTOR. The CONTRACTOR shall provide removal services by a licensed solid waste management firm.

b. Dumpsters shall be emptied a minimum of once per week and more often if necessary, unless otherwise approved by the ENGINEER. CONTRACTOR generated waste materials shall be disposed of in an approved solid-waste facility or other approved facility.

c. It shall be the responsibility of the CONTRACTOR to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of area landfills in the vicinity of the project. Any fees or charges required to be paid for disposal of materials shall be paid by the CONTRACTOR. In the event that certain materials cannot be disposed of in the area waste disposal facility, the CONTRACTOR shall identify a suitable alternative approved waste disposal facility and shall dispose of the material at such facility at no additional cost to the COMPANY.

3. **Areas Within the Contaminated Area of the Construction Support Zone or Within the Mine Affected Area ("Inside the Fence")**:

a. Large items of construction generated waste such as haul truck tires shall be decontaminated to the extent practicable.

b. Waste that cannot be decontaminated shall be disposed of in the WCA in areas and with methods approved by the ENGINEER.

c. Waste that can be successfully decontaminated shall be disposed of in accordance with Paragraph 1.7 A 2.

B. **Non-Mine Hazardous Wastes:** All hazardous materials used for the construction shall be stored, handled, and applied per the manufacturer's printed instructions and per all applicable Federal, State, and local codes. The CONTRACTOR shall ensure that the CONTRACTOR'S onsite work crews and subcontractors are trained and knowledgeable in the proper manner of disposal for hazardous wastes. The disposal of hazardous wastes from the construction site shall be the responsibility of the CONTRACTOR and be performed by a licensed hazardous waste management firm.

C. **Record Keeping**: The CONTRACTOR shall maintain records of the type and quantity of waste materials disposed from the site, the disposal firm, and other information required by Federal, State, and local regulations. These records shall be maintained in the CONTRACTOR'S construction trailer during the entire construction period and available for inspection. A copy of the records shall be transferred to the COMPANY at the end of the construction period.

1.9 SANITATION

A. **Sanitary facilities shall be provided in accordance with Section 01510 – Temporary Utilities.**

1.10 CHEMICALS

A. Chemicals used on the WORK or furnished for facility operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.11 ABATEMENT OF NOISE

A. The CONTRACTOR shall comply with all ARARs and substantive requirements of permits that would otherwise be required absent CERCLA. These shall include Tribal regulations, applicable National and local laws and ordinances, orders, and regulations concerning the prevention, control, and abatement of excessive noise.

B. Construction activities shall be performed only during COMPANY approved working hours.

1.12 CULTURAL RESOURCES

A. Identification and protection of cultural resources at the Site shall comply with the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800, which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. In the event potential cultural resources are discovered during subsurface excavations at the Site, the following procedures shall be instituted:

1. The COMPANY shall issue a temporary Notice to Suspend Work directing the CONTRACTOR to cease construction operations at the location of identified potential cultural resources.

2. The suspension Notice shall contain the following:

a. A clear description of the WORK to be suspended.

b. Instructions regarding issuance of further orders by the CONTRACTOR for material services.

c. Guidance as to the action to be taken on subcontracts.

d. Suggestions to the CONTRACTOR to minimize incurred costs.

e. Estimated duration of the temporary suspension.

3. Such suspension shall be effective until such time as a qualified archeologist can assess the value of the potential cultural resources and make recommendations to Washington State Cultural Resources Officials and the Spokane Tribe of Indians.

4. The COMPANY shall implement appropriate actions as directed by the Washington State Cultural Resources Officials and the Spokane Tribe of Indians. The CONTRACTOR shall cease WORK in the area of a discovery until appropriate actions have been determined in accordance with this paragraph.

5. If human remains are discovered, WORK in the immediate vicinity of the find shall stop. The County Coroner and Spokane Tribe of Indians shall be notified.

C. If the archeologist determines that the potential find is a bonafide cultural resource, at the direction of the Washington State Cultural Resources Officials and the Spokane Tribe of Indians, the COMPANY shall extend the duration of the suspension.

D. Changes to the Contract Price and Contract Times for suspension due to discovery of a potential cultural resource shall be made in the following manner:

1. Contract Times

a. If the WORK temporarily suspended is on the “critical path”, the total number of Days for which the suspension is in effect shall be added to the Contract Times.

b. If a portion of WORK at the time of such suspension is not on the “critical path”, but subsequently becomes WORK on the critical path, the Contract Times shall be computed from the date such WORK is classified as on the critical path.

2. Contract Price

a. If, as a result of a cultural resources suspension, the CONTRACTOR sustains a loss that could not have been avoided by judicious handling of forces and equipment or redirection of forces or equipment to perform other WORK on the contract, there shall be paid an amount based on time and materials for the loss in accordance with the following:

1) Idle Time of Equipment: Compensation for equipment idle time shall be determined in accordance with the General Conditions for equipment time and equipment rental time.

2) Idle Time of Labor: Compensation for idle time of workers shall be determined in accordance with the General Conditions for labor.

b. Costs of labor shall be compensated only to the extent such cost was in fact caused by the suspension.

c. Compensation for loss due to idle time of either equipment or labor shall not include markup for profit.

d. The hours for which compensation shall be paid shall be the actual normal working time during which such suspension lasts, but shall in no case exceed eight hours in any single day.

e. The days for which compensation shall be paid exclude Saturdays, Sundays, and legal holidays during the suspension.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01570 – STORMWATER POLLUTION PREVENTION PLAN

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK described in this section shall consist of providing all labor, equipment, materials, and services to prepare, implement, and maintain a Construction Storm Water Pollution Prevention Plan (CSWPPP) for the Midnite Mine site and all areas subject to the Remedial Action.

1. The CONTRACTOR'S attention is directed to the requirement of a separate and independent SWPPP that shall be prepared for the work conducted within the Rhoads Borrow Area, in accordance with the requirements of Specification Section 02105 – Rhoads Borrow Area.

B. The CSWPPP is subject to review and approval by the ENGINEER and the EPA in accordance with Paragraph 1.6 of this Section.

C. All construction activities shall be conducted in compliance with the approved CSWPPP and the measures identified therein. This specification section provides a minimum standard and requirement for the CONTRACTOR to develop and implement the CSWPPP.

D. The CSWPPP shall be revised, updated and resubmitted on an annual basis according to the requirements of this Section.

E. The project is a CERCLA action and therefore the CSWPPP shall be developed with the intent to limit the release of contaminated material from the site as well as the release of sediments from uncontaminated areas. Also, the CSWPPP shall be developed with the intent to prevent blending of contaminated and uncontaminated material.

F. The CONTRACTOR shall comply with requirements of the EPA CERCLA action as well as the substantive requirements of the National Pollutant Discharge and Elimination System (NPDES) Construction Stormwater General Permit (CSWGP) administered by the Washington State Department of Ecology (Ecology). The CONTRACTOR is not required to comply with the administrative requirements of the CSGWP, and therefore is <u>not required</u> to file a Notice-of-Intent with Ecology.

1. The CONTRACTOR shall comply with the administrative requirements of the CSGWP for the separate and independent SWPPP for the Rhoads Borrow Area.

1.2 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Master Stormwater Management Plan

1.3 RELATED SPECIFICATION SECTIONS

A. 01575 – Spill Prevention Control and Countermeasure Plan (SPCCP)

B. 01560 – Temporary Environmental Controls

C. 02160 – Sediment and Erosion Control

D. 02170 – Revegetation

1.4 REFERENCES

A. The CSWPPP shall be developed in accordance with the following guidance and regulatory documents:

1. EPA guidebook, “Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices” (EPA publication number 823-R-92-005, September 1992).

2. The Stormwater Management Manual for Eastern Washington (Ecology Publication Number 04-10-076, 2004).

3. National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide (USDA, Forest Service, 2012)

4. Best Management Practices for Reclaiming Surface Mines in Washington and Oregon (WADNR Open File Report 96-2, 1997).

5. Internet Link to EPA SWPPP Template: http://cfpub.epa.gov/npdes/stormwater/swppp.cfm#template

6. Internet Link to WA State SWPPP Template: http://www.ecy.wa.gov/programs/wq/stormwater/construction/

1.5 DEFINITIONS

A. Area of Land Disturbance: The calculation of the acres of land (soil) that will be disturbed by any construction activity including clearing, grading, stockpiling, and excavating. Off-site material and waste disposal sites must either have their own NOI and SWPPP, or their disturbed land area must be included in the Project.

B. BMPs (Best Management Practices): BMPs are schedules of activities, prohibition of practices, maintenance procedures and other management practices. They include temporary or permanent structural and non-structural devices. BMPs, when used alone or in combination, minimize erosion and contain sediment within the project site, and prevent discharge of pollutants to water bodies and wetlands. Pollutant is defined in 40 CFR 122.2 (a partial listing of this definition includes solid waste, garbage, chemical wastes, dredged spoil, rock, and sand.

C. Final Stabilization: Final stabilization occurs when soil disturbing activities at the site have been completed and the following two criteria are met: (a) establish a uniform and evenly distributed perennial vegetative cover with a density of seventy percent (70%) of the native background vegetative cover for the area, on unpaved areas that are not covered by non-erodible permanent stabilization, and (b) equivalent non-erodible permanent stabilization measures have been constructed (such as riprap, gabions, geotextiles, and crushed aggregate base course) where vegetative cover is not required.

D. CSWGP (Construction Stormwater General Permit): The general NPDES permit administered by Ecology for control of stormwater pollution from construction projects.

E. CSWPPP (Construction Storm Water Pollution Prevention Plan): The CONTRACTOR's detailed plan and record of activities, to prevent pollution and minimize erosion, and to contain sediment before it leaves the project site or enters waterways or wetlands.

1. CSWPPP Amendment: A document that adds to, deletes from, or changes the SWPPP.

2. CSWPPP Manager: The CONTRACTOR's representative in the field who supervises implementation of the SWPPP.

3. CSWPPP Preparer: The person who prepares the initial SWPPP.

F. Temporary Stabilization: Temporary stabilization measures are BMPs that protect disturbed land, material stockpiles, material sources, and waste disposal sites; until the next land disturbance, grading, material movement, or final stabilization occurs.

1.6 SUBMITTALS

A. CSWPPP: Submit the signed copies of the CSWPPP to the ENGINEER for review approval. Deliver these documents to the ENGINEER no less than forty-five (45) days before the construction begins.

1. The ENGINEER will submit the CSWPPP to the EPA for concurrent review.

2. The ENGINEER will review the CSWPPP submittals within thirty (30) days. Submittals will be returned to the CONTRACTOR, and marked as either requiring modification or as approved by the ENGINEER.

B. Annual CSWPPP Update: Submit two signed copies of the CSWPPP annual update to the ENGINEER for approval. Deliver these documents to the ENGINEER no less than twenty-one (21) days before the anniversary of the date of commencement in the Notice-To-Proceed.

1. The ENGINEER will submit the CSWPPP to the EPA for concurrent review.

2. The ENGINEER will review the CSWPPP annual update submittals within fourteen (14) days. Submittals will be returned to the CONTRACTOR, and marked as either requiring modification or as approved by the ENGINEER.

PART 2 -- CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

2.1 GENERAL PROJECT INFORMATION

A. **Site Area:** Midnite Mine was an open-pit, hard rock uranium mine that is located approximately 45 miles northwest of Spokane, Washington and 8 miles northwest of Wellpinit, Washington. The Site is approximately 350 acres in size, and is affected by uranium mining which occurred between 1955 and 1981. It is located on the Spokane Indian Reservation in Stevens County, Washington at an elevation ranging from approximately 2500 to 3400 feet above mean sea level (amsl).

B. **Description of Construction Activities:** The COMPANY is implementing a remediation of the Site under a Consent Decree with EPA. The major anticipated components are as outline in Section 01010 Summary of Work. Anticipated construction activities are also outline in Section 01010. Each of these activities and areas shall be addressed in the CSWPPP.

C. **Pollutant Source During Construction:** During the project construction, the likely sources of stormwater pollution include soil from excavation/backfill operations, soil from construction-related vehicles leaving the construction site, oil and fuel from construction equipment, metals, pesticides, fertilizers, hazardous materials, sanitary wastes, and loading/unloading of various chemicals and hazardous materials.

2.2 PERSONNEL QUALIFICATION AND AUTHORITY

A. The CSWPPP Preparer must meet the following qualifications:

1. Current certification as a Certified Erosion and Sediment Control Lead (CESCL), or as a Certified Professional in Erosion and Sediment Control (CPESC).

2. Two years of experience in erosion and sediment control.

B. The CSWPPP Manager must meet the following qualifications:

1. Current certification as a Certified Erosion and Sediment Control Lead (CESCL).

2. Two years of experience in earthwork construction.

3. Knowledgeable in the principles and practices of erosion and sediment controls.

4. In possession of the skills to assess conditions at the construction site that could impact storm water quality, and to assess the effectiveness of any pollution, sediment and erosion control measures selected.

C. Responsibilities:

1. The CSWPPP Manager must be knowledgeable in the requirements of this Section, the SWPPP, and the CSWGP. The SWPPP Manager shall be responsible for and oversee the installation, maintenance and removal of erosion and pollution control BMPs, as detailed in the SWPPP or as directed by the ENGINEER.

2. The primary job of the CSWPPP Manager shall be Work related to this Section. The CSWPPP manager shall be on-site whenever land is being disturbed, moved, stockpiled, or disposed and shall inspect BMPs and update the SWPPP.

D. The CSWPPP Manager must have the CONTRACTOR's authority to order immediate corrective action.

2.3 CSWPPP CONTENTS

A. CSWPPP Requirements

1. The CSWPPP must address preventing pollution, minimizing erosion, separating contaminated and un-contaminated waters, and containing sediment before it leaves the project site, or enters waterways or wetlands. The CWSPPP must identify specific areas where pollution or erosion may occur, and describe BMPs including site-specific controls and procedures. Establish a record of land disturbance, and the installation, maintenance, and removal of BMPs. Describe temporary and permanent stabilization measures.

2. The CONTRACTOR shall develop the CSWPPP to be consistent with the Master Stormwater Management Plan (MSMP). Specific BP's are prescribed at the end of each phase on construction in the MSMP.

3. The CSWPPP must address the activities of subcontractors, and of utility companies performing Work in the Project area. The CSWPPP must describe the roles and responsibilities of the CONTRACTOR, subcontractors, utility companies and the OWNER with regard to implementation of the CSWPPP.

4. All material and waste disposal sites must be included in the Project CSWPPP, except when they have their own SWPPP. The Rhoads Borrow Area shall have its own SWPPP in accordance with Specification Section 02105 – Rhoads Borrow Area. Commercial material sites and waste sites that sell to both public and private purchasers typically have their own SWPPP.

5. Specify the line of authority and designate a CSWPPP Manager for implementing CSWPPP compliance. Designate one representative for each subcontractor who performs land disturbing activities, or who installs and maintains erosion and sediment control measures.

6. Once construction begins, the CSWPPP must be continuously updated with records of land disturbance, erosion and sediment control activity, grading and stabilization activities, and daily precipitation records.

7. Within the CSWPPP include:

    a. A reference to the Project SPCC Plan (refer to Section 01575 – SPCCP)

    b. Inspection reports, record updates and amendments required during construction

    c. CONTRACTOR's and other on-site operators' signed certification of SWPPP

8. An annual update of the CSWPPP shall be performed in compliance with Paragraph 3.3 G.

PART 3 -- EXECUTION

3.1 GENERAL

A. Prior to Construction:

1. Post notices at publicly accessible locations near the active part of the Project. The posting must be protected from the weather, and located where the public can read it easily without obstructing construction activities (for example, at an existing pullout). Post notices near the beginning and end of the Project, and the project office, that include the following information:

    a. Name and phone number of CSWPPP Manager; and

    b. Location of a CSWPPP.

2. Keep a copy of the updated CSWPPP and SPCCP at the Project site or locally available.

3. Install an outdoor rain gauge and thermometer on the project site in a readily accessible location. CONTRACTOR shall maintain documentation of temperatures and rainfall depths.

4. The CSWPPP Manager shall ensure that subcontractors and utility companies, understand and comply with the CSWPPP, and avoid disturbing installed BMPs.

B. During Construction.

1. Comply with requirements of the approved CSWPPP and the Master Stormwater Management Plan.

   a. The CONTRACTOR'S attention is directed to the Master Stormwater Management Plan which prescribes certain BMP's at the end of each phase of construction.

2. Comply with requirements of the approved SPCCP, and all State and Federal regulations that pertain to the handling, storage, cleanup, and disposal of oil products or other hazardous substances. Contain, clean up, and dispose of discharges of oil and other hazardous materials. Perform fueling operations in a safe and environmentally responsible manner. Report oil spills as required by federal, state and local law, and as described in the SPCCP.

3. BMP installation shall be in compliance with the CSWPPP and Specification Section 02270 – Temporary Erosion Control.

4. If storm water discharges threaten water quality, take immediate suitable action to preclude erosion and pollution.

5. BMPs that have been damaged or undercut shall be repaired or replaced. If maintenance or modifications to existing BMPs are necessary following a storm or inspection, complete implementation as soon as possible and before the next storm event whenever practicable.

6. Maintain BMPs in accordance with the CSWPPP and Specification Section 02270 – Temporary Erosion Control. Maintain temporary and permanent erosion and sediment control measures in effective operating condition. Coordinate BMPs with subcontractors and utility companies doing Work in the Project area.

7. Keep the official updated CSWPPP at the construction site.

8. Ensure that the SWPPP remains current.

3.2 NON-STORM WATER DISCHARGES

A. Non-storm water discharges will result from this construction activity, each flow shall be handled differently. These activities, as described below, shall not be performed until the proper stormwater pollution controls described above have been installed and are functioning properly.

1. <u>Flushing of Pipelines</u>. Pipelines shall be flushed after installation. The CONTRACTOR shall direct flushing water to a retention system installed early in the project. If water is contaminated or, if the water is suspected of having been contaminated by a regulated compound, testing may be ordered by the ENGINEER to determine contamination. Contamination is defined as either having a pH less

than 4.0 or greater than 10.0, evidence of hydrocarbon contamination, or presence of a free chlorine residual.

If testing indicates the water is contaminated, the COMPANY will be the sole judge on whether the flushing water is contaminated. Depending on the type of contamination, the flow shall be collected and disposed as approved by the ENGINEER.

2. Dewatering of Contaminated Groundwater: Water from dewatering activities during the construction of this project shall be directed to the retention system for treatment at the water treatment plant. The CONTRACTOR shall maintain siltation protection during disposal of water from dewatering activities. The CONTRACTOR shall be responsible to obtain all ARARs and substantive requirements of permits that would be required absent CERCLA required for the dewatering activities.

3. Miscellaneous Washdown Water for Buildings and Pavement: Washdown of structures and pavement shall only occur in areas having no sign of contamination of hazardous substances, such as vehicle oil or fuel. Washdown water shall be directed to the storm drain system via proper grading of the site, particularly in the area of the washdown.

3.3 MATERIAL BEST MANAGEMENT PRACTICES

A. General Good Housekeeping: The following techniques shall be utilized when construction materials are onsite:

1. Only materials used for this construction project will be stored onsite. These materials shall be stored in quantities reasonable for use on this project.

2. Materials shall be stored in a neat and orderly fashion in their original containers. The materials shall be protected from the elements as specified in the individual materials specification sections.

3. The handling and storage of all materials shall follow the manufacturer's written instructions, the project specifications, or applicable governmental codes; whichever is most stringent.

4. Construction materials storage containers shall be disposed in a proper manner and if possible, only after all the contents have been used.

5. The CONTRACTOR shall post onsite, at the CONTRACTOR’S construction trailer, all manufacturer’s printed recommendations for the storage, handling, use, and disposal of construction materials.

6. The CONTRACTOR shall inspect the materials storage area on a daily basis to ensure that proper housekeeping practices are utilized for materials storage.

7. The CONTRACTOR shall maintain an inventory of construction materials stored onsite. The inventory shall be kept in the CONTRACTOR’S construction trailer and be available for inspection by the ENGINEER.

8. When transferring or unloading materials, the CONTRACTOR shall ensure that the area is either protected from stormwater and that the materials transfer operation shall not cause contamination (as defined above) to stormwater due to runoff from the materials transfer location.

9. During adverse weather, and against the possibility thereof, the CONTRACTOR shall take all necessary precautions to insure the protection of the construction materials storage areas.

3.4 CSWPPP INSPECTIONS, REPORTS AND AMENDMENTS.

A. Perform inspections, prepare inspection reports, and prepare CSWPPP amendments in compliance with the project CSWPPP. The CONTRACTOR's CSWPPP is the CSWPPP of record that regulatory agencies will examine.

B. Construction Site Inspections. The CSWPPP Manager shall conduct joint site inspections with the ENGINEER and additional personnel named at the following times:

1. Before starting construction with the CSWPPP Preparer. Discuss implementation of the CSWPPP, and placement dates of BMPs in relation to the progress schedule.

2. At least once per month during construction, with the CSWPPP Preparer. Review the BMPs and CSWPPP for substantive conformance with the CSWGP. This meeting may be combined with other required meetings.

3. At least once every seven (7) days during construction and within twenty-four (24) hours of the end of a storm exceeding one-half inch (1/2") in twenty-four (24) hours (as recorded at the Project site).

4. Before any winter or temporary shutdown, to ensure that the site has been adequately stabilized and BMP devices are functional.

5. At project completion, to ensure final stabilization of the project.

C. Winter/Temporary Shutdown Site Inspections.

1. The CSWPPP Manager shall conduct joint site inspections with the ENGINEER, at least once every month and within twenty-four (24) hours of a storm resulting in rainfall of one-half inch (1/2") or greater in twenty-four (24) hours if the following requirements are met:

a. The entire site is temporarily stabilized; and

b. Runoff is unlikely due to winter conditions (e.g. the site is covered with snow, ice or the ground is frozen).

2. The ENGINEER may waive winter monthly inspection requirements until one month before thawing conditions are expected to result in a discharge, if the following requirements are met:

a. Below-freezing conditions are anticipated to continue for more than one month;

b. Land disturbance activities have been suspended; and

c. The beginning and ending dates of the waiver period are documented in the CSWPPP.

D. Items to Inspect. Inspect the following items during a construction or winter site inspection:

1. Disturbed areas that have not been finally stabilized

2. Areas used for storage of erodible materials that are exposed to precipitation

3. BMPs

4. Locations where vehicles enter or exit the site

5. Offsite material sources and waste disposal sites

6. Staging and equipment storage areas

7. Petroleum storage, handling and fueling sites

8. Hazardous material storage sites

E. Inspection Reports.

1. Prepare reports on forms prepared and provided in the CSWPPP.

2. Sign and certify the inspection report. Include reports as an appendix to the CSWPPP. If the report identifies incidents of non-compliance with either the SWPPP or the CSWGP, then implement corrective action and record when the action was taken.

F. Updating CSWPPP.

1. The CSWPPP Manager shall keep the CONTRACTOR's CSWPPP up to date at all times.

2. Keep CSWPPP amendments in the CSWPPP document, with a summary of amendments. Keep inspection reports in the CSWPPP document.

3. Record in the CSWPPP:

a. The location, date of installation, date maintenance was performed and the date of removal for all BMPs;

b. The dates when major grading activities occur (begin and end dates);

c. The dates when construction activities temporarily or permanently cease on a portion of the site;

d. The dates when stabilization measures are initiated; and

e. The rainfall and outside air temperature each day.

4. Prepare CSWPPP amendments, and initial and date them, within seven (7) days following an inspection:

   a. whenever there is a change in design, construction, operation, or maintenance that could have a significant effect on the discharge of pollutants in storm water leaving the project site;

   b. if during inspections it is determined that the CSWPPP is ineffective in eliminating or significantly minimizing pollutants in storm water discharges from the project site; and

   c. Whenever inspections identify a problem that requires additional or modified BMPs.

G. Annual Update

1. The CONTRACTOR shall submit a revised and updated CSWPPP on an annual basis.

2. Site maps included in the annual update shall be marked with the BMP's in-place at the time of the update.

3. CSWPPP Amendments from the previous year shall be incorporated into the revised CSWPPP.

4. Records of land disturbance, erosion and sediment control activity, grading and stabilization activities, and daily precipitation from the previous year shall remain in that year's CSWPPP and a new collection of records shall be initiated with the annual update.

5. Each year's CSWPPP shall be compiled neatly into binders and stored alongside the current annual CSWPPP.

- END OF SECTION -

SECTION 01575 – SPILL PREVENTION CONTROL AND COUNTERMEASURE PLAN

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK described in this section shall consist of providing all labor, equipment, materials, and services to prepare, implement, and maintain a Construction Spill Prevention Control and Countermeasures Plan (CSPCCP) for the Project.

B. All construction activities shall be conducted in compliance with the ENGINEER approved CSPCCP and the measures identified therein. This specification section provides a minimum standard and requirement for the CONTRACTOR to develop and implement the CSPCCP.

C. A Draft SPCCP is provided with the Contract Documents. This Draft SPCCP shall be used by the CONTRACTOR as the minimum basis for development of the CSPCCP.

1.2 RELATED SPECIFICATION SECTIONS

A. 01570 – Storm Water Pollution Prevention Plan (SWPPP)

B. 01560 – Temporary Environmental Controls

1.3 REFERENCES

A. The CSPCCP shall be developed in accordance with 40 CFR Part 112.

1.4 SUBMITTALS

A. Submit two signed copies of the CSPCCP to the ENGINEER for approval no less than forty-five (45) days before construction begins.

1. The ENGINEER will submit the CSWPPP to the EPA for concurrent review.

2. The ENGINEER will review the CSPCCP submittals within thirty (30) days. CSPCCP Submittals will be returned to the CONTRACTOR, and marked as either requiring modification or as approved by the ENGINEER.

PART 2 -- SPILL PREVENTION CONTROL AND COUNTERMEASURES

2.1 CSPCCP CONTENTS

A. A draft SPCCP is provided with the Contract Documents. This Draft SPCCP shall be used by the CONTRACTOR as the minimum basis for development of the CSPCCP. Incorporate into the draft SPCCP additional information required to ensure compliance with the requirements of this Section.

B. The CSPCCP shall address prevention of pollution that stems from the storage, use, containment, cleanup, and disposal of hazardous material, including oil products related to construction activities and equipment. Refer to 40 CFR 117 and 302 for listing of hazardous materials. Collate Material Safety Data Sheets in one location and reference location in CSPCCP.

C. List the types and quantities of equipment and cleanup materials available on site. Include a list and location map of cleanup materials, at each different work site and readily available off site (main site, material site, batch plant, storage yard, explosives dump, equipment or fueling yard, etc.).

D. Specify the line of authority and designate a field representative for spill response, and one representative for each subcontractor.

E. List and give the location of hazardous materials, including office materials, to be used or stored on site, and estimated quantities. Store hazardous materials in covered storage areas.

F. Detail methods of disposing of waste petroleum products and other hazardous materials generated by the project.

G. Identify the locations where storage, fueling and maintenance activities will take place, describe the maintenance activities, and list controls to prevent the accidental spillage of oil, petroleum products and other hazardous materials.

H. Detail procedures for containment and cleanup of hazardous substances. Detail a plan for the prevention, containment, cleanup, and disposal of soil and water contaminated by accidental spills. Detail a plan for dealing with unexpected contaminated soils and water encountered during construction.

2.2 WASTE DISPOSAL

Waste disposal from the construction site for CONTRACTOR generated wastes, sanitary wastes, chemicals, and non-mine hazardous wastes shall be conducted in accordance with Section 01560 – Temporary Environmental Controls.

PART 3 -- EXECUTION

3.1 SPILL PREVENTION

A. Hazardous Materials: The following additional housekeeping practices shall be followed for hazardous construction materials:

1. Hazardous materials shall be stored separately from non-hazardous materials onsite.

2. Products shall remain in their original containers with the original legible product label attached to the container.

3. All products shall be used before disposal of the container.

4. The handling and storage of all hazardous materials shall follow the manufacturer's written instructions, the project specifications, or applicable governmental codes, whichever is most stringent.

5. Hazardous materials, including diesel fuel, must be stored in contained areas which are able to contain 150 percent of the volume of the largest container's contents. If the area is not exposed to stormwater, the volume of the containment area shall be 110 percent of the volume of the largest container's contents. Each hazardous material shall be stored in its own containment area. Under no circumstances shall hazardous materials be used or stored within 100 feet of any water supply well,

unless specifically permitted by the ENGINEER and governing Federal, State, or local agency.

a. At a minimum, the containment area shall be constructed with dikes and lined with a material resistant to the properties of the hazardous material being contained. Before removal of any stormwater from the containment area, a representative sample of the water shall be tested for contamination by the hazardous material stored in that containment area. If the stormwater is found to be contaminated, as defined above, the CONTRACTOR shall follow the spill control measures for this hazardous material.

6. The CONTRACTOR shall maintain all manufacturer's storage, handling, use, and disposal recommendations and post the Material Safety Data Sheets of all hazardous materials at the CONTRACTOR'S construction trailer.

7. The CONTRACTOR shall inspect the hazardous materials storage area on a daily basis to ensure proper storage of the hazardous materials.

8. The CONTRACTOR shall maintain an inventory of hazardous materials stored onsite. The inventory shall be kept in the CONTRACTOR'S construction trailer and be available for inspection by the ENGINEER.

9. When transferring or unloading hazardous materials, the CONTRACTOR shall ensure that the area is either protected from stormwater and that the materials transfer operation shall not cause contamination (as defined above) to stormwater. The hazardous materials handling operation shall occur in a contained area on the construction site. If any spillage or leakage occurs during the materials handling operation, the CONTRACTOR shall follow the spill control practices listed in the approved SWPPP.

10. During adverse weather, as described in the General Conditions of the Contract Documents, and against the possibility thereof, the CONTRACTOR shall take all necessary precautions to insure the protection of the hazardous materials storage areas.

B. **Product Specific Practices:** Special stormwater management specific practices shall be utilized for specific products. These products are discussed in the following sections.

1. Petroleum-Based Products: All onsite vehicles shall be properly maintained and checked for any leaks of fluids or petroleum-based products. If a leak is found, the vehicle shall be repaired immediately or removed from the site. Diesel fuel shall be considered a hazardous material and stored in a containment area as indicated above.

2. Acid and Base Chemicals: All acid and base chemicals are considered hazardous materials and shall be stored in containment areas as described above. Disposal of acid or base chemicals shall, under no circumstances occur via the storm drain system, but instead through proper hazardous materials disposal procedures.

3. Paints, Thinners and Solvents: Paints, thinners and solvents shall be stored in their original containers. Unused paints, thinners, and solvents shall not be dumped onsite. Disposal of unused paints, thinners and solvents shall be through proper hazardous materials disposal procedures.

4. Fertilizers, herbicides, and Pesticides: Fertilizers and pesticides shall be applied at the minimum rate recommended by the manufacturer or as listed in the specification Section 02270 – Erosion Control (Vegetative). Application of herbicides shall be in accordance with Region 6 Herbicide Use Guidelines and the Integrated Resource Management Plan (IRMP) for the Spokane Indian Reservation. Storage of fertilizers shall be protected from exposure to stormwater. Contents of partially used bags of fertilizer shall be transferred to sealable containers to prevent spillage and exposure to stormwater. Fertilizer shall be worked into the soil upon application in a landscaped area.

5. Concrete Trucks: The washdown of concrete trucks or the disposal of unused or unacceptable concrete from a concrete truck will be permitted onsite only if the CONTRACTOR has set aside a specific area, with dikes to prevent contact between the washdown water or excess concrete and stormwater, for this purpose. Once the solids in the area have hardened, the CONTRACTOR shall dispose of the solids in a proper manner as approved by the ENGINEER.

6. In Water Work: All equipment used for in-water work below Ordinary High Water Line in Lake Roosevelt or any other waters shall utilize vegetable based hydraulic fluids and lubricants. In water work, shall be defined as within bank full limits of the waterway as determined by the ENGINEER. Vegetable-based hydraulic fluids shall be readily biodegradable and non-toxic ISO 40(J-20-C) grade tractor oil for use in heavy-duty brake, transmission and hydraulic systems. Must be based on natural ester technology and a direct replacement for petroleum oil based tractor fluids. Product material data shall be submitted to the ENGINEER. Equipment that has been prepared for in-water work shall be marked with a uniform marking system for easy field identification.

C. **Spill Control Practices:** In addition to good housekeeping practices, hazardous materials practices, and the product specific practices described above, the CONTRACTOR shall implement all practices defined in the Agency approved Spill Prevention, Control, and Countermeasures Plan. At a minimum the following practices shall be followed:

1. Any and all spills shall be cleaned immediately.

2. The CONTRACTOR shall notify the ENGINEER, COMPANY, and all applicable governmental agencies if a spill occurs, particularly if a hazardous material spill occurs.

3. Manufacturer's printed instructions for the cleanup of a spill shall be kept onsite by the CONTRACTOR at all times. The CONTRACTOR'S work crews and subcontractors shall be required to be familiar with the requirements and procedures for spill cleanup. Equipment necessary for spill cleanup, such as gloves, metal containers, mops, etc., shall be maintained onsite by the CONTRACTOR. The cleanup instructions and the location of the cleanup equipment shall be posted onsite at the CONTRACTOR'S construction trailer during construction activities.

4. Workers involved in the cleanup of a spill shall be properly protected by protective suits, ventilation masks, goggles, and other necessary equipment, prior to contact with the spilled material.

5. The CONTRACTOR shall name an employee or employees who will be onsite full-time throughout the duration of the project as the spill cleanup coordinators. The

spill cleanup coordination will be responsible for notifying the proper personnel and agencies of a spill and obtaining the proper equipment and personnel to cleanup the spill. The name and phone number where the spill cleanup coordinator can be reached at all times shall be posted on the construction site. The spill cleanup coordinator shall be properly trained in spill cleanup procedures.

6. The CONTRACTOR shall maintain material data safety sheets for all hazardous materials in the CONTRACTOR'S trailer. The spill cleanup coordinator shall have access to the material data safety sheets at all times during construction. The CONTRACTOR shall provide the ENGINEER with a copy of all the material data safety sheets.

7. After a spill is contained and cleaned up, a spill occurrence report shall be completed by the onsite inspector. A copy of the form is attached. The CSPCCP shall be modified to prevent a reoccurrence of a type of spill.

- END OF SECTION -

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SECTION 01585 – GREEN AND SUSTAINABLE PRACTICES

PART 1 -- GENERAL

1.1 GENERAL DESCRIPTION

A. Furnish all labor, materials, equipment and supplies required to implement the green and sustainable practices outlined in this specification.

B. Required green and sustainable practices include elements of Materials Management, Water Management, and Emissions Reduction are tabulated below. These efforts shall be conducted throughout RA activities at the site.

Materials Management	Paper reduction Recycling Equipment Reuse
Water Management	Water treatment plant effluent for site water uses, as appropriate
Air Emissions Reduction	Ultra-low sulfur diesel fuel for vehicles and equipment Vehicle and equipment “no-idling” policy Vehicle speed limit Worker Transportation (carpool/rideshare) Emissions reduction measures for temporary generators Nonroad diesel equipment fleet requirements

1.2 REFERENCES AND STANDARDS

A. Comply with all Federal and State laws or ordinances, as well as applicable codes, standards, regulations and/or regulatory agency requirements including the partial list below:

1. Occupational Safety and Health Administration (OSHA) 29 CFR Part 1926 Safety and Health Regulations for construction.

2. WSDOT Traffic Manual M 51-02.05 Page 2-1 (for signage).

3. National Primary Drinking Water Standards 40 CFR Part 141.61-.63

4. Green Remediation Best Management Practices - Pump and Treat Technologies, EPA 542-F-09-005, December 2009.

5. Green Remediation Best Management Practices for Excavation and Surface Restoration, EPA 542-F-08-012, December 2008.

1.3 SUBMITTALS

A. The following plans are required to be prepared and submitted by the CONTRACTOR for ENGINEER review and approval.

1. Comply with Section 01300 – Contractor Submittals.

2. **Materials Management Plan**: Include plans to maximize use of electronic format for communications and submittals, and to minimize paper uses (i.e., provide double-sided prints). Include recycling plans for collection of plastics, paper, cardboard, and aluminum.

3. **Emissions Reduction Plan:** Verify the existence of and contract with a local low-sulfur diesel supplier for all vehicles and equipment used; provide worker transportation plan, include carpool or rideshare parking area(s) in centralized location(s) (i.e., Wellpinit or Reardon); and no-idle and speed limit policies. Outline an emissions reduction education plan for workers, include benefits of not idling (e.g., reduction in emissions). Include a section titled "Emission Reduction Plan for Temporary Generators" outlining policies to minimize power uses from temporary fuel-powered generators that will be needed before power drops are available at the construction support facilities. The plan shall include procedures and guidelines for optimizing the use of temporary generator sets for heating, lighting, tools, and equipment. (Include guidelines for reducing idling time, following manufacturer's recommended maintenance and engine warm-up and cool-down times, and optimize generator size given anticipated needs.)

4. **Water Management Plan:** To the extent possible, optimize water use through construction practices. Plans for the use of effluent water (uses, schedule for use, estimated volume, location of water truck filling stations, effluent/pipeline diversion details, treatment details for off-site water use as appropriate, deviation criteria [e.g., criteria when treatment plant effluent will not be used], etc.) shall be submitted in accordance with Section 01300 Contractor Submittals. Include coordination efforts with COMPANY and plant operators.

5. **Signs**: Submit plans for speed limit and no-idling policy signs.

6. **Nonroad Diesel Equipment List**: A list of all nonroad diesel engine powered construction equipment to be used on the project shall be submitted at the beginning of each project phase (Phases are defined in Specification Section 01010 – Summary of Work). All the project-specific Nonroad Construction Equipment shall be reviewed by the Construction Contractor every 12 months to ensure compliance with the fleet requirements tabulated in section **3.2 F** of this specification.

1.4 SCHEDULING

A. Install required signage before or at the onset of construction mobilization.

B. Temporary heating and lighting use plan approved before or at the onset of construction mobilization.

C. Utilize treated effluent from the existing water treatment plant (WTP) for construction uses until the new WTP is constructed and operational.

1.5 COORDINATION

A. Coordinate with the COMPANY and plant operators concerning access to treated water effluent.

B. Coordinate with officials of centralized carpooling and bus pickup locations (e.g., cities of Wellpinit, Ford and/or Reardon) concerning selection and approval of carpool and rideshare parking areas in their respective municipalities.

PART 2 -- PRODUCTS

2.1 SIGNS

A. On Site and haul roads speed limits and no-idle zone signs shall comply with WSDOT requirements, including but not limited to sign size, letter size, and posts. Size of lettering shall comply with the appropriate comprehension rate given the speed limit (refer to WSDOT Traffic Manual).

PART 3 -- EXECUTION

3.1 MATERIALS MANAGEMENT

A. Reduce paper use:

1. Minimize hardcopy submittals. Utilize electronic communications and submit required submittals in electronic format.

2. Develop electronic file sharing system for submittals and communication.

3. Set printers to default double-sided print. When hardcopy printouts are necessary, utilize double-sided printing.

B. Equipment reuse. Dismantle specified existing equipment in the existing water treatment plant for use in the new water treatment plant (refer to Demolition specification, Section 11563 Recessed Plate Filter Press, and engineering drawings for list of equipment to be dismantled and reused).

3.2 EMISSIONS REDUCTION

A. Fuel for Vehicles and Equipment. Ultra-low sulfur diesel fuel shall be used for all on and off-road operation of vehicles and construction equipment if available locally and is cost competitive.

B. On-Site Vehicle Speed Limits. On-Site vehicle speeds will be restricted to accommodate safe roadway conditions based on roadway grade, roadway soil conditions, roadway congestion, and the need to limit air emissions caused by roadway fugitive dust. These dust emission shall be controlled on-site through use of chemical dust suppressant and/or water applications to roadways.

C. No-idling Policy

1. No work vehicles or work equipment is allowed to idle longer than 5 minutes unless:

a) The vehicle/equipment is undergoing testing, servicing, repair, or diagnostic

b) The vehicle/equipment is in queue
c) The vehicle/equipment is accomplishing work for which it was designed
d) There is a safety issue.

2. Follow manufacturer-recommended warm-up and cool-down periods.

D. Worker Transportation. Identify carpooling and/or rideshare parking areas in centralized area(s) for workers to use to get to the site (i.e., Reardon and/or Wellpinit). Encourage worker participation.

E. Conduct Worker Training. Cover specific idle-reduction operating practices, environmental benefits, and safety.

F. Minimize Emissions from Temporary Generators. Follow protocol outlined in the approved 'Emissions Reduction Plan for Temporary Generators' section of the approved Emissions Reduction Plan. Implement measures to minimize use of temporary generators for lighting, heat, tools, and equipment. (To include, but not necessarily be limited to: minimizing generator idling time, following manufacturer's recommended maintenance and motor warm-up/cool-down, and optimizing generator sizing and selection based on anticipated loads.)

G. Nonroad Diesel Powered Construction Equipment Fleet Requirements. All nonroad diesel engines for construction equipment shall meet federal standards (40 CFR 1039 in a phased approach as outlined in the table below:

Project Construction Phase	**Maximum Percentage of Tier 2 Equipment**	**Required Percentage of Tier 3 or newer Equipment**	**Required Percentage of Tier 4 (or better) Equipment**
Early Works and Phase I	50% max	50% min	20% min
Phase II	20% max	80% min	40% min
Phase III	None	30% max	70% min
Post Phase III	None	None	100%

3.3 CLEAN WATER MANAGEMENT

A. Follow ENGINEER approved Water Management Plan, and coordinate with COMPANY and plant operators.

1. Dust Suppression Water. Utilize treated effluent water from the on-site water treatment plant for on-site areas. Dust suppression water for use at off-site areas, including off-site borrow areas and haul roads, shall meet National Primary Drinking Water Standards.

2. Decontamination Water. Utilize treated effluent water from the treatment plant for decontamination activities as much as practicable.

- END OF SECTION -

SECTION 01600 - PRODUCTS, MATERIALS, EQUIPMENT AND SUBSTITUTIONS

PART 1 -- GENERAL

1.1 DEFINITIONS

A. The word "Products," as used in the Contract Documents, is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form WORK. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying, and erection of the WORK.

1.2 QUALITY ASSURANCE

A. **Source Limitations:** To the greatest extent possible for each unit of WORK, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.

B. **Compatibility of Options:** Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. The CONTRACTOR shall deliver and store the WORK in accordance with manufacturer's written recommendations and by methods and means which shall prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the Site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF PRODUCTS IN STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.

B. The CONTRACTOR shall comply with manufacturer's product storage requirements and recommendations.

C. The CONTRACTOR shall maintain manufacturer-required environmental conditions continuously.

D. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, the CONTRACTOR shall provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to final acceptance by the COMPANY in accordance with the Contract Documents.

1.7 SHELF LIFE

A. CONTRACTOR shall not use any product that has exceeded is manufacturer indicated shelf-life.

1.8 PROPOSED SUBSTITUTIONS OR "OR-EQUAL" ITEM

A. Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular manufacturer, the naming of the item is intended to establish the type, function, and quality required. If the name is

followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other manufacturers may be accepted if sufficient information is submitted by the CONTRACTOR to allow the ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitution product, material or equipment shall be upon the CONTRACTOR.

2. The ENGINEER shall be the sole judge as to the type, function, and quality of any such substitution and the ENGINEER's decision shall be final.

3. The ENGINEER may require the CONTRACTOR to furnish additional data about the proposed substitution.

4. The COMPANY may require the CONTRACTOR to furnish a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the ENGINEER of a substitution item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitution.

6. The CONTRACTOR shall pay all costs of implementing accepted substitutions, including redesign and changes to WORK necessary to accommodate the substitution.

B. The procedure for review by the ENGINEER shall include the following:

1. If the CONTRACTOR wishes to provide a substitution item, the CONTRACTOR shall make written application to the ENGINEER on the "Substitution Request Form" provided to the CONTRACTOR by the ENGINEER.

2. CONTRACTOR shall provide a preliminary list of proposed substitutions within 7 days after the date of commencement as identified in the Notice-To-Proceed in accordance with Section 01300 – Contractor Submittals.

3. CONTRACTOR shall provide a revised list of proposed substitutions at the Pre-Construction Conference in accordance with Section 01300 – Contractor Submittals.

4. Wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the ENGINEER, the CONTRACTOR shall provide the material or equipment indicated in the Contract Documents.

5. The CONTRACTOR shall certify by signing the form that the list of paragraphs on the form are correct for the proposed substitution.

6. The ENGINEER shall evaluate each proposed substitution within a reasonable period of time.

7. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the ENGINEER'S prior written acceptance of the CONTRACTOR'S "Substitution Request Form."

C. The CONTRACTOR's application shall address the following factors which shall be considered by the ENGINEER in evaluating the proposed substitution:

1. Whether the evaluation and acceptance of the proposed substitution shall prejudice the CONTRACTOR's achievement of Substantial Completion on time.

2. Whether acceptance of the substitution for use in the WORK shall require a change in any of the Contract Documents to adapt the design to the proposed substitution.

3. Whether incorporation or use of the substitution in connection with the WORK is subject to payment of any license fee or royalty.

4. Whether all variations of the proposed substitution from the items originally specified are identified.

5. Whether available maintenance, repair, and replacement service are indicated. The manufacturer shall have a local service agency (within 70 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

6. Whether an itemized estimate is included of all costs that shall result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other contractors affected by the resulting change.

7. Whether the proposed substitute item meets or exceeds the experience and/or equivalency requirements listed in the appropriate technical specifications.

D. Without any increase in cost to the COMPANY, the CONTRACTOR shall be responsible for and pay all costs in connection with proposed substitutions and of inspections and testing of equipment or materials submitted for review prior to the CONTRACTOR's purchase thereof for incorporation in the WORK, whether or not the ENGINEER accepts the proposed substitution or proposed equipment or material.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01700 - PROJECT CLOSEOUT

PART 1 -- GENERAL

1.1 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the COMPANY will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

1.2 CLOSEOUT TIMETABLE

A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the COMPANY, the ENGINEER, and their authorized representatives sufficient time to schedule attendance at such activities.

1.3 TECHNICAL MANUAL SUBMITTAL

A. Equipment testing and plant start-up will not be allowed to begin until the approved Technical Manual complying with Section 01300 has been submitted. Substantial completions will not be issued until start-up has successfully been completed according to Section 01660.

1.4 TECHNICAL MANUAL SUBMITTAL

A. The CONTRACTOR's attention is directed to the condition that one percent of the Contract Price will be retained from any monies due the CONTRACTOR as progress payments, if at the 75 percent construction completion point the approved Technical Manual complying with Section 01300 – Contractor Submittals has not been submitted. The aforementioned amount will be retained by the OWNER as the agreed, estimated value of the approved Technical Manual. Any such retention of money for failure to submit the approved Technical Manual on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the CONTRACTOR under the terms of the General Conditions.

1.5 FINAL SUBMITTALS

A. The CONTRACTOR, prior to requesting final payment, shall obtain and submit the following items to the ENGINEER for transmittal to the COMPANY:

1. Written guarantees, where required.

2. Technical Manuals and instructions.

3. New permanent cylinders and key blanks for all locks.

4. Maintenance stock items; spare parts; special tools.

5. Final Surveys.

6. Redline Drawings. Refer to Section 01300 – Contractor Submittal.

7. Bonds for roofing, maintenance, etc., as required.

8. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

9. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

1.6 MAINTENANCE AND GUARANTEE

A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the Contract.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private COMPANY or public agency releasing the COMPANY from further responsibility in connection with such repair or resurfacing.

C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the COMPANY. If the CONTRACTOR fails to make such repairs or replacements promptly, the COMPANY reserves the right to do the WORK and the CONTRACTOR and its surety shall be liable to the COMPANY for the cost thereof.

1.7 BOND

A. The CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee".

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

DIVISION 02 - SITEWORK

SECTION 2016 - WELL DECOMMISSIONING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall supply all labor, equipment and materials necessary to perform well decommissioning in accordance with the Contract Documents.

1.2 PERMITTING

A. The RA is governed by the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). As a result, no federal, state, or local permits are required for performing RA activities, as stipulated by CERCLA under 42 U.S.C. 9621(e)(1). However, the well decommissioning activities described herein shall substantially comply with Washington Administrative Codes (WAC) regulations and policy, specifically WAC Chapter 173-160-460 for the decommissioning of resource protection wells.

1.3 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Remedial Action Work Plan

2. Well Decommissioning Plan

1.4 CONTRACTOR SUBMITTALS

A. **General:** CONTRACTOR submittals shall conform to Section 01300 - Contractor Submittals, and the supplementary requirements herein.

B. **Equipment List:** The CONTRACTOR shall submit a list of the equipment it proposes to utilize on the project which shall include manufacturer's load capacities, horsepower, year of manufacture and year of purchase by the present owner. The list shall include drilling or pump rig, grout pump and grout mixer.

C. **Daily Log:** A daily log of abandonment activities shall be prepared by the CONTRACTOR. The log shall include types, additives, quantities, and measured setting depths of materials, methods of material installation, and all other pertinent information pertaining to abandonment activities. The log shall include all difficulties or unusual conditions met in daily activities. The daily log shall be available for inspection at the Site at all times.

D. **Final Description:** The final well description shall show the following: existing casing diameter, depth and material; depths, quantities and material composition of abandonment materials, final wellhead termination details; and all other pertinent details.

1.5 QUALITY ASSURANCE

A. At the time of well abandonment utilizing grout, the CONTRACTOR shall reserve grout samples in sturdy containers on Site for inspection by the ENGINEER. The purpose of

these samples will be to observe the grout curing process. If the grout mixture fails to fully cure within 48 hours or if gravel or grout depths are unacceptable to the ENGINEER, the well shall be drilled out and the abandonment materials satisfactorily reinstalled.

1.6 MATERIALS DELIVERY, STORAGE AND PROTECTION OF MATERIALS

A. Materials shall be delivered in an undamaged condition and stored, if necessary, to provide protection against damage. Defective or damaged materials shall be replaced with new materials.

1.7 CONTRACTOR'S EQUIPMENT

A. The CONTRACTOR's equipment shall be clean, well maintained, and in good operating condition when delivered to the Site and during the entire operation.

1. The equipment shall be of adequate size, strength, horsepower, and capacity for the project and shall be of the type successfully utilized by the CONTRACTOR for the abandonment of similar wells within the last 2 years.

PART 2 -- PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. **Grouting Method:** Tremie pipe shall be used to pressure grout all wells. The tremie pipe used for the production well abandonment shall be a minimum 2-inch Schedule 40 threaded and coupled or flush threaded black steel pipe. The CONTRACTOR shall furnish a grout mixer capable of mixing the volume of grout required to assure continuous grouting operations. The grout mixer shall have sufficient agitation by means of paddles or jetting of fluid to create a homogeneous mix of the cement, bentonite and clear water.

B. **Grout Pump:** The CONTRACTOR shall furnish a grout pump capable of providing sufficient pressure to overcome tremie pipe friction losses, fill the well intervals with grout, and displace any fluids in the well.

C. **Water Source:** The CONTRACTOR shall make all necessary provisions for conveying potable water to the wellsites for use during the abandonment operation.

PART 3 -- EXECUTION

3.1 GENERAL

A. **The wells that shall be decommissioned, including locations and available details, are listed in the Well Decommissioning Plan referenced in Paragraph 1.3 of this specification and included with the Contract Documents.**

B. The work shall be performed in accordance to AWWA A100 - Standard for Water Wells and adhere to all regulatory requirements by a competent crew with equipment that is sufficient to complete all phases of well abandonment.

C. Rework, resulting from the CONTRACTOR's performance, including all additional materials, labor and equipment required, shall be furnished at the expense of the

CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

3.2 WELL ABANDONMENT

A. **Wells Completed in Mine Wastes:**

1. The ENGINEER shall measure well depth and identify wells with depths less than the thickness of mine waste. Measurements of depths shall be referenced to existing ground surface at each well.

   a. Well Depth Less Than Mine Waste Thickness: The well shall be excavated along with mine wastes and disposed of in the Waste Containment Areas in areas designated by the ENGINEER.

   b. Well Depth Greater Than Mine Waste Thickness: The ENGINEER shall determine and identify wells that were properly constructed and wells that were not properly documented or constructed. Properly constructed wells have the annular space between the bore hole and the permanent casing sealed with bentonite, neat cement, or cement grout.

2. Properly Constructed Wells (Gravity Grout):

   a. The well casing that extends from 10 feet above the bottom of mine waste to the bottom of the well shall be grouted using the tremie method.

   b. A 2-inch steel tremie pipe shall be placed in the well to within 2-feet of the bottom of the well. Cement grout shall be gravity fed through the tremie pipe filling the well to the top.

   c. The tremie pipe shall be raised as the continuous grouting operation proceeds and grout appears at the surface.

   d. The CONTRACTOR shall verify that the well is properly filled by placing the full well casing volume with grout. Additional grout mix shall be prepared and available if needed.

   e. The cement grout shall be allowed to set for minimum of 12 hours prior to the continuation of abandonment activities.

   f. Excavate the well materials along with the mine waste and dispose of the materials in the Waste Containment Areas in areas designated by the ENGINEER.

3. Improperly or Undocumented Wells (Pressure Grout):

   a. Perforate the section of well casing that extends from 10 feet above the bottom of mine waste to the bottom of the well.

   b. Pressure grout the perforated section using the tremie method.

   c. A 2-inch steel tremie pipe shall be placed in the well to within 2-feet of the bottom of the well. Cement grout shall be pumped through the tremie pipe filling the well to the top.

d. The grouting operation shall be conducted at the pressure required to overcome friction losses in the tremie pipe and penetrate casing perforations to grout the annular space.

e. The tremie pipe shall be raised as the continuous grouting operation proceeds and grout appears at the surface.

4. The CONTRACTOR shall verify that the well is properly filled by pumping the full well casing and annular space volume with grout. Additional grout mix shall be prepared and available if needed.

5. The cement grout shall be allowed to set for minimum of 12 hours prior to the continuation of abandonment activities.

6. Excavate the well materials along with the mine waste and dispose of the materials in the Waste Containment Areas in areas designated by the ENGINEER.

B. **Wells Completed Outside Mine Wastes:**

1. The ENGINEER shall determine and identify wells that were properly constructed and wells that were not properly documented or constructed. Properly constructed wells have the annular space between the bore hole and the permanent casing sealed with bentonite, neat cement, or cement grout.

2. Properly Constructed Wells (Gravity Grout):

a. The well casing shall be grouted from the well bottom to 2 feet below ground surface using the tremie method.

b. A 2-inch steel tremie pipe shall be placed in the well to within 2-feet of the bottom of the well. Cement grout shall be gravity fed through the tremie pipe filling the well to the top.

c. The tremie pipe shall be raised as the continuous grouting operation proceeds and grout appears at the surface.

d. The CONTRACTOR shall verify that the well is properly filled by placing the full well casing volume with grout. Additional grout mix shall be prepared and available if needed.

e. The CONTRACTOR shall terminate the well casing to a minimum final depth of 2-feet below ground level. The excavation shall be backfilled and compacted with nearby native soils and graded to match existing contours.

3. Improperly or Undocumented Wells (Pressure Grout):

a. Perforate the section of well casing from the well bottom to 2 feet below grade surface.

b. Pressure grout the perforated section using the tremie method.

c. A 2-inch steel tremie pipe shall be placed in the well to within 2-feet of the bottom of the well. Cement grout shall be pumped through the tremie pipe filling the well to the top.

d. The grouting operation shall be conducted at the pressure required to overcome friction losses in the tremie pipe and penetrate casing perforations to grout the annular space.

e. The tremie pipe shall be raised as the continuous grouting operation proceeds and grout appears at the surface.

f. The CONTRACTOR shall verify that the well is properly filled by placing the full well casing and annular volume with grout. Additional grout mix shall be prepared and available if needed.

g. The CONTRACTOR shall terminate the well casing to a minimum final depth of 2-feet below ground level. The excavation shall be backfilled and compacted with previously excavated material and graded to match existing contours.

3.3 DISPOSAL OF ABANDONMENT WASTES

A. The CONTRACTOR shall remove abandonment wastes and materials from the well site and dispose of these materials in the Waste Containment Area.

- END OF SECTION –

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SECTION 02017 – MONITORING WELLS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

General: The CONTRACTOR shall provide groundwater monitoring wells and appurtenant WORK, in accordance with the Contract Documents.

The Redundant BPA Dewatering Well shall be constructed in accordance with this section.

The ENGINEER will be responsible for identifying and marking the final well locations prior to drilling.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

ASTM F480	Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR) SCH 40 and SCH 80

1.3 CONTRACTOR SUBMITTALS

Furnish submittals in accordance with Section 01300 - Contractor Submittals.

Submit product data for all monitoring well materials.

Submit a list of drilling equipment.

Submit procedures for development water collection and disposal.

PART 2 -- PRODUCTS

2.1 CASING, SCREENS, AND APPURTENANCES

Well Casing: Each well casing shall be 6-inch nominal Schedule 80 PVC pipe, 5-inch nominal Schedule 80 PVC, 4-inch nominal diameter Schedule 40 PVC pipe, as indicated, with ASTM threads according to ASTM F 480. The blank PVC shall be factory-assembled in 20-foot lengths. Smaller lengths of 5- to 10-feet shall also be furnished to accommodate the final well design. The blank PVC casing surface shall be free of solvents, oils, grease, paint, and dirt and shall be certified clean from factory or be steam cleaned at the Site. Sections of casing shall be received from the supplier wrapped in polyethylene protective wrappers with sealed ends to limit exposure to potential contaminants. Casing shall not be removed from the wrapping until immediately before placing it in the borehole. Bottom caps shall be flush- threaded and top caps shall be of the oversize slip cap type.

Casing Joints: Casing joints shall be ASTM thread and shall be attached in accordance with the requirements of ASTM F 480. The CONTRACTOR shall not utilize glued joints.

Well Screen: The screen slot size shall be 20 slot (0.020 inch) or 40 slot (0.040 inch) as indicated. Screen openings shall widen inward so as to be non-clogging. Final screen length and positioning will be approved by the ENGINEER and is subject to change based on observed field conditions. The well screen shall be sufficient size and design to hold back and support the filter pack and in-situ soils surrounding the screen. The

well screen surface shall be free of solvents, oils, grease, paint, and dirt and shall be certified clean from the factory or be steam-cleaned on Site. The well screen shall have smooth, sharp-edged openings free of burrs, chipped edges, or broken pieces on the interior and exterior surface of the pipe. Sections of screen shall be received from the supplier wrapped in polyethlyene protective wrappers with sealed ends for limiting exposure to potential contaminants. Wrapping shall not be removed until screen is to be used.

Centralizers: Centralizers shall be PVC or stainless steel.

Above-Ground Completion/Well Heads: Wellheads shall be constructed as indicated.

2.2 SEALING MATERIAL

A. **Cement:** The cement/bentonite grout mixture shall consist of 95 to 97 percent Type V or Type II-V Portland Cement and 3 to 5 percent bentonite powder by weight (equivalent to one 94-pound bag of cement and between 2.8 and 4.7 pounds of bentonite).

2.3 FILTER PACK MATERIAL

Filter Pack material: The filter pack shall consist of 8 x 12 (40 slot screen) or 10 x 20 (20 slot screen) Colorado Silica Sand (or equivalent).

Filter pack material shall be protected from contaminants prior to placement by either sorting it in plastic-lined paper bags or in a location protected from the weather and contamination on plastic sheeting. Filter pack materials shall be transported to the well in a manner preventing contamination by other soils, oils and grease, and other chemicals.

The filter pack material shall be compatible with the well screen slot size. A sample and sieve analysis of filter packing materials shall be submitted for review and acceptance prior to anticipated placement of the material in the well annulus. Failure to match gradation of approved sample shall be grounds for rejection of the material. The filter pack material, if stockpiled at the Site, shall be kept free of foreign matter.

PART 3 -- EXECUTION

3.1 DRILLING

Each well shall be installed in a single work shift, or continuous work shifts without shutdown.

Wells shall be drilled using air-rotary drilling methods. Drilling shall be performed using Barber (dual-rotary), odex, or other temporary casing methods. Air will be the primary drilling fluid used. If other fluids are needed for borehole stability, cuttings removal, or restoring circulation, they will be used in the following sequence: (1) air/water mist, (2) foam, (3) polymer, and (4) bentonite mud. The discharge from the borehole will be directed to a cyclone so that ground water discharge rates can be measured.

1. Hollow-stem auger drilling methods may be proposed by the CONTRACTOR for monitoring wells. Hollow-stem auger drilling methods shall be approved by the ENGINEER.

The diameter of the boreholes shall be sufficient to provide a minimum 2-inch annulus between the well casing and the borehole. The borehole diameter is anticipated to be

14 inches at the surface to allow for 10-inch steel surface casing. The borehole below the steel casing is anticipated to be 10 inches nominal.

Sequence

Wells shall be constructed as follows:

Set up drill rig.

Drill borehole.

Collect and deliver lithologic samples from each borehole to ENGINEER.

Provide well casing and screen assembly.

Develop the well by approved methods.

Construct the final above ground surface well completions.

3.2 DATA COLLECTION

General Notes

The borehole shall be airlifted to dryness (or until clean ground water is produced) at the end of a shift. This may require airlifting 15 to 30 minutes, letting the borehole sit undisturbed for 15 to 30 minutes, and then airlifting again.

First Occurrence of Water

The depth at which water is first encountered shall be noted. There is no minimum amount of water required to count as first water (i.e., any water encountered regardless of quantity qualifies as first water).

If drilling dry, the zones that produce moist/damp cuttings but no free water shall be noted. It shall be noted if damp/wet zones are encountered and if deeper zones are dry. In zones that produce moist/damp cuttings, stop drilling, let the borehole sit undisturbed for 10 to 15 minutes, and then airlift to determine if free water is present.

Alluvial Bedrock Contact

Stop drilling at the alluvial/bedrock contact and let the borehole sit undisturbed for 10 to 15 minutes and then airlift to determine if free water is present. Record in the field logbook whether or not water is present.

Water Production Measurement During Drilling

Measure water production during drilling as follows:

Airlift until water production stabilizes or diminishes to less than 0.5 gallons per minute (gpm), as specified in item 2 below. The procedure will be performed 1) every 10 feet of drill advancement, 2) after each drill rod is fully advanced, 3) after cleaning cuttings from the borehole, 4) after discontinuing drilling fluid injection, and 5) at the end of each shift.

Airlift, without injecting drilling fluid, a minimum of 5 minutes. Continue airlifting until water production stabilizes or is less than 0.5 gpm. Stabilization of water production usually takes between 5 and 15 minutes depending on borehole conditions (e.g., depth, degree of fracturing, drill fluid additives, and the amount of ground water).

After airlifting a minimum of 5 minutes, consider water production to be stable when two consecutive discharge measurements are nearly the same.

Measure discharge to the nearest 0.25 gpm using a calibrated 1- or 5-gallon bucket and a stopwatch.

Record the stable water production rate in the field logbook.

Ground water may not be present in sufficient quantities to sustain water production during airlifting. Note if a slug of water is observed after the new drilling rod is added or at the start of a shift.

Record other hydrogeologic information when possible. Note fracture zones, zones where flow increases/decreases, lost circulation zones, voids, and water blowing out of other boreholes.

Collection and Description of Samples

Borehole stratigraphy shall be logged by examination of the sample cuttings or split barrel samples. Monitoring wells shall be drilled using air-rotary drilling methods. Air will be the primary drilling fluid. The return fluid will consist of air, drill cuttings, and ground water, which will be routed through a cyclone to separate the air and allow measurement of ground water production. Representative samples of cuttings shall be collected by routing a portion of the cuttings/ground water discharge stream from the cyclone into a sample bag. The sample bag shall be replaced at 10-foot intervals. The sample bag shall be labeled with the borehole number, depth interval, date, and time of collection. A split of the sample shall be placed in a chip tray. The chip tray shall be labeled with the same information as the sample bag.

3.3 MONITORING WELL DESIGN AND COMPLETION

Well Design For Four-Inch or Five-Inch Casing and Screen

All groundwater monitoring wells shall be completed with new 5-inch schedule-80 PVC riser or 4-inch, schedule-40 PVC riser. Joints shall be flush threaded. The screen shall be factory slotted and approximately 20 feet in length. Screen lengths may be increased or decreased depending on hydrogeologic conditions. The screen slot size shall be 20 slot (0.020 inch). Bottom caps shall be flush- threaded and top caps shall be of the oversize slip cap type.

Well Design For Six-Inch Casing and Screen

All groundwater production wells shall be completed with new 6-inch schedule-80 PVC riser. Joints shall be flush threaded. The screen shall be 6- inch schedule-80 PVC and shall be either wire-wrapped, high-flow factory slotted, or regular-flow factory slotted, depending on ground water flow rates encountered during drilling. The screen length is anticipated to be 20 feet, but it may be increased or decreased depending on hydrogeologic conditions. The screen slot size shall be 20 slot (0.020 inch) or 40 slot (0.040 inch) depending on subsurface material sizes and ground

water flow rates encountered during drilling. Bottom caps shall be flush-threaded and top caps shall be the oversize slip cap type.

Centralizers

Stainless steel or PVC centralizers shall be used at the top and bottom of the screen.

Filter Pack

The filter pack shall consist of 8 x 12 (40 slot screen) or 10 x 20 (20 slot screen) Colorado Silica Sand (or equivalent). The filter pack shall extend from the bottom of the screen to a point between 3 and 5 feet above the top of the screen. The filter pack shall be placed by pumping with water through a tremmie pipe.

Bentonite Seal

A bentonite seal that is a minimum of 5 feet thick shall be placed above the filter pack. The bentonite seal shall consist of coated pellets, pellets, chips, or slurry, depending on borehole conditions. Slurry seals shall be used only when pellets or chips cannot be placed in the annulus, and shall be mixed 20 to 30 percent solids by weight and be a minimum of 10 feet thick. Slurry seals shall be pumped through tremmie pipe and positively displaced upward.

Cement/Bentonite Grout

The annular space between the well casing and the borehole shall be grouted from the top of the bentonite seal to the surface. If the grout seal is placed on top of a bentonite slurry seal, the bentonite slurry seal shall be allowed to set before placement of the grout seal. If the grout seal is placed on top of a bentonite chip or pellet seal, the chip or pellet seal shall be allowed to hydrate a minimum of 1 hour before placement of the grout seal. The cement/bentonite grout mixture shall consist of 95 to 97 percent Type V or Type II-V Portland Cement and 3 to 5 percent bentonite powder by weight (equivalent to one 94-pound bag of cement and between 2.8 and 4.7 pounds of bentonite). Approximately 8.5 gallons of water shall be used for each cement/bentonite batch. The grout mixture shall be prepared by thoroughly mixing the bentonite powder with water first and then mixing in the cement.

Grout shall be placed in the well annulus with a tremmie pipe located within approximately 10 feet of the top of the bentonite seal. For wells less than 60 feet in depth, the grout shall be pumped through the tremmie pipe and positively displaced upward until undiluted grout flows from the annular space at ground surface. For wells deeper than 60 feet, the grout shall be pumped through the tremmie and positively displaced upward until approximately one-half the calculated volume has been pumped. The tremmie pipe shall then be pulled up to a depth approximately one-half the distance between the bentonite seal and the surface, and the remaining annular space shall be grouted by positively displacing the grout upward until undiluted grout flows from the annular space at ground surface.

No single lift of grout shall exceed 100 feet. If the depth of the annular space is greater than 100 feet, the annular space shall be grouted in two or more lifts, each lift being less than 100 feet. Each lift shall be allowed to set before the next lift is placed. Grout accelerants shall not be used.

Surface Completion

Steel protective casings with locking caps shall be installed at the surface around the monitoring wells. The steel casings shall be cemented in place and shall extend a minimum of 5 feet below ground surface and 3 feet above ground surface. The protective casings shall be a minimum of 4 inches larger in diameter than the PVC monitoring wells.

Grout shall be placed within the protective casing annulus from ground surface to one-half foot above ground surface. A weep hole shall be drilled in the protective casing at the top of the grout.

The monitoring well number shall be written on the top of the PVC monitoring well cap. A permanent mark shall be placed on the north side of the PVC monitoring well casing to indicate the water level measurement point.

Tremmie Pipe

Tremmie pipe used for the placement of the filter pack, bentonite slurry seals, and grout shall comprise flush-threaded steel or schedule-80 PVC. The tremmie pipe shall have a minimum inner diameter (ID) of 1.25 inches.

3.4 MONITORING WELL INSTALLATION

Perform the following procedures when drilling and installing wells using casing advance systems:

All drilling equipment shall be decontaminated. Record the decontamination procedure and personnel present in the field logbook.

Count and measure the lengths and sizes of all drilling rods, temporary drilling casing, and bits and record this information in the field logbook. This information may be useful in verifying borehole depths and diameters. Record the type of drill rig and the names of the drillers and helpers on the borehole log and in the field logbook.

Advance the borehole to total depth. During drilling, perform ground water airlift testing as specified in Paragraph 3.1 D and record the results on the borehole logs and/or in the field logbook.

Collect cuttings samples over 10 foot intervals and log and label them as specified in Section Paragraph 3.1 E.

After the borehole has been drilled to total depth, record the depth on the borehole log and in the field logbook. Trip out the drill string and measure the total depth of the open hole using a weighted fiberglass tape or by tagging with the well casing when installing. Record the total open hole depth on the borehole log and in the field logbook.

Measure and record each joint of blank riser, screen, and the endcap to the nearest 0.1 foot.

Assemble the endcap, screen, and riser as it is lowered into the borehole and attach centralizers as specified in Paragraph 3.1 F. Record the locations of the centralizers on the borehole log and/or in the field logbook.

For monitoring wells that do not use wire-wrapped screen, lower the screen and casing until the endcap rests on the bottom of the borehole and then raise the casing string

until it is held in tension. For monitoring wells that use wire wrapped screen, lower the screen and casing until the endcap is approximately 1 foot off the bottom, based on measurements of the casing string and the open borehole depth.

Measure the stickup of the top of the casing above ground surface and calculate the screened interval. Adjust the screened interval by raising the casing assembly to desired interval, if necessary, and add bentonite pellets or sand to fill the bottom of the borehole to the bottom of the endcap. Record the total depth of the casing on the borehole log and in the field book.

Calculate and record the volume of the filter pack, bentonite seal, and grout required to fill the annular space based on the borehole size and casing size. The volume is calculated by subtracting the volume of the casing (based on the outer diameter) from the volume of the borehole using the equation:

$V=\pi(rb2 - rc2)h$

where: V =volume (in feet3); rb = radius of borehole (in feet); rc = radius of casing (in feet); h =height (in feet) between the top and bottom of the material (filter pack, bentonite, or grout).

As the temporary casing is pulled back, begin adding the filter pack into the annular space as described in Section 5.5.4. Repeated depth soundings to monitor the filter pack level shall be taken using either measured tremmie pipe or a weighted tape. The filter pack should be kept 1 to 2 feet up into the temporary casing so that the screen/riser is never exposed to the open borehole. The filter pack shall be extended to between 3 and 5 feet above the top of the screen. Allow sufficient time for the filter pack to settle through the water column before measuring and recording the final filter pack level.

Following filter pack placement, install a minimum 5-foot-thick bentonite pellet or chip seal or a minimum 10-foot-thick bentonite slurry seal. Pellets or chips shall be poured slowly to minimize bridging. Bentonite slurry seals shall be mixed to between 20 and 30 percent solids and pumped through a tremmie pipe for placement. Repeated depth soundings to monitor the bentonite seal level shall be taken using either measured tremmie pipe or a weighted tape. Bentonite chip and pellet seals shall be allowed to hydrate a minimum of 1 hour before the placement of the grout seal. Bentonite slurry seals shall be allowed to set before placement of grout.

Grout the remaining annulus from the top of the bentonite seal to the surface using the grout mixture and procedures specified in Section 5.5.6. If the annular distance is greater than 100 feet, additional lifts of grout will be required. Each lift shall be allowed to harden before a new lift is placed. The grout shall be placed by tremmie pipe as specified in Section 5.5.8. All grout batches mixed and pumped shall be weighed using a mud scale; the weight of the grout should be between 13 and 15 pounds per gallon. All grout weights, gallons of water, and quantities of bags of cement and bags of bentonite powder used shall be recorded on the borehole logs and/or in the field book.

Before the last lift of grout sets, center the protective steel casing around the monitoring well casing and insert the steel casing approximately 5 feet into the grouted annulus. Insert a temporary spacer between the protective casing locking lid and the monitoring well cap to prevent the protective casing from settling. Label the monitoring well.

After the last grout lift has set for 24 hours, check it for settlement and add additional grout, if necessary.

3.5 MEASUREMENTS

Measurements made during drilling of the borehole shall be performed to the nearest foot. Measurements made during well construction and of well construction materials shall be performed to the nearest 0.1 foot. Measurements shall consist of the following:

Total depth of borehole at end of drilling below ground surface (bgs)

Total depth of open borehole bgs, before the start of well construction

Lengths of the endcap, screen sections, riser blank sections, and stickup of well above ground surface

The depth bgs of the top of the filter pack, top of the bentonite seal, and the top of each grout lift.

Following well completion, the horizontal location of the monitoring well shall be determined by civil survey or with the use of a global positioning system (GPS) receiver. The elevation of the top of the protective casing, ground surface, top of PVC well, and water level measuring point (e.g., the top of the PVC well) shall be determined.

1. Survey points for monitoring wells shall be located to the nearest 0.1 ft horizontally and vertically.

3.6 WELL DEVELOPMENT

General: After the well has been completely constructed in accordance with the requirements of the Contract Documents, the CONTRACTOR shall notify the ENGINEER and make the necessary arrangements for conducting the well development. Well development will consist of swabbing, bailing, and pumping. Well development shall begin no earlier than 48 hours after the grout has been placed. Well development will be performed using one or more of the following methods: surging, over-pumping, or bailing, as determined by the ENGINEER. The method to be used will be selected based on specific hydrogeologic conditions at the Site but will generally consist of a sequence of bailing, surging, bailing, and then pumping. A minimum of 3 casing volumes of water or a volume indicated by the ENGINEER shall be removed. Water exiting the well shall be containerized allowing time for any suspended solids to settle prior to being discharged to the local stormwater inlet. Well development shall continue until the water is reasonably sand-free and turbidity is reduced. As appropriate, pH, specific conductance, turbidity, and temperature will be measured by the ENGINEER to evaluate the adequacy of monitoring well development.

3.7 DISPOSAL OF DEVELOPMENT AND TEST WATER

General: The CONTRACTOR shall provide collection and conveyance for discharging water from the well to pit 3 or other location is directed by the ENGINEER.

3.8 ABOVE GROUND COMPLETION/WELL HEADS

General: Wellheads shall be constructed as indicated.

3.9 WELL ACCEPTANCE

It is the responsibility of the CONTRACTOR to properly construct and install, develop, and test wells so that the wells are suitable for water level monitoring and/or a water quality compliance monitoring program. If the CONTRACTOR installs wells that are not functional or not in accordance with requirements, the ENGINEER will disapprove the well as Defective WORK and will direct the CONTRACTOR to repair or replace it at the ENGINEER's option. Repair of Defective WORK shall be done as part of the WORK.

3.10 REMEDIAL WORK

If remedial WORK becomes necessary to make the well acceptable because of accident, loss of tool, defective material, or for any other cause, the CONTRACTOR shall propose in writing a method for correcting the problem. Suggested methods shall be reviewed and approved by the ENGINEER before WORK proceeds. Remedial WORK shall not be justification for extending the length of the Contract.

- END OF SECTION -

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SECTION 02050 - DEMOLITION

PART 1 -- GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment and incidentals required for demolition, removal, and recycle.

B. Disposal and relocation as shown and as specified herein.

C. Demolition includes structural concrete, foundations, structural steel, metals, roofing, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, and similar existing facilities, above and below ground. Demolished items shall be disposed of within the Waste Containment Area (WCA) as Unclassified Waste, as defined in Section 02205 – Waste Excavation and Disposal, and as shown on the Drawings.

Items to be demolished include:

Item	Description
Water Treatment Plant	Pre-engineered steel frame building, associated interior/exterior tanks, piping, and appurtenances
Seep Collection Facilities	Wood and metal frame buildings with associated tanks, pumps, and piping
Decontamination Facility	Wood frame building
Misc. Outbuildings	Various small steel frame buildings located near the west edge of Western Drainage and other locations
Culverts	Galvanized steel various lengths
Storm Water Storage Pond	Single 40-mil HDPE geomembrane for pond liner. Geofabric in the spillway area (under riprap). 12-inch HDPE outlet pipe/decant riser.
Construction Support Facilities	Various temporary facilities installed to support the WORK shall be demoilished upon completion of the RA.
Access Controls	Fencing and other existing access contols that will be removed or replaced by final access controls.

D. Asbestos may be present in the areas to be demolished. The CONTRACTOR shall assess the extent of the asbestos and perform the necessary abatement and removal prior to beginning demolition work. Asbestos abatement and disposal shall be performed in accordance with 40 CFR Part 61, NESHAPS; 40 CFR Part 763, AHERA; WAC 296-62 and 296-65, EPA Region 10, the Washington State Department of Ecology. Asbestos materials shall be segregated and transported off-site for disposal in accordance with applicable Stevens County, Washington State, and Federal regulations.

E. PCB containing transformers and light ballasts may be located in the area designated for demolition and removal. The CONTRACTOR shall assess the condition and level of PCB contamination within these items prior to removal and shall dispose of these items according to the requirements of 40 CFR Part 761, WAC 173-303. PCB's shall be segregated and transported off-site for disposal in accordance with applicable Stevens County, Washington State, and Federal regulations.

F. Lead-based paint may be present in the areas to be demolished. The CONTRACTOR shall assess the extent of the lead and perform the necessary abatement and removal prior to beginning demolition work. Lead abatement shall be performed in accordance

with EPA Testing Method 1311 for TCLP, EPA Region 10. Materials contaminated with lead-based paint shall be segregated and transported off-site for disposal in accordance with applicable Stevens County, Washington State, and Federal regulations.

G. Other hazardous materials not listed above shall be segregated and transported off-site for disposal in compliance with applicable Stevens County, Washington State, and Federal regulations.

H. Work shall conform to requirements of this Section for all references to demolition and removals in other Sections. Excavation and disposal of contaminated soils and sediments is addressed in Section 02205 – Mine Waste Excavation and Disposal.

I. Included under this Section shall be the removal and relocation or re-routing of any existing piping, valves, conduit, equipment and appurtenances which are not specifically shown on the Drawings or described in the Specifications, but are found to interfere with completion of required demolition.

1. As used above, the terms “relocation” and “re-routing” shall include the furnishing and installation of all new piping, conduits, wires, insulation, and the like; with all new fittings, gaskets, supports, anchors, fasteners, painting and miscellaneous appurtenances required in order to relocate or re-route the system or equipment as necessary and to return the system or equipment to service capable of providing the full range of service and function originally intended.

2. All new materials shall meet the requirements of similar materials specified in these Specifications.

3. Existing materials, with the following exceptions shall not be reused. The filter press, membrane squeeze tank, and associated pumps and electrical control panels shall be reused in the new water treatment plant.

J. Included under this Section shall be the relocation, or removal and replacement of any existing fencing found to interfere with completion of the WORK.

1. Where fencing must be temporarily removed to accommodate the WORK, then fencing shall be replaced in a similar configuration.

2. Where fencing must be relocated to accommodate the work, the fencing shall be constructed of similar materials and in a configuration approved by the ENGINEER.

3. Existing fencing materials shall be reused where practical. New materials shall be of similar quality to existing materials.

K. The CONTRACTOR is encouraged to visit the work site during the bidding period to determine the hazards, working conditions, accessibility and true extent of the Demolition work required under this Section.

1.2 REFERENCE REDEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Remedial Action Work Plan

2. Staging/Temporary Stockpiling Plan

1.3 REFERENCE CODES AND STANDARDS

A. Comply with all Federal, State laws or ordinances, as well as applicable codes, standards, regulations and/or regulatory agency requirements including the partial list below:

1. Occupational Safety and Health Administration (OSHA); 29 CFR Part 1926 Safety and Health Regulations for construction.

1.4 SUBMITTALS

A. The Submittals indicated below shall conform to Section 01300 – CONTRACTOR Submittals.

B. Submit to the ENGINEER for review proposed methods, equipment, and operations sequence. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of the COMPANY'S operations.

C. **Structural Assessment:** OSHA requires that an engineering assessment be conducted and documented in writing prior to the start of demolition operations [29 CFR 1926.850(a)] to evaluate the structural integrity and the potential for an unplanned collapse. This assessment shall be completed by the CONTRACTOR and submitted to the ENGINEER prior to the initiation of demolition activities.

1.5 SCHEDULING

A. Conduct work so as to avoid interference with operations and work in the existing facilities.

B. Comply with the staged construction/demolition requirements as outlined on the Drawings and as described herein.

1.6 COORDINATION

A. Review the demolition requirements described in other Sections of the Specifications or shown on the Drawings and coordinate with the general work requirements in this Section. Unless more specific direction is given by a particular project specification or drawing detail, the requirements of this Section shall govern insofar as they pertain to the repair of surfaces which are exposed by the demolition or which shall remain exposed upon the completion of this Contract.

B. The CONTRACTOR shall be responsible for any additional or differing demolitions, removals and subsequent repair of exposed surfaces which may be found necessary due to the selection of alternate equipment or the requirements of miscellaneous appurtenances of the equipment specified.

C. Any removal and/or connections, which require downtime for any treatment equipment, shall be scheduled in advance with the COMPANY.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Examination and Verification of Condition:

1. Before demolition begins, the CONTRACTOR shall inspect existing structures and equipment that shall remain in place within and adjacent to the demolition area for existing defects and damage. Record and notify the ENGINEER of defects and damage found during this inspection.

2. Prior to demolition of the WTP the CONTRACTOR and ENGINEER shall conduct a joint inspection to identify equipment that shall be salvaged for reuse. Equipment to be salvaged shall be inspected for existing defects and damage.

3.2 PREPARATION

A. Notification

1. Do not start any equipment removal or demolition operations without the permission of the COMPANY.

B. Protection

1. Before demolition begins, disconnect all mechanical and electrical services affected by the work. Interconnecting piping and electrical services that are to remain in service either permanently or temporarily shall be capped or rerouted in a manner that shall not interfere with the operation of the existing facilities to remain and the demolition work.

2. Execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris, exposure to weather or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.

3. Provide fire safety measures at all times in areas where burning torches are being used. Maintain all these items during the demolition period.

4. Perform testing and air purging where the presence of hazardous material, gases, flammable materials or dangerous substance is apparent or suspected. Eliminate the hazard before demolition is started.

5. Do not close or obstruct roadways adjacent to the work by the placement or storage of materials.

6. Conduct all operations with a minimum interference to on-going operations of adjacent concurrent construction activities.

7. Erect and maintain safety barriers, lights, and other required protective devices.

8. Repair damage done to facilities to remain, or to any property belonging to the COMPANY.

9. Provide adequate lighting at all times during demolition operations.

10. Provide warning signs as required, for personnel and the public.

11 Provide temporary supports and bracing of all existing structures, equipment and utilities that shall remain in the service.

12. Provide adequate drainage of water from dust control or precipitation during demolition activities.

3.3 DEMOLITION PHASING

A. Due to overall construction sequencing, demolition of some structures must occur before a suitable disposal area within the WCA has been prepared. In these situations, demolition debris shall be placed in a temporary stockpile within the MWA as shown on the Drawings. Alternative stockpile locations shall only be used if approved by the ENGINEER. .

B. Structures and facilities shall be demolished/removed in the following order unless otherwise approved by the Engineer:

Anticipated Demolition Order	**Facility or Structure**	**Schedule**
1	Existing structures in the proposed construction support facilities area (west edge of the Western Drainage)	Start of RA (Early Works)
2	Pipelines and structure in the Western Drainage below the toe of the South Waste Rock Pile	Phase 2
3	Existing WTP and appurtenant structures	Phase 2
4	Pump houses and pipelines in the Eastern and Far East Drainages	Phase 2
5	Pump houses, pipelines, and other facilities in the Central Drainage, including those associated with the Pollution Control Pond	Phase 3
6	Fencing associated with construction support facilities (New Construction)	End of RA
7	Crew meeting/lunch trailers (New Construction)	End of RA
8	Construction offices (New Construction)	End of RA
9	Storage trailers (New Construction)	End of RA
10	Maintenance/electrical shop (New Construction)	End of RA
11	Decontamination office (New Construction)	End of RA
12	Locker, shower, and laundry building (New Construction)	End of RA
13	Construction fuel and water storage and delivery systems (New Construction)	End of RA
14	Ambulance garage (New Construction)	End of RA
15	Safety/Emergency Services Office (New Construction)	End of RA
16	Restroom trailers (New Construction)	End of RA
17	Demolition of existing site access control fencing	End of RA

C. Buried pipelines and other non-essential utilities not identified on the drawings shall be removed during the course of the WORK as they are encountered. Culverts and power-lines shall be removed as necessary and in a manner that prevents interruption of surface water management or power supply to operating facilities.

3.4 APPLICATION

A. Possession of Removed Items

1. Removed Items to Remain Property of the COMPANY

a. All items to be removed under this project are to remain the property of the COMPANY.

B. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.

a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations.

c. Upon completion of removal operations in the area, clean and return adjacent areas to conditions existing prior to the start of the work.

2. The Contractor shall be required to provide containers for any hazardous or dangerous waste identified during demolition. Materials Identified shall at the sole discretion of the ENGINEER either be disposed of in the WAC or be removed from the site and disposed of in accordance with applicable laws and codes.

C. Structural Removals

1. Sequence

a. The extent of structural demolition area shall first be outlined by the Contractor so as to demonstrate that the true extent and nature of the removal is completely understood.

b. Limits of Removal

1) All aboveground and underground portions of the structures shall be demolished. Slabs on grade and concrete foundations shall be broken up and removed.

c. Demolition Debris shall be sorted and sized in general accordance with the following guidelines:

Demolition Debris Material	Sizing Guidelines
Structural Steel	Straight 10 foot length
Concrete Rubble	2 foot maximum dimension
Concrete Walls	4 foot x 4 foot x 1 foot
Structural Wood	8 foot maximum dimension

d. Disposal of Materials:

1) Demolition debris shall be disposed of in the WCA as Unclassified Waste as shown on the Drawings, and in accordance with Section 02205 – Waste Excavation and Disposal.

2) Compressible materials shall be crushed and then covered with backfill. Incompressible materials shall be placed in the disposal area, with the void spaces outside of the materials filled with backfill.

3) Materials such as pipe and tubing have a varying degree of compressibility, depending on the diameter and wall thickness of the pipe. Pipe with a 12-inch diameter or larger shall be crushed or filled with soil for burial, and pipe with smaller diameter shall be crushed before burial.

4) Vessels and tanks shall either be crushed (if thin-walled and compressible) or cut open (if thick-walled and incompressible). Vessels that are to be cut open and filled, shall be placed in the disposal area such that fill can also be placed around them and compacted. Thick-walled tanks or vessels that cannot be cut open due to cutting difficulties or worker health concerns shall be placed in the designated area of disposal, with interior voids spaces filled with grout.

5) Metallic debris shall be placed by sizes so that larger pieces are not stacked on top of each other at angles. Large structural shapes shall either be laid edge to edge so that they can be covered by backfill or they shall be spaced far enough apart that equipment can operate between them to spread backfill. Long structural (incompressible) members shall be oriented horizontally.

6) Demolition debris shall be comingled with the backfill, to minimize the void spaces.

7) Demolition debris shall be distributed throughout designated areas of the backfill to avoid concentrated areas of debris.

8) Demolition debris shall be placed and spread in maximum 2 foot thick loose lifts. The debris is then covered with backfill in a maximum 2-foot loose lift.

9) To the extent practical, uncontaminated material associated with demolition of the Construction Support Zone facilities shall be sent off-site for reuse or disposal.

D. Water Management Ponds

1. Piping and appurtenances shall be removed from water management ponds prior to demolition of the liner system.

2. Synthetic liner materials and geotextiles shall be cut in manageable pieces and removed in folder pieces or rolls.

3. Rolls shall not exceed 25 feet in length and flat pieces or folded sections shall not exceed 250 square feet when placed in the WCA.

4. Liner materials shall be distributed throughout designated areas of the backfill to avoid concentrated areas.

Liner materials shall be covered with backfill in a maximum 2-foot lift.

E. Mechanical Removals

1. Process Piping

a. Facility equipment and structures shall have remaining reagents, residues, and fluids removed and disposed.

b. Water lines shall be drained to appropriate locations for storage and treatment.

F. Clean-Up

1. General

a. Remove all debris resulting from the demolition operations as it accumulates.

b. Upon completion of the work, remove all materials, equipment, waste, and debris of every kind and leave the premises clear, neat and orderly.

G. Safety Barriers

1. Erect and maintain safety barriers, warning lights and other protective devices as required around all areas of structural demolition and/or openings in the operating floors, walls or roofs.

2. All areas of open excavation or partially removed floors shall be kept lighted at all times, 24 hours per day, with floodlights or other lighting devices.

- END OF SECTION -

SECTION 02100 - SITE PREPARATION

PART 1 -- GENERAL

1.1 SUMMARY

A. Site Preparation shall include clearing, grubbing, stripping; and re-grading certain areas, in accordance with the Contract Documents.

B. The CONTRACTOR shall protect existing fences, structures and associated improvements, roads, and utilities downslope of construction area from damage due to boulders, trees, or other objects dislodged during Site Preparation.

C. This section does not address site preparation of the Rhoades Borrow Area. Rhoades Borrow Area site preparation is addressed in Section 02105 – Rhoades Borrow Area.

1.2 SITE INSPECTION

A. Prior to mobilizing onto the Site, the CONTRACTOR shall inspect the Site conditions and review maps delineating the COMPANY's property and right-of-way lines.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 PRIMARY SITE ACCESS

A. The CONTRACTOR shall develop any necessary access to the Site, including access road improvements and access barriers to prohibit entry of unauthorized persons.

B. **Utility Interference:** Where existing utilities interfere with the WORK, notify the utility owner and the ENGINEER before proceeding in accordance with the General Conditions.

3.2 TIMBERING

A. Removal and salvage of merchantable timber shall be conducted under a separate contract. CONTRACTOR shall not remove and salvage merchantable timber unless otherwise directed by the ENGINEER in writing.

3.3 CLEARING AND GRUBBING

A. General

1. Clearing limits shall be marked by the CONTRACTOR and approved by the ENGINEER prior to starting any clearing and grubbing activity.

2. Trees and other natural vegetation outside clearing limits shall be protected from damage during construction.

3. Burning of cleared and grubbed debris shall not be allowed.

B. **Areas <u>Not Subject</u> to Excavation of Contaminated Soils and Sediments**

1. Construction areas shall be cleared of structures, trees, logs, and any other objectionable material which would interfere with the performance or completion of the WORK or create a hazard to safety. Trees, shrubs, and debris removed during clearing operations shall be stockpiled on Site at locations designated by the ENGINEER. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction.

2. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove stumps, roots, buried logs, and other objectionable material. Material removed during clearing and grubbing shall be hauled to on-Site stockpile locations designated by the ENGINEER.

3. Brush and cleared debris shall be chipped is for use as mulch.

C. **Areas Subject to Excavation of Contaminated Soil and Sediments:**

1. Prior to clearing and grubbing, an initial soil contamination evaluation shall be performed by the COMPANY to verify areas where removal of contaminated soil shall be necessary. These areas shall be delineated by the COMPANY.

2. Phasing: Contaminated soil and sediment excavation and disposal shall be conducted in phases, in accordance with Section 02205 – Excavation and Disposal of Waste Materials. Clearing and grubbing in areas of contaminated soil and sediment excavation shall be conducted in similar phases.

3. Areas subject to excavation of contaminated soils and sediments shall be cleared of structures, trees, logs, and any other objectionable material which would interfere with the performance or completion of the WORK or create a hazard to safety. Trees, shrubs, and debris removed during clearing operations in contaminated areas shall be considered contaminated and shall be stockpiled at a location designated by the ENGINEER.

4. Areas subject to excavation of contaminated soil and sediment shall not be subject to grubbing. Surface vegetation remaining in these areas after clearing shall be removed as part of the excavation of contaminated soil and sediments.

5. Brush and vegetative debris, including leftover slash from timbering, shall be chipped and disposed of in the WCA as unclassified waste in accordance with Section 02205 – Mine Waste Excavation and Disposal. Chipped material shall be placed in lifts of less than 6-inch thickness and mixed with the backfill.

3.4 STRIPPING

A. Areas subject to excavation of contaminated soils and sediment shall not be subject to stripping.

B. For all other areas, upon completion of grubbing operations, areas to be affected by construction shall be stripped to a depth of 1.5-feet below the existing ground contours, or as otherwise directed by the ENGINEER. The stripped materials shall be stockpiled at a location designated by the ENGINEER.

3.5 OVEREXCAVATION, REGRADING, AND BACKFILL UNDER FILL AREAS

A. After the fill areas have been cleared, grubbed, and stripped, the areas to receive fill may require over-excavation to remove wet, soft, or otherwise undesirable material prior to fill placement.

B. Material removed during over-excavation shall be stockpiled at on-Site locations designated by the Engineer.

C. The excavated ground surface shall be re-contoured for keying the fill and removing severe or abrupt changes in the topography of the Site. The over-excavated areas shall be backfilled with compacted fill in accordance with the requirements of Section 02200 - Earthwork.

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SECTION 02105 – RHOADS BORROW AREA

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide all labor, equipment and materials for development and reclamation of the Rhoads Borrow Area in accordance with the Contract Documents.

B. CONTRACTOR shall excavate, haul and stockpile cover soil from the Rhoads Borrow Area.

1.2 SITE INSPECTION

A. Prior to mobilizing onto the Site, the CONTRACTOR shall inspect the Site conditions and review maps delineating the COMPANY's property and right-of-way lines.

1.3 REFERENCE PLANS OF OPERATION

A. The work under this section shall be conducted in substantial compliance with the following plans of operation included as part of the Contract Documents:

1. Rhoads Property Plan of Operations and Reclamation

2. Remedial Action Work Plan

1.4 CONTRACTOR SUBMITTALS

A. Submit the following in conformance with Section 01300 – Contractor Submittals

B. Submit a Stormwater Pollution Prevention Plan (SWPPP) specific to the Rhoads Borrow Area in accordance with Paragraph 1.5.

C. Submit manufacturer's product data/ information and weed-free certifications on all materials used to construct sediment and erosion control features.

1.5 SWPPP SUBMITTALS

A. The CONTRACTOR shall prepare and submit a Storm Water Pollution Prevention Plan (SWPPP) specific to the Rhoads Borrow Area.

1. The Rhoads Borrow Areas SWPPP shall comply with the Construction Stormwater General Permit (CSWGP) administered by the Washington State Department of Ecology (Ecology).

B. SWPPP: Submit two signed copies of the SWPPP to the ENGINEER for approval. Deliver these documents to the ENGINEER no less than forty-five (45) days before the construction begins. The ENGINEER will review the SWPPP submittals within thirty (30) days. Submittals will be returned to the CONTRACTOR, and marked as either requiring modification or as approved by the ENGINEER.

C. SWPPP Submittal Requirements:

1. Sign and certify the approved SWPPP according to the CSWGP requirements, before submitting the eNOI. The SWPPP must also be signed and certified by the ENGINEER.

2. Submit the eNOI to Ecology and submit a copy of the eNOI to the ENGINEER at the same time. The ENGINEER will submit the COMPANY'S eNOI to Ecology. Allow adequate time for State processing of all eNOIs, before beginning construction activities.

D. Basis of Work: The active status eNOIs, approved SWPPP, and CSWGP are the basis of the Work required for the Rhoads Borrow Area erosion, sediment, and pollution control.

E. Ending Permit Coverage: Within thirty (30) days of when the Rhoads Borrow Area is stabilized as determined by the ENGINEER, submit the eNOT to Ecology and send a copy of the eNOT to the ENGINEER. Upon receipt of the eNOT, the COMPANY will submit the OWNER's eNOT to Ecology, and will terminate the CSWGP coverage.

F. SWPPP personnel, content, and implementation shall be in accordance with Specification Section 01570 –SWPPP.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 HAULAGE

A. A temporary haul road shall be constructed as shown on the Drawings.

1. Gravel running surface shall be Crushed Aggregate Surface Course as defined in Specification Section 02200.

2. Drainage features and culverts shall be installed in conformance with Section 02200 – Earthwork and Section 02567 – Corrugated Pipe.

B. Haulage shall be conducted in a manner that does not result in contamination of the temporary haul road, excavation areas, or undisturbed areas.

C. Haulage vehicles shall travel only on clean roads and borrow material shall be stockpiled in clean areas such that it will not be required to decontaminate vehicles between trips from the mine site to the Rhoads Borrow Area.

D. All vehicles and equipment shall be pressure washed prior to use within the Rhoads Borrow Area for noxious weed and contamination control.

3.2 TIMBERING

A. Removal and salvage of merchantable timber shall be conducted by others under a separate contract. CONTRACTOR shall not remove and salvage merchantable timber unless otherwise directed by the ENGINEER in writing.

3.3 UNDISTURBED AREAS

A. A 25-foot buffer at the property boundary shall not be disturbed.

B. CONTRACTOR shall avoid disturbance of the duff layer, topsoil, and natural vegetation in areas not subject to disturbance as shown on the Drawings.

C. A minimum 50-foot buffer on either side of Whitetail Creek shall not be disturbed. The COMPANY shall delineate the buffer zone prior to commencement of the WORK.

D. The temporary haul road shall cross Whitetail Creek at the location shown on the Drawings.

E. Areas with slopes of steeper than 3H:1V shall not be disturbed.

3.4 SEQUENCING

A. The borrow area shall be developed in segments as described in the Rhoads Property Plan of Operations and Reclamation referenced in Paragraph 1.3 and included with the Contract Documents.

3.5 CLEARING AND GRUBBING

A. Clearing shall be limited to the area required for the current segment of excavation.

B. Clearing limits shall be marked by the CONTRACTOR and approved by the ENGINEER prior to starting any clearing and grubbing activity.

C. Construction areas shall be cleared of structures, trees, logs, and any other objectionable material which would interfere with the performance or completion of the WORK or create a hazard to safety. Trees, shrubs, and debris removed during clearing operations shall be stockpiled on Site at locations designated by the Engineer.

D. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove stumps, roots, buried logs, and other objectionable material. Material removed during clearing and grubbing shall be hauled to on-Site stockpile locations designated by the ENGINEER.

E. Trees and other natural vegetation outside clearing limits shall be protected from damage during construction.

F. Burning of cleared and grubbed debris shall not be allowed.

G. Brush and cleared debris shall be chipped is for use as mulch.

3.6 STRIPPING

A. Upon completion of grubbing operations, areas to be affected by construction shall be stripped to a depth of 1.0-feet below the existing ground contours, or as otherwise directed by the ENGINEER. The stripped materials shall be stockpiled at a location designated by the ENGINEER.

3.7 BORROW EXCAVATION

A. Borrow material shall be excavated in phases in accordance with Paragraph 3.4 and shall be hauled to the mine site for use as cover soil.

B. Excavation of borrow material shall progress from areas of higher elevation to areas of lower elevation.

C. A minimum 1-foot thick layer of native soil shall be left in-place over the underlying weathered bedrock.

3.8 RECLAMATION

A. Each segment of borrow area development shall be reclaimed upon completion of excavation, and concurrent with the development of the subsequent segment.

B. A minimum 1-foot layer of residual soil shall be left in place at the bottom of excavations.

C. The excavated surface of each segment shall be ripped to a minimum depth of 1.5 feet, along contour, with a track-mounted dozer equivalent to a Caterpillar D-8 or larger, with a three-toothed ripper.

D. A one-foot layer of salvaged topsoil shall be replaced on the excavated surface and the area shall be graded to blend in with the surrounding terrain.

E. Re-contoured surfaces shall have slopes of 3H:1V or flatter.

F. Revegetation shall be conducted in accordance with Section 02970 – Revegetation.

- END OF SECTION -

SECTION 02120 – ROAD AND STAGING AREA MAINTENENCE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall perform grading and maintenance on existing and new haul roads, staging areas and parking areas throughout construction. This WORK shall include all appurtenant work and equipment including the furnishing and placement of graders, backhoes, compaction equipment, surfacing material, and disposal of excess or waste material, all in accordance with the Contract Documents.

B. CONTRACTOR shall execute the WORK in a manner that does not result in contamination of roads, staging or parking areas that are indicated in the Contract Documents as uncontaminated or "clean."

PART 2 -- PRODUCTS

2.1 ROAD SURFACING

A. Crushed Aggregate Surface Coarse and Crushed Aggregate Base Coarse shall conform to Section 02200 – Earthwork

PART 3 -- EXECUTION

3.1 MAINTENANCE OF ROADS

A. **General:**

1. CONTRACTOR shall maintain temporary roads and parking to continuously provide at the Site access for construction vehicles and trucks, ENGINEER vehicles, deliveries for ENGINEER, emergency vehicles, and parking areas for ENGINEER'S personnel.

2. Public roads shall be passable at all times unless a road closure is allowed in writing by ENGINEER.

3. When temporary roads and parking without hard surfacing become contaminated with soil and create a nuisance, remove contaminated material and replace with clean aggregate as required.

B. Dust resulting from CONTRACTOR'S activities shall be controlled in accordance with Section 01560 – Temporary Environmental Controls.

C. Provide temporary, heavy-duty steel roadway plates to protect existing manholes, handholes, valve boxes, vaults, and similar buried facilities.

3.2 ROAD SUBGRADE REPAIR

A. In areas of temporary construction roads and public roads where the road subgrade has deteriorated, CONTRACTOR shall repair these areas using the materials, methods and compaction requirements per Section 02200 - Earthwork.

3.3 COVER

A. Maintain a minimum of two feet of cover over culverts and buried utilities. Material for the cover shall be as per Section 02200 - Earthwork.

3.4 CUTTING

A. CONTRACTOR shall cut the entire road surface, edge to edge, to a sufficient depth as to remove all superficial potholes and washboards. All cut material shall be windrowed to the center or outside edge of the roadway.

3.5 LAY BACK

A. Windrowed material shall be spread uniformly across both lanes to provide a normal centerline crown. Windrowed material shall not be bladed over the road shoulder into the drainage ditch.

3.6 COMPACTION

A. CONTRACTOR SHALL ensure that road subgrade and surfacing repaired or replaced is evenly graded and compacted. The compaction requirements shall be as per Section 02200 - Earthwork.

3.7 SHAPE

A. The final road cross section shall be as shown on the Drawings.

3.8 SAFETY BERMS

A. Safety berms shall be provided and maintained on the banks of roadways where a drop-off exists of sufficient grade or depth to cause a vehicle to overturn or endanger persons in equipment or as otherwise shown on the Drawings.

B. Safety berms shall be at least mid-axle height of the largest equipment which usually travels the roadway.

C. Safety berms shall be maintained throughout construction.

D. Safety berms shall be replaced when removed by maintenance activities.

E. Safety berm material shall be as indicated on the drawings. Compaction shall be as needed to retain shape and reduce erosion.

3.9 SAFETY BARRIERS AND SIGNAGE

A. Safety barriers must be maintained during construction and not damaged by grading operations. The ENGINEER shall be notified immediately if safety barriers are damaged or otherwise repairs are required.

3.10 CULVERT AND DITCH MAINTENANCE

A. Culvert and ditch maintenance shall be conducted in accordance with the Interim Operations and Maintenance Plan.

B. Culvert and ditch maintenance must only occur when culverts and ditches are dry.

- END OF SECTION -

SECTION 02140 – DEWATERING AND CONTROL OF WATER

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall dewater trench, sump, and structure excavations, and store and treat water as required, in accordance with the Contract Documents. The CONTRACTOR shall secure all necessary permits to complete the requirements of this section of the Specifications, and shall conform to all applicable laws and permit requirements, including but not limited to water quality and erosion regulations.

B. The CONTRACTOR shall design, construct, operate, and maintain River (as defined below) diversions, cofferdams and dewatering systems of sufficient size and capacity to allow construction in the work areas and structure excavations to occur in the dry, in accordance with the Contract Documents. Designs shall accommodate the possibility of highly porous and permeable materials that are expected in a natural River environment.

C. The CONTRACTOR shall design and furnish all materials and construct and maintain all temporary diversions, water quality systems and protective works necessary for diversion and care of water during construction, including but not limited to cofferdams, channels, pipelines, flumes, drains, pumps, sumps and water quality systems. It shall be the CONTRACTOR's responsibility to perform all investigations necessary and to provide designs for dewatering systems which meet the requirements of these Specifications. Any dewatering systems shown in the Drawings are provided to demonstrate possible system concept(s) that meet the construction requirements and environmental protection requirements of the Project that have been conveyed to the agencies for the acquisition of OWNER-furnished Project permits.

D. The CONTRACTOR shall, at a minimum, provide for the protection of fish by executing the work within any fish bearing River as expediently as practical and without delay.

1.2 DEFINITIONS

A. The word "River" in this section shall include Blue Creek, Lake Roosevelt, and all natural streams, creeks and waterways.

1.3 CONTRACTOR SUBMITTALS

A. The submittals indicated below shall conform to Section 01300 – Contractor Submittals.

B. Construction Dewatering Plan

1. The intent of the Construction Dewatering Plan submittal is for the CONTRACTOR to clearly communicate the CONTRACTOR's plan for control of water throughout the entire site, through all activities of the Work, to the OWNER and ENGINEER. The Construction Dewatering Plan shall include sufficient detail to convey that the WORK shall be conducted in such a manner as to ensure the safety of workers and shall be conducted in accordance with the requirements of the permits and Contract Documents.

2. Prior to commencement of any work within or adjacent to the River, dewatering or excavation, the CONTRACTOR shall submit a Construction Dewatering Plan including final detailed plans and operation schedule for dewatering of isolated in-

water work areas and excavations including the care and disposal of the water and sediment. The CONTRACTOR shall be required to demonstrate the system proposed and to verify that adequate equipment, personnel and materials are provided to divert water and dewater the excavations at all required locations and times.

3. The CONTRACTOR's Construction Dewatering Plan is subject to review by the ENGINEER. The CONTRACTOR shall submit the Construction Dewatering Plan at least 30 Days prior to commencement of any excavation or work in the River.

4. The CONTRACTOR shall address each of the following areas individually, in separate sections:

   a. Pit 3 and Pit 4 Dewatering

   b. Effluent Pipeline Installation – Blue Creek

   c. West Pond Excavation

   d. Miscellaneous trench and structure excavation dewatering

5. Construction Dewatering Plan, at a minimum, shall include:

   a. Complete description of construction methods and equipment for in-water work.

   b. Complete descriptions of each water control facility to be installed and the construction and removal techniques.

   c. Descriptions of proposed diversions and groundwater and surface water control facilities including, but not limited to, equipment, methods, standby equipment and power supply, means of measuring discharge due to dewatering, pollution control facilities, discharge locations to be utilized.

   d. Drawings showing locations, dimensions, and relationships of all diversions, water control facilities and elements of each system. Drawings shall reflect all phases of construction and revisions to the system as work progresses.

      1) The CONTRACTOR’S attention is brought to the following: Pit 3 and Pit 4 dewatering requires initial dewatering prior to sediment removal and installation of the underdrain system and dewatering sumps. Subsequent dewatering requires repeated reconfiguration of dewatering piping as waste placement proceeds. Construction Dewatering Plan shall address the required phasing and reconfiguration of these systems.

   e. Design calculations demonstrating adequacy of proposed diversion and dewatering systems and components.

   f. Back-up diversion and dewatering provisions for the event of power or equipment failure.

   g. Summary bar chart type schedule demonstrating the following activities for each dewatering area:

      1) Mobilization

2) Site Preparation

3) Excavation/Installation

4) Construction, use and removal of diversion and water control facilities

5) Restoration/Demobilization

6) In-water work windows

h. Component data and capacities of the hydraulic structures of diversion and water control facilities.

i. Coordination between dewatering areas identified in this Specification section.

j. Fish salvage and protection plan for all dewatered areas.

1.4 QUALITY CONTROL

A. It shall be the sole responsibility of the CONTRACTOR to control the rate and effect of diversions and dewatering in such a manner as to avoid all objectionable settlement and subsidence.

B. All dewatering operations shall be adequate to assure the integrity of the finished Project and shall be the responsibility of the CONTRACTOR.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed diversion and dewatering systems, reference points shall be established and observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which shall protect adjacent structures and facilities rests solely with the CONTRACTOR. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR. As may be needed, the CONTRACTOR shall submit a repair plan, stamped and signed by a licensed Professional Engineer in the State of Washington, for approval by the ENGINEER. The repair shall be monitored by the ENGINEER's or the OWNER's appointed representative. Any such restorations or repairs, including design, review and approval, and monitoring, shall be at the sole expense of the CONTRACTOR.

D. The CONTRACTOR shall take all necessary measures to assure compliance with the water quality standards listed in the Project permits. Concrete preparation and placement activities in dewatered River work areas and in the River shall be carefully carried out and monitored to avoid concrete contamination of surface waters that may result in elevate pH conditions which may harm fish. For instream work areas, the CONTRACTOR shall allow adequate curing time for concrete before area is re-watered in order to avoid pH contamination from not adequately cured concrete.

1.5 RESERVOIR AND CREEK DISCHARGE REQUIREMENTS

A. Control of Reservoir and Stream Flows: The CONTRACTOR shall be responsible for the management and removal of River flows passing through the Work areas, and for general protection of the Work. The CONTRACTOR shall, at its own expense, design and construct temporary facilities to route River flows past the Work site as indicated herein.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. Water diversion and dewatering, where required, may include the use of well points, sump pumps, cofferdams, temporary pipelines for water disposal, rock or gravel placement, and other means.

B. Keep sufficient pumping equipment and machinery on hand at all times for emergencies, including electric power failures.

C. Keep experienced personnel familiar with diversion and dewatering equipment available at all times to operate pumping equipment, machinery, and appliances.

PART 3 -- EXECUTION

3.1 GENERAL REQUIREMENTS

A. The CONTRACTOR shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation in the event of a primary dewatering system failure.

B. Dewatering for structures and pipelines conducted prior to being encountered in any excavation, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this section or other requirements.

C. Where excavations may obstruct the natural flow of a watercourse, implement measures to control and dispose of the surface water that will not adversely affect water quality or beneficial use of the water course. Divert watercourse flows around excavation areas by constructing barriers, cofferdams, sandbags, temporary culverts and pipelines or other appropriate means.

D. Do not allow water containing mud, silt, or other pollutants from aggregate washing or other construction to enter a water course or be placed in locations that may be subjected to high storm flows or spillway releases.

E. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

F. Dewatering shall at all times be conducted in such a manner as to not disturb or reduce the bearing capacity of the subgrade soils or rock at the proposed bottom of excavation.

G. If foundation soil or rock are disturbed or loosened by the seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock.

H. The CONTRACTOR shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance of the work.

I. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous removal of water. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

J. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the CONTRACTOR shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

K. The CONTRACTOR shall dispose of water from the WORK in a suitable manner. CONTRACTOR shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the ENGINEER. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

L. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures and pipelines.

M. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the WORK and all costs thereof shall be included in the various contract unit and lump sum prices in the price bid, unless a separate bid item has been established for dewatering.

N. No equipment shall be allowed to operate below ordinary high water of the River without first diverting the creeks upstream, controlling runoff from the work area and as allowed by permit.

O. Diversion and dewatering facilities shall be removed prior to the start of any winter shut-down or other temporary shutdown of construction activities where they would interfere with natural flow of the River, unless otherwise approved by the ENGINEER. Any facilities not removed, even if allowed by the ENGINEER, shall be at the sole risk of the CONTRACTOR and costs due to damage thereto shall be borne entirely by the CONTRACTOR.

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SECTION 02160 – SEDIMENT AND EROSION CONTROL

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall develop and implement sediment and erosion control program and practices in accordance with the approved Storm Water Pollution Prevention Plan required by Section 01570.

B. Design, construct, maintain, and remove temporary drainage facilities as necessary to control surface water runoff, groundwater seepage, dewatering system discharges, and stream flows at the construction site so that water from these sources does not disturb the constructed facilities, cause erosion of the existing topography, or adversely impact downgradient water.

C. Furnish all materials and labor to construct sediment fences, to place wood fiber wattles, construct rock or log check dams, construct brush barriers, install turf reinforcement mats and erosion control blankets, and other permanent or temporary sediment control methods as detailed in the SWPPP and/or Drawings required for reduction of erosion and protection of water courses.

D. Maintain and remove all temporary sediment and erosion facilities.

1.2 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans.

1. Remedial Action Work Plan

2. Master Stormwater Management Plan

1.3 CONTRACTOR SUBMITTALS

A. Submit the following in conformance with Section 01300 – Contractor Submittals

B. The CONTRACTOR shall prepare and submit a Construction Storm Water Pollution Prevention Plan (CSWPPP) in conformance with Section 01570 – Storm Water Pollution Prevention Plan.

C. Submit manufacturer's product data/ information and weed-free certifications on all materials used to construct sediment and erosion control features.

D. Rolled Erosion Control Products (RECP):

1. The Contractor shall provide the Engineer a certificate stating the name of the RECP manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the geotextile.

2. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.

3. The manufacturer's certificate shall state that the furnished RECP meets MARV requirements of the specification as evaluated under the manufacturer's quality control program. The certificate shall be attested to by a person having legal authority to bind the Manufacturer.

1.4 EROSION CONTROL REQUIREMENTS

A. The CONTRACTOR shall design and implement erosion and sediment control measures for correcting conditions unforeseen during the design of the project, and for emergency situations that develop during construction. Measures and methods proposed by the CONTRACTOR shall be reviewed and approved by the ENGINEER prior to installation.

B. The CONTRACTOR shall incorporate into the project all erosion and sediment control features, as well as spill prevention and containment measures, at the earliest practicable time as outlined in the acceptable schedule.

C. If erosion occurs in completed WORK before permanent reclamation, the CONTRACTOR shall place temporary soil stabilization to stop the erosion. The CONTRACTOR shall not be entitled to additional payment for any temporary soil stabilization.

D. The CONTRACTOR shall continuously maintain all erosion and sediment control measures so that they perform their intended function during construction and WORK suspensions until the project is completed. If the CONTRACTOR fails to maintain the erosion and sediment control features, the ENGINEER/COMPANY may at the expiration of a period of 48 hours, after giving the CONTRACTOR written notice, proceed to maintain the features as deemed necessary. The cost thereof shall be deducted from any compensation due, or which may become due to the CONTRACTOR.

E. Disturbed areas of the construction site in which construction activities will not occur for a period of more than 10 days shall have erosion and sedimentation control measures implemented.

F. Temporary erosion and sediment control measures shall be removed upon completion of the project unless otherwise directed by the ENGINEER or COMPANY. At the completion of the Contract, removed temporary erosion control items shall become the property of the CONTRACTOR.

G. Sediment removed during maintenance of erosion control features shall be disposed of by the CONTRACTOR at a location approved by the ENGINEER or COMPANY.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All products, including those not specifically listed herein, shall be approved by the ENGINEER.

B. Seed, Fertilizer and Mulch: In accordance with Specification Section 02940 - Revegetation.

2.2 SEDIMENT FENCES

A. Sediment fences for sediment control shall consist of fabric and posts suitable for sedimentation control application. Sediment fence fabric shall be UV (ultra-violet)

protected. Posts shall be metal or wood with a minimum length of 3.3-feet. Metal posts shall be “studded tee” or “U” type with a minimum weight of 1.2 lbs. per foot. Wood posts shall have a minimum diameter or cross section dimension of 2 inches. When used, wire mesh reinforcement for filter fabric shall be minimum 14 gauge with a maximum mesh opening of 6 inches.

2.3 ROCK CHECK DAMS

A. Rock check dams shall consist of well-graded rock between 2 inches to 10 inches.

2.4 WOOD FIBER WATTLES

A. Wood fiber products shall be certified as free of noxious weed by the United States Department of Agriculture, Natural Resources Conservation Service, Local Soil and Water Conservative District, Alaska Weed Free Forage Certification Program.

B. Wooden stakes shall have a minimum diameter or cross-section dimension of 2 inches.

C. Straw wattles shall not be used.

2.5 BRUSH BARRIERS

A. Brush barriers shall be constructed of slash and timber from on-site clearing activity. Imported materials shall not be used in brush barrier construction.

2.6 LOG CHECK DAMS

A. Log check dams shall consist of hardwood or other durable wood between 12 inches to 20 inches in diameter.

2.7 EROSION CONTROL BLANKET (ECB)

A. Machine fabricated ECB covered on both sides by netting and sewn together on two inch centers with minimum 840 denier, Ultraviolet (UV) stabilized polypropylene thread.

B. Fiber shall be 100 percent coconut fiber, homogeneously blended and distributed evenly throughout the ECB.

C. Netting shall be UV stabilized polypropylene with mesh openings of approximately 0.625 in by 0.625 in.

D. Minimum Average Roll Values:

Property	**Test Method**	**Units**	**Property Requirement**
Thickness	ASTM D-6525	mm (in)	7.6 (0.30)
Tensile Strength	ASTM D-6818	kN/m (lbs./ft)	2.2 x 2.2 (150 x 150)
Tensile Elongation	ASTM D-6818	percent	25

E. Approved Products:

1. Propex Landlok C2, or equal

2.8 TURF REINFORCEMENT MAT (TRM)

A. Three-dimensional, lofty woven polypropylene geosynthetic specially designed for erosion control applications on steep slopes and vegetated waterways.

B. Matrix composed of monofilament yarns woven into uniform configuration of resilient pyramid-like projections.

C. Material to exhibit very high interlock and reinforcement capacity with both soil and root systems and demonstrate high tensile modulus.

D. Minimum Average Roll Values:

Property	**Test Method**	**Units**	**Property Requirement**
Thickness	ASTM D-6525	mm (in)	10.2 (0.40)
Resiliency	ASTM D-6524	percent	80
Mass Per Unit Area	ASTM D-6566	G/sq m (oz/sy)	457.7 (13.5)
Tensile Strength	ASTM D-6818	kN/m (lbs/ft)	58.4 x 43.8 (4,000 x 3,000)
Tensile Elongation	ASTM D-6818	percent	40 x 35
Light Penetration (% Passing)	ASTM D-6567	percent	15 (max)
UV Resistance	ASTM D-4355	percent	90 at 6000 hrs 85 at 10000 hrs

E. Approved Products:

1. Propex Pyramat, or equal.

F. RECP Ground Anchoring Devices:

1. Length: 200 to 450 mm (8 to 18 inches); sufficient ground penetration to resist pullout. Use longer anchors for loose soils.

2. U-shaped wire staples, metal pins, or triangular wooden stakes.

3. Wire staples: Minimum 8 gauge.

4. Metal pins: Steel, minimum 5 mm (0.20 in) in diameter with 40 mm (1.5 in) steel washer.

PART 3 -- EXECUTION

3.1 GENERAL

A. All BMP's shall be installed in locations indicated on the approved CSWPPP and at additional locations as may be required to comply with the erosion and sediment control requirements of the CSWPPP.

B. Install prescribed BMP's at the locations shown on the Drawings.

3.2 SEDIMENT RETENTION PONDS

A. Install sediment ponds to the lines and grades shown on the Drawings.

3.3 INSTALLING SEDIMENT FENCES

A. Drive posts or stakes vertically into the ground to a minimum depth of 1.6 feet.

B. The height of the reinforced sediment fence from the ground surface shall be a minimum of 2 feet, but shall not exceed 3 feet.

C. Excavate a trench approximately 0.5 feet wide by 1 foot deep along the line of posts or stakes, and upslope from the reinforced sediment fence. The bottom 1 foot of the reinforced sediment fence fabric shall be buried into this trench. Backfill the trench with compacted fill using the excavated materials.

D. Fasten filter fabric securely to metal posts using wire tires, or to wood stakes with 0.8 inches long No. 9 heavy duty staples.

E. Minimize the use of joints.

F. Space stakes or posts a maximum of 10 feet apart.

G. If wire mesh is used, fasten wire mesh support fence securely to the upslope side of the posts using heavy duty wire staples at least 0.8 inches long, tie wires or hog rings. The wire mesh shall extend into the trench a minimum of 2 inches and shall not extend more than 3 feet above the original ground surface.

H. Install the reinforced sediment fence along the toes of fills and along a level contour. Provide area behind the fence for runoff to pond and sediment to settle. Maintain a minimum of 5 feet between the slope toe and the reinforced sediment fence.

I. Sediment shall be removed from behind the reinforced sediment fence when it accumulates to one half the exposed fabric height.

J. Sediment fence shall not be placed perpendicular to concentrated flow.

3.4 INSTALLING ROCK CHECK DAMS

A. Key into the channel bottom a minimum of 24 inches. Base of key trench shall be a minimum of 24 inches.

B. Drainage area shall not be greater than 2.5 ac.

C. Height shall not be greater than 40 inches.

D. Check dams shall be spaced as necessary in the channel so the toe of the downstream dam is 1.5 times the height of the downstream dam below the elevation of the toe of the upstream dam.

E. Place check dams perpendicular to the direction of flow.

3.5 INSTALLING WOOD FIBER WATTLES

A. Entrench and backfill wood fiber wattle. Excavate trench the width of a wattle and the length of the barrier to a minimum depth of 4 inches. Backfill against each wattle with soil excavated from the trench. Backfill soil should match the original ground surface on each side of the wattle.

B. Securely anchor each wattle using wood stakes. Drive stakes a minimum of 1 foot into the ground. Re-bar shall not be allowed for staking bales.

C. Install the wattles at the toe of fills and along level contours.

3.6 INSTALLING LOG CHECK DAMS

A. Key into the channel bottom a minimum of 12 inches. Key into banks 1.5 to 3 feet.

B. Drainage area shall not be greater than 0.5 ac.

C. Height shall not be greater than 40 inches.

D. Check dams shall be spaced as necessary in the channel so the toe of the downstream dam is 1.5 times the height of the downstream dam below the elevation of the toe of the upstream dam.

   1. Place check dams perpendicular to the direction of flow.

3.7 INSTALLING BRUSH BARRIERS

A. Brush shall be windrowed along contour and may require machine compaction (excavator bucket). Stumps may be placed within brush barriers.

3.8 INSTALLING RECP

A. Grade and compact areas to be treated with RECP and compacted as indicated or as directed by Engineer.

B. Remove large rocks, soil clods, vegetation, and other sharp objects that could keep RECP from intimate contact with subgrade.

C. Construct anchor trenches as indicated, or as otherwise required to adequately anchor the RECP for the required application.

D. Install RECP at elevation, alignment, and extents indicated.

E. Extend RECP 2 to 3 feet over crest of slope, secure into trench with anchoring devices, backfill, and compact with specified soil or as directed by Engineer.

F. Unroll RECPs downslope, overlapping adjacent rolls minimum 6 in. Lay material loosely, maintaining direct contact with soil.

G. Secure RECP to slope with ground anchoring devices as follows:

H. Alternate installation methods must be approved by Engineer prior to execution.

3.9 TEMPORARY SEEDING

A. Temporary seeding shall be in compliance with Specification Section 02970 - Revegetation.

B. Within 24 hours of installing a culvert, temporary seed the disturbed area or within a 25-foot radius of the inlet and outlet of the culvert, whichever is greater.

3.10 MMAINTENANCE OF SEDIMENT CONTROL MEASURES

A. The CONTRACTOR shall inspect sediment control measures regularly as defined in the SWPPP. Sediment control measures that are damaged shall be repaired as soon as possible and prior to the next precipitation event. If sediment accumulates in sediment control measures designed to trap sediment then it shall be removed. Removed sediment shall be considered for use as a component of cover soils.

B. In locations where silt fences are used, sediment trapped by the silt fence shall be removed by the CONTRACTOR when one-third of the height of the silt fence is covered by sediment.

C. In locations where sediment retention ponds are used, the CONTRACTOR shall remove sediment buildup in the pond when the sediment has filled 2/3 or more of the pond volume, of if the buildup begins to interfere with the proper drainage of the site. Sediment retention ponds that remain in place at the end of each phase of the WORK shall be excavated to design profile depths and slopes regardless of the volume of sediment collected.

3.11 RREMOVAL OF TEMPORARY FACILITIES

A. Do not remove erosion and sediment control facilities without approval from the ENGINEER.

B. Removed sediment and erosion control materials shall be disposed of in the Waste Containment Area (WCA) at a location designated by the ENGINEER.

C. Remove and dispose the sediments collected in the sediment control systems at a location approved by the ENGINEER or COMPANY.

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SECTION 02200 – EARTHWORK

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall perform the following specific earthwork as indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

B. Fill materials placed outside of the waste containment area (WCA) and as part of the cover system shall be placed in accordance with this section.

C. Excavation of above grade mine waste materials and contaminated soils and sediments, and disposal of these materials within the WCA shall be conducted in accordance with Section 02205 – Mine Waste Excavation and Disposal.

1.2 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Remedial Action Work Plan

2. Staging/Temporary Stockpiling Plan

3. Master Stormwater Management Plan

4. Construction Quality Assurance Plan

5. Analytical Support and Verification Plan

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Washington State DOT Standard Specifications for Road, Bridge, and Municipal Construction (latest edition).

B. ASTM C33 – Standard Specifications for Concrete Aggregates

C. ASTM C117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

D. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

E. ASTM C150 - Standard Specification for Portland Cement

F. ASTM D75 – Standard Practices for Sampling Aggregates.

G. ASTM D422 – Standard Test Method for Particle Size Analysis of Soil.

H. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

I. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes.

J. ASTM D3665 – Standard Practice for Random Sampling of Construction Materials.

K. ASTM D4220 – Standard Practices for Preserving and Transporting Soil Samples.

L. ASTM D4718 – Standard Practice for Correction of Unit Weight and Water Content for Soil Containing Oversize Particles.

M. ASTM D6913 – Standard Test Method for Particle Size Distribution (Gradation) Using Sieve Analysis.

N. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 CONTRACTOR SUBMITTALS

A. Submit in accordance with Section 01300 – Contractor Submittals.

B. Submit CONTRACTOR's Detailed Shoring Plan as follows:

1. The CONTRACTOR, prior to beginning any trench or structure excavation 4 feet deep or deeper, shall submit to the ENGINEER and shall be in receipt of the ENGINEER's written acceptance of the CONTRACTOR's detailed plan showing the design of shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation.

2. If such plan varies from the shoring system standards established by OSHA, such alternative systems plans shall be prepared by a civil or structural engineer licensed in the State of Washington.

3. The ENGINEER’s acceptance of said plan shall be for verification of submittal of the plan with this requirement.

C. Submit product Information for imported and on-site processed materials including pertinent information to evaluate proposed materials for compliance with the specifications such as grain-size distribution, soil classification, durability data, and other pertinent material information.

D. Samples: The CONTRACTOR shall submit samples of materials proposed for the WORK, if requested by the ENGINEER.

E. Blasting Plan: Blasting Plan submittal for rock excavation shall be in accordance with Section 02210 Blasting.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General:

1. Fill materials that shall be placed outside of the WCA and as part of the cover system shall meet the soil cleanup standards set forth below.

Contaminant of Concern	Cleanup Level
Uranium (total)[1]	43 mg/kg
Lead-210	7.5 pCi/g*
Radium-226	4.7 pCi/g

2. Fill and backfill materials and placement locations shall conform to the Drawings.

3. Fill materials that are to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

2.2 DEFINITIONS

A. Suitable Materials:

1. Materials not defined below as unsuitable shall be considered as suitable materials and may be used in fills, backfilling, and embankment construction subject to the indicated requirements. Suitable materials may be obtained from on-Site excavations, or may be processed on-Site materials.

2. Suitable materials may be imported. If imported materials are required by this Section or are required in order to meet the quantity requirements of the WORK, the CONTRACTOR shall provide imported materials as part of the WORK, unless a unit price item is included for imported materials in the Bidding Schedule.

B. Unsuitable materials:

1. Materials that do not meet the soil cleanup standards of Part 2.1 A of this Section.

2. Materials that in the opinion of the ENGINEER 1) exhibit poor strength or durability qualities; 2) are compressible or expansive; 3) are too wet or dry to be placed or compacted properly; 4) are frozen; 5), contain contaminants, organics, debris, or other deleterious materials; 6) are corrosive or react with concrete or steel; or 7) are otherwise not suitable for the intended use of the material. Unsuitable material placed as fill in unapproved areas shall be removed and replaced with suitable material in accordance with these Specifications at the CONTRACTOR's expense.

C. General Fill and Structural Fill

1. General Fill and Structural Fill shall consist of suitable materials with no cobbles or rock larger than six inches, and a maximum of 12% passing the #200 sieve. Fines shall be non-plastic.

D. Attenuation Berm Embankment Fill

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[1] Throughout this document, "uranium" refers the natural (total) form unless an isotopic form (e.g. U-238) is specified.

* Note that Table 8-3 in the Midnite Mine Record of Decision (ROD; EPA, September 2006) lists the units for Lead-210 as pCi/kg. It is assumed that this is a typographical error and the correct units should be pCi/g as stated in Table 8-4.

1. Attenuation Berm Embankment Fill shall be suitable materials with no cobbles or rock larger than six inches and with a minimum percent 20% passing the #200 sieve.

E. Cover Soil

1. Cover Soil shall be materials obtained from the Rhoads Borrow Area; or from excavated soils and waste soils, including sediments removed from erosion control devices, that meet the site cleanup standards in Part 2.1 A of this Section.

2. Cover Soil shall be suitable material and shall meet the following gradation requirements.

Sieve Size	PERCENTAGE PASSING
3-inch	100
1-inch	90-100
No, 4	65-100
No. 40	30-80
No. 200	10-50

F. Crushed Aggregate Base Course

1. Crushed Aggregate Base Course shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

2. Crushed Aggregate Base Course shall be uniformly graded, and shall meet the following gradation requirements.

Sieve Size	PERCENTAGE PASSING
1 1/4-inch	100
1-inch	80 -100
5/8-inch	50 – 80
No. 4	25 – 45
No. 40	3 – 18
No. 200	7.5 max.

G. Crushed Aggregate Surface Course

1. Crushed Aggregate Surface Course shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

2. Crushed Aggregate Surface Course shall be uniformly graded, and shall meet the following gradation requirements:

Sieve Size	PERCENTAGE PASSING
3/4 – inch	100
1/2-inch	80 – 100
No. 4	46 – 66
No. 40	8 – 24
No. 200	10 max.

H. Pea Gravel

1. Pea Gravel shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

2. Pea Gravel shall be uniformly graded, and shall meet the following gradation requirements:

Sieve Size	PERCENTAGE PASSING
½-inch	100
3/8-inch	85 – 100
No. 4	10-30
No. 8	0-10
No. 16	0-15

I. Clean Drain Gravel

1. Clean Drain Gravel shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying.

2. Clean Drain Gravel shall meet the following gradation requirements:

Sieve Size	Percent Passing (by weight)
3 inch	100
1 ½ inch	100
1 inch	0 - 90
¾ inch	0 - 40
½ inch	0 - 20
3/8 inch	0 -10
No. 4	0 – 5
No. 200	0 – 5

J. Pipe Bedding

1. Pipe Bedding shall be suitable material classified per ASTM D2487 as GW, GP, GM SW, SP, GW-GC, or SP-SM, with 100 percent passing the ¾ -inch sieve. Pipe bedding shall have a maximum of 12% passing the #200-seive, and fines shall be non-plastic.

K. Geomembrane Bedding Material

1. Geomembrane bedding material shall consist of suitable materials with a maximum particle size of ¾-inch.

L. Filter Sand

1. Filter Sand shall be imported material conforming to ASTM C33 Standard Specifications for Concrete Aggregates, Fine Aggregate. Filter sand shall not contain any unsuitable material.

2. Filter Sand shall have the following grain-size distribution:

Sieve Size	Percentage Passing
3/8 –inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10

M. Intermediate Filter Sand

1. Intermediate filter sand shall be imported material conforming to ASTM C33 Standard Specifications for Concrete Aggregates, No. 67 Coarse Aggregate.

2. Intermediate filter sand shall have the following grain size distribution:

Sieve Size	Percent Passing (by weight)
1 inch	100
¾ inch	90 – 100
½ inch	20 – 55
3/8 inch	0 – 10
No. 4	0 – 5

N. Rip Rap and Filter

1. Rip Rap and Filter materials shall conform to Section 02273 Rip Rap and the Drawings. These materials shall not contain any unsuitable material.

2.3 SLUSH GROUT

A. Slush Grout – Slush Grout is Portland cement grout used to fill open fractures exposed at the surface of storm water channels excavated in rock

B. Slush grout shall be composed of neat cement Type I grout or cement, sand, and water and shall be approved by the ENGINEER. The ratios of the materials may vary to ensure penetration of the crack or crevice being slush grouted. The ratio of sand to cement shall not exceed two parts sand to one part cement by weight. Adequate water shall be mixed thoroughly into the cement or cement and sand mixes to produce a workable mixture for proper placement as approved by the ENGINEER. The grout mixture shall be prepared by a mechanical mixer and shall be used within 30 minutes after mixing.

C. Cement for slush grout shall be Type II conforming to ASTM C150. A sufficient quantity of cement shall be available at the site to ensure that slush grouting operations will not be delayed by shortage of materials. Cement shall be used in the same sequence that it is received at the work site. Deliver and store cement at a temperature not exceeding 120 degrees F.

D. Sand for slush grout shall conform to ASTM C33 for deleterious substances and soundness requirements and shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
No. 16	100
No. 100	10 – 30
No. 200	0 – 5

E. Water shall conform to the requirements of Section 03300 – Cast-in-Place Concrete.

2.4 MATERIALS TESTING

A. Testing of on-site processed materials and imported materials to verify conformance to specified standards shall be performed by the CONTRACTOR and submitted to the ENGINEER for approval.

B. Soils testing of samples submitted by the CONTRACTOR shall be performed by a testing laboratory approved by the ENGINEER.

C. The ENGINEER may direct the CONTRACTOR to supply samples for testing of any material used in the WORK.

D. Particle size analysis of soils and aggregates shall be performed using ASTM D422.

E. Sample Collection and Handling

1. Samples shall be collected in accordance with ASTM D75.

2. Samples selection shall be conducted in accordance with ASTM D3665.

3. Samples shall be preserved and transported in accordance with ASTM D4220.

2.5 SOIL CLASSIFICATION

A. Soils Classification for all aspects of the WORK, including references in these Specifications and the Drawings to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

B. Rock Classifications for all aspects of the WORK, including references in these Specifications and the Drawings to rock classification types and standards shall have the meanings and definitions indicated in the U.S. Bureau of Reclamation (USBR) Field Manual, unless specifically noted otherwise.

C. The CONTRACTOR shall be bound by applicable provisions of ASTM D 2487 and the U.S. Bureau of Reclamation (USBR) Field Manual in the interpretation of soil and rock classifications.

2.6 DETECTABLE IDENTIFICATION TAPE

A. Unless otherwise indicated, detectable identification tape shall be placed above buried pipelines that are not comprised of magnetic components at least in part. Culverts are exempt from this requirement.

B. Identification tape shall be 6-inches wide, yellow in color, composed of polyethylene, and provided with an integral metallic wire.

C. Tape shall be labeled with CAUTION – BURIED UTILITIES.

PART 3 -- EXECUTION

3.1 SURFACE PREPARATION

A. Clearing, grubbing, and stripping shall be conducted in accordance with Section 02100 – Site Preparation prior to performing any excavation or placing any fill.

B. Surfaces to receive fill materials shall be smooth and firm, free of brush, trees, stumps, and other objectionable material, and shall be brought to the line and grade indicated.

C. Frozen Material

1. Do not place material on surfaces that are muddy, frozen, or contain frost and/or ice.

2. Fill containing any frozen materials shall be considered unsuitable material.

3.2 DRAINAGE

A. Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry.

B. Construct any storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils.

C. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new suitable material as specified herein. It is the responsibility of the CONTRACTOR to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.3 DEWATERING

A. Dewatering shall be conducted in accordance with Specification 02140 – Dewatering and Control of Water.

3.4 TEMPORARY STOCKPILES

A. The CONTRACTOR shall establish their stockpile areas in accordance with Section 01552 – Staging and Stockpile Areas. Stockpile locations and sequencing shall be as show on the Drawings and as described in the Staging//Temporary Stockpiling Plan

B. Inactive stockpiles shall be stabilized in accordance with the Construction Stormwater Pollution Prevention Plan (CSWPPP). Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times.

C. Protect stockpiles of suitable materials from contamination which may destroy the quality and fitness of the stockpiled material.

D. If the CONTRACTOR fails to protect the stockpiles, and any material becomes unsuitable, remove and replace such material with suitable material from approved sources.

E. Removal and Restoration:

1. Permanent stockpiles shall not be allowed.

2. Upon depletion of any stockpile, the area shall be graded to match the surrounding topography. Stockpile areas shall be revegetated in accordance with Section 2970 – Revegetation.

3. Repair or replace drainage paths and other landscaping items affected by temporary stockpiles.

4. All restoration shall be approved by the ENGINEER.

3.5 TOPSOIL STOCKPILE EXCAVATION

A. The existing Southwest, Southeast, Northwest, and Northeast topsoil stockpiles shall be excavated to the limits detailed in the Drawings, or as otherwise directed by the ENGINEER. These materials shall be characterized and temporarily stockpiled at a location defined by the ENGINEER based on the result of characterization. Characterization sampling is the responsibility of the COMPANY and shall be conducted in accordance with the Analytical Support and Verification Plan.

B. If these materials meet soil cleanup levels, they shall be used as soil cover.

C. If these materials do not meet soil cleanup standards, they shall be stockpiled within existing mine waste areas and consolidated in the WCA in accordance with Section 02205.

3.6 GENERAL EXCAVATION

A. General:

1. Perform excavation of every type of material encountered within the limits of the project to the lines, grades, elevations, and tolerances indicated and as specified. Except when specifically provided to the contrary, excavation shall include the removal of materials, including obstructions that would interfere with the proper execution and completion of the WORK.

2. Excavate unsuitable materials encountered within the limits of the Work below grade and replace with Suitable materials as directed. Include such excavated material and the suitable material ordered as replacement in excavation.

3. Excavations shall commence from high to low elevation with a horizontal working surface and an elevated surface at the downhill portion of the active excavation area to retain storm water within the excavation area.

4. Excavate material required for fill, embankment, or cover in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas as designated by the ENGINEER.

B. Ditches and Channels

1. Finish excavation of ditches and channels by cutting accurately to the cross sections, grades, and elevations shown on the Drawings. Do not excavate ditches or channels below grades shown.

2. Backfill any excessive open ditch or channel excavation with thoroughly compacted suitable material to grades shown.

3. Maintain excavations free of leaves, brush, sticks, trash, and other debris until final acceptance of the Work.

C. Over-Excavation:

1. Indicated: Where areas are indicated to be over-excavated, excavation shall be to the depth indicated, and fill shall be installed to the grade indicated.

2. Not Indicated: When ordered to over-excavate areas deeper and/or wider than required by the Contract Documents, the CONTRACTOR shall over-excavate to the dimensions ordered and fill to the indicated grade.

3. Neither Indicated nor Ordered: Any over-excavation carried below the grade that is neither ordered or indicated shall be filled and compacted to the required grade with the indicated material as part of the WORK and at the CONTACTOR'S expense.

D. Rock Excavation

1. Rock excavation shall include removal and stockpiling at an on-site location designated by the ENGINEER of the following items:

   a. Boulders measuring 1/3 of a cubic yard or more in volume;

   b. Rock material in ledges, bedding deposits, and un-stratified masses that cannot be removed using conventional equipment as defined herein and which require systematic drilling and blasting for removal;

   c. Conglomerate deposits or weathered bedrock that are so firmly cemented that they possess the characteristics of solid rock and cannot be removed using conventional equipment as herein defined and require systematic drilling and blasting for removal.

2. Explosives and Blasting: Blasting shall not be permitted at any location other than the Pit 3 and Pit 4 sumps unless authorized in writing by the ENGINEER. Blasting shall be performed in accordance with Section 02210 - Blasting.

E. Exploratory Excavations:

1. The CONTRACTOR shall excavate and expose buried points of connection to existing utilities as indicated on the Drawings.

2. Excavation shall be performed prior to the preparation of Shop Drawings for connections and before the fabrication and installation of the pipe

3. The data obtained from exploratory excavations shall be used in preparing the Shop Drawings.

4. Data, including dates, locations excavated, and dimensioned sketches, shall be submitted to the ENGINEER within one week of excavation.

5. Damage to utilities from excavation activities shall be repaired by the CONTRACTOR at their expense.

3.7 TRENCH EXCAVATION

A. General

1. Excavate the trench as shown on the Drawings.

2. The CONTRACTOR shall furnish, place, and maintain supports and shoring required to maintain stability of all aspects of the excavations.

3. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable state safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR 1926).

4. Below the top of pipe elevation, do not exceed a trench width of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 18 inches inside diameter, and do not exceed 36 inches plus pipe O.D. for sizes larger than 18 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the CONTRACTOR. The CONTRACTOR is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the OWNER.

B. Trenching in Embankments, Fills and Structural Backfills:

1. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

2. Upon completion of the embankment or structural backfill, a trench conforming to the appropriate detail may be excavated and the pipe may be installed.

C. Trench Bottom Preparation:

1. Grade the bottoms of trenches accurately and uniformly to the bottom of Pipe Bedding.

2. Remove particles of 3-inch or greater, unless otherwise specified by the pipe manufacturer, to avoid point bearing.

3. Removal of unsuitable material: Where Unsuitable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to

the proper grade with General Fill. When removal of unsuitable material is required due to the CONTRACTOR's fault or neglect in performing the Work, the CONTRACTOR is responsible for excavating the resulting material and replacing it at the expense of the CONTRACTOR.

D. Open Trenches:

1. The maximum amount of open trench permitted in any one location for the WTP influent/effluent, and groundwater collection pipelines shall be 500 feet or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater.

2. Trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day.

3. These requirements for backfilling or use of steel plate shall be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure; in such cases, however, barricades and warning signs meeting appropriate safety requirements shall be provided and maintained.

E. Trench Shield

1. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield such that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls and causing sloughing or caving of the trench walls.

2. If the trench walls cave or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3. If a moveable trench shield is used during excavation, pipe installation, and fill operations, the shield shall be moved by lifting the shield free of the trench bottom or fill and then moving the shield horizontally.

4. The CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and fill.

3.8 EXCAVATION FOR APPURTENANCES

A. Provide excavation for manholes or similar structures of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or loose debris and cut to a firm surface either level, stepped, or as directed by the ENGINEER. Remove loose disintegrated rock, thin strata, or unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Structures shall be constructed as soon as practical following the completion of excavation.

3.9 EXCAVATION BENEATH STRUCTURES AND EMBANKMENTS:

A. The subgrade areas beneath fills and embankments shall be excavated to remove all deleterious, loose, and otherwise unsuitable material and not less than the top 6 inches

of native material. Where such subgrade is sloped, the native material shall be benched.

B. After the required excavation or over-excavation for fills and embankments has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to -1% to +3% of optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density as determined by the Standard Proctor Test (ASTM D 698).

C. Ensure that foundation and footing subgrades have been inspected and approved by the ENGINEER prior to concrete placement.

D. Notification of ENGINEER:

1. The CONTRACTOR shall notify the ENGINEER at least 3 Days in advance of completion of any structure or roadway excavation and shall allow the ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with fill or with any construction materials.

3.10 SLUSH GROUT

A. Channels excavated in rock shall be slush grouted to seal open fractures as required by the ENGINEER.

B. Care shall be taken to confine slush grout to the fracture being slush grouted. Avoid grout spillage and feather-edging of slush grout.

C. All fractures to be treated shall be thoroughly cleaned of all loose material to a depth of at least six inches by using high-pressure air or water or other methods approved by the ENGINEER and shall be wetted immediately before placement of the slush grout material.

D. Placement of slush grout shall be by pouring, rodding, or funneling into individual cracks, and brooming with a stiff-bristled broom over surfaces containing closely spaced fractures or by other approved methods.

3.11 FILL – ALL TYPES

A. Pre-Placement Conditions

1. Surface preparation beneath structures and embankments shall conform to Part 3.9 of this specification.

2. Except for drain gravel being placed in over-excavated areas or trenches, fill shall be placed after water is removed from the excavation and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

3. Immediately prior to placement of fill materials, the bottoms and sidewalls of trenches and structure excavations shall have any loose, sloughing, or caving soil and rock materials removed.

4. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of fill materials.

B. Placement

1. Fill shall not be dropped directly upon any structure or pipe.

2. Fill shall not be placed around nor upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

3. Fill around water-retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

4. Fill materials shall be placed and spread evenly in horizontal lifts, and shall be mixed as necessary to promote uniformity of material.

5. Unless otherwise indicated, when compaction is achieved using mechanical equipment, the horizontal lifts shall be evenly spread such that when compacted each horizontal lift shall not exceed 12 inches in compacted thickness.

C. Moisture Content

1. Where the fill material moisture content is below the specified moisture content range, water shall be added before or during spreading until the proper moisture content is achieved.

2. Where the fill material moisture content is above the specified moisture content range, the material shall be dried until the proper moisture content is achieved.

3.12 TRENCH BACKFILL

A. General

1. Backfill trenches as approved by the ENGINEER to the grade shown.

2. Replacement of Unyielding Material – Replace unyielding material removed from the bottom of the trench with Pipe Bedding Material.

3. Replacement of Unstable Material – Replace unstable material removed from the bottom of the trench or excavation with Pipe Bedding as directed in lifts not exceeding 6 inches in uncompacted thickness.

4. Immediately prior to placement of fill materials, the bottoms and sidewalls of trenches shall have any loose, sloughing, or caving soil and rock materials removed.

5. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of fill materials.

B. Trench Shield:

1. If a moveable trench shield is used during fill operations, the shield shall be lifted to a location above each layer of fill material prior to compaction of the layer.

C. Definitions

1. Pipe Bedding Zone: The bedding is defined as that portion of the trench between a plane 6-inches below the bottom of the pipe and a plane 12-inches above the top of the pipe.

2. Trench Backfill Zone: The trench backfill zone is defined as fill in the trench cross-sectional area from the top of the bedding zone to final grade, or subgrade.

D. Bedding:

1. Pipe Bedding shall be used for the Bedding Zone backfill.

2. Pipe Bedding shall be compacted to the density specified in Part 3.16 A.

3. The first lift of the embedment zone (below the pipe) shall not exceed 6 inches when compacted to the required density. Each lift shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of achieving the required density in 2 passes and that is acceptable to the ENGINEER.

4. After compacting the initial lift, the CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid shall be continually in contact with the bedding along the extreme bottom of the pipe.

5. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing.

6. The CONTRACTOR shall exercise care in order to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and fill operations.

7. Fill shall be manually spread evenly around the pipe, maintaining the same height on both sides of the pipe such that when compacted, the pipe zone fill shall provide uniform bearing and side support.

8. Fill shall be placed and compacted under the haunch of the pipe and up each side evenly so as not to move the pipe during the placement of the fill.

9. Fill shall be placed in lifts that shall not exceed 6 inches when compacted to the required density. In addition, fill shall be subjected to vibratory compaction at the springline of the pipe and the top of the pipe zone fill.

10. Fill around and over pipelines that is mechanically compacted shall be compacted using light, hand-operated vibratory compactors and rollers that do not damage the pipe.

E. Trench Backfill Zone Fill

1. Backfill trenches with General Fill.

F. Fill the remainder of the trench as designated below:

1. Beneath Roadways/Embankments/Structures: Place General Fill backfill up to the required subgrade elevation as specified. Deposit backfill in lifts of a maximum of 12 inches loose thickness. Do not permit water flooding or jetting methods of compaction. Spread each lift uniformly and moisten or aerate as necessary and compact to the density specified in Part 3.16 A.

2. Open Areas: Place General Fill backfill up to the required subgrade elevation as specified. Deposit backfill in lifts of a maximum of 12 inches loose thickness. Do not permit water flooding or jetting methods of compaction. Spread each lift uniformly

and moisten or aerate as necessary and compact to the density specified in Part 3.15 A.

G. Identification Tape

1. Install identification tape as indicated.

2. Terminate the tape in a precast concrete box either adjacent to or part of the valve box, manhole, vault, or other structure into which the non-metallic pipe enters or at the end of the non-metallic pipeline.

3. The termination box shall be covered with a cast iron lid.

4. The box shall be located at grade in paved areas or 6 inches above grade in unpaved areas.

5. The CONTRACTOR shall not displace the pipe or fill while the shield is being moved.

3.13 GENERAL FILL

A. Fill in open areas shall be placed and spread evenly in horizontal lifts, and shall be mixed as necessary to promote uniformity of material.

B. General Fill shall not be mechanically compacted unless otherwise indicated.

C. Safety Berms: Safety berms shall be constructed as per Section 02120 – Road and Staging Area Maintenance.

3.14 STRUCTURAL FILL

1. Fill for appurtenances, roadways, and structures shall be placed and spread evenly in horizontal lifts, and shall be mixed as necessary to promote uniformity of material, with each lift moistened and aerated as necessary.

2. Unless otherwise approved by the ENGINEER, no lifts shall exceed 12 inches of compacted thickness.

B. Structural Fill shall be compacted to the density specified in Part 3.16 A.

1. Flooding, ponding, and jetting shall not be used for fill around structures, for final fill materials, or aggregate base materials.

C. Backfill for Appurtenances

1. After the manhole, inlet, outlet or similar structure has been constructed and the concrete has been allowed to cure in accordance with Section 03000 – Cast-in-Place Concrete, place, backfill in such a manner that the structure is not damaged by the shock of falling earth. Deposit the backfill material, compact it as specified, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

D. Heavy Equipment:

1. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the vertical depth of the fill above undisturbed soil at that time.

2. Hand-operated power compaction equipment shall be used where the use of heavier equipment is impractical or restricted due to weight limitations.

3.15 EMBANKMENT FILL

A. West Pond Embankment

1. West Pond Embankment shall be constructed with Structural Fill.

2. Place the material in successive horizontal lifts of loose material not more than 12 inches in depth. Spread each lift uniformly on a soil surface that has been moistened or aerated as necessary. After spreading moisten or aerate as necessary to achieve the compaction specified in Part 3.16 A.

B. Attenuation Berms

1. Attenuation Berms shall be constructed with Attenuation Berm Embankment Fill as defined in Paragraph 2.2 D of this Section. Place the material in successive horizontal lifts of loose material not more than 12 inches in depth. Spread each lift uniformly on a soil surface that has been moistened or aerated as necessary. After spreading moisten or aerate as necessary to achieve the compaction specified in Part 3.16 A.

C. Miscellaneous

1. When an embankment is to be constructed and compacted against hillsides or fill slopes steeper than 4:1, the slopes of the hillsides or fills shall be horizontally benched in order to key the embankment to the underlying ground.

2. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

3.16 COMPACTION REQUIREMENTS

A. The following compaction requirements shall be in accordance with the Standard Proctor test (ASTM D 698). If more than 5% of the material is larger than ¾-inch in size, an oversize correction shall be applied in accordance with ASTM D4718.

TRENCHES	% of Maximum Dry Density	% Optimum Moisture
Pipe Bedding Zone	90	+/- 2%
Trench Backfill Zone: Beneath Roads/Structures/Embankments	95	+/- 2%
Trench Backfill Zone: Open Areas	90	+/- 2%

FILL/BACKFILL	% of Maximum	% Optimum

	Dry Density	Moisture
General Fill	No mechanical compaction unless otherwise indicated	
Structural Fill	95	+/- 2%
Safety Berms	Compact with bucket tamping or other methods to retain shape and reduce erosion	

EMBANKMENTS	% of Maximum Dry Density	% Optimum Moisture
West Pond Embankment	95	-1% to +3%
Attenuation Berms	95	-1% to +3%

B. Equipment that is capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is within the specified moisture content range.

3.17 TEST FILLS

A. Method specifications for compaction of rock fill or materials that contain more than 30% by weight material greater than ¾-inch in size may be used when authorized in writing by the ENGINEER.

B. A test fill shall be used to define appropriate placement procedures including :

1. Lift thickness

2. Compaction equipment type

3. Number of passes

4. Moisture conditioning

C. Test Fills shall be conducted in the presence of the ENGINEER.

3.18 COVER PLACEMENT

A. Cover shall be placed on mine waste containment areas and graded mine waste areas as shown on the Drawings.

B. Grading control shall be achieved with the use of GPS guided equipment.

C. Any equipment that contacts mine waste shall be decontaminated before contacting cover material.

D. Placement

1. Cover Soil shall be placed in one or more lifts, with the initial lift a minimum of 18 inches thick.

2. Placement and spreading shall be performed with a low ground pressure bulldozer and compaction of material shall be minimal.

3. Soil cover placement shall commence in an upslope or cross-slope direction when placement is occurring over the geomembrane cover.

4. Cover material shall be placed in a manner that prevents damage to the geomembrane cover.

5. Compaction effort should be limited to the compaction resulting from incidental passes by the tracked equipment used to place the material. No compactive effort is required or recommended by the use of vibratory or sheepsfoot compactors.

E. Finishing and Plantings

1. Finishing and planting shall conform to Section 02970 Revegetation.

2. Finished surface shall be graded with a uniform surface to the slopes and grades shown on the drawings.

3.19 FIELD TESTING

A. Field testing shall be performed by the COMPANY or a COMPANY-retained testing laboratory.

B. When test results indicate that compaction is not as specified, remove the material, replace and recompact the tested material to meet Specification requirements. Tests shall be performed on recompacted areas to determine conformance with Specification requirements.

C. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

1. Gradation:

a. Gradation of fill and backfill material determined in accordance with ASTM C117, ASTM C136, or ASTM D6913 as appropriate for the material being tested.

b. Frequency:

2. **Pipe Bedding**: One tests per 2,500 cubic yards of stockpiled or in-place source material, or, in the determination of the ENGINEER, as source materials change.

a. General **Fill**: One test per 5,000 cubic yards of stockpiled or in-place source material, or, in the determination of the ENGINEER, as source materials change.

b. **Structural Fill**:

1) <u>Roads, Appurtenances, Miscellaneous Uses</u>: One test per 2,500 cubic yards of stockpiled or in-place source material, or, in the determination of the ENGINEER, as source materials change.

2) <u>West Pond Embankment</u>: One test per 5,000 cubic yards of material placed, or, in the determination of the ENGINEER, as source materials change.

c. **Attenuation Embankment Fill**: One test per 5,000 cubic yards of material placed, or, in the determination of the ENGINEER, as source materials change.

d. **Cover Soil**: One test per 10,000 cubic yards of material placed, or, in the determination of the ENGINEER, as source materials change.

3. Density:

a. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content shall be determined in accordance with the Standard Proctor test (ASTM D 698).

b. Field density in-place tests shall be performed with the nuclear density gauge method (ASTM D 6938), or by such other means acceptable to the ENGINEER.

c. Frequency:

1) **Trench Fill**: One test per 150 linear feet, or fraction thereof, of each lift of trench fill (all types).

2) **Structural Fill**:

a) One test per 2,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines. A minimum of two tests should be performed on fill or backfill that will support a structure.

b) One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines and backfill around appurtenances.

c) One test per 150 linear feet, or fraction thereof, of each lift of structural fill beneath roadways.

3) Embankments

a) West Pond Embankment: One test per 13,500 square feet, or fraction thereof, of each lift of fill.

b) Attenuation Embankments: One test per 13,500 square feet, or fraction thereof, of each lift of fill.

4. Optimum Moisture and Laboratory Maximum Density

a. Tests for each type material or source of material including borrow material shall be performed to determine the optimum moisture and laboratory maximum density values. One representative test may be performed per material used of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

D. CONTRACTOR's Responsibilities:

1. The CONTRACTOR shall provide test trenches and excavations, including excavation, trench support and groundwater removal for the COMPANY's field soils testing operations.

2. The trenches and excavations shall be provided at the locations and to the depths as required by the COMPANY.

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SECTION 02205 – MINE WASTE EXCAVATION AND DISPOSAL

PART 1 -- GENERAL

1.1 SUMMARY

A. The WORK under this Section includes excavation of above grade mine waste materials and contaminated soils and sediments, and disposal of these materials in the waste containment area (WCA).

B. Other mine waste materials associated with the WORK including demolition debris, waste and debris from historical mining operations, cleared vegetation from areas subject to excavation of contaminated soils and sediments, and CONTRACTOR generated waste that cannot be decontaminated, shall be classified and disposed of in accordance with this section.

C. Mine waste materials that shall be regraded and disposed of in place are also addressed by this section.

1.2 REFERENCE REMEDIAL ACTION WORK PLANS

A. The work under this section shall be conducted in substantial compliance with the following work plans included as part of the Contract Documents in accordance with Section 01015 – Remedial Action Work Plans:

1. Remedial Action Work Plan

2. Staging/Temporary Stockpiling Plan

3. Master Stormwater Management Plan

4. Construction Quality Assurance Plan

5. Analytical Support and Verification Plan

a. The CONTRACTOR's attention is brought to the sampling and verification procedures and sequencing contained in the Analytical Support and Verification Plan. Areas subject to excavation of contaminated soil and sediments will require verification and final cleanup. CONTRACTOR shall coordinate the WORK with these requirements and shall execute the WORK in a manner that does not re-contaminate areas that have been verified as clean.

1.3 REFERENCE STANDARDS

A. ASTM C33 – Standard Specifications for Concrete Aggregates

B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

C. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

D. ASTM D6913 – Standard Test Method for Particle Size Distribution (Gradation) Using Sieve Analysis.

1.4 DISPOSAL OF NON-MINE WASTE MATERIALS

A. Cleared vegetation from areas not subject to excavation of contaminated soils and sediments shall be disposed of in accordance with Section 02100 - Site Preparation

B. Contractor generated waste materials shall be disposed of in accordance with Section 01560 – Temporary Environmental Controls.

1.5 CLASSIFICATION OF MINE WASTE MATERIALS

A. Mine Waste Materials shall include those materials which are excavated from the designed excavations at the site which are not suitable for use in construction; contaminated soils and sediments; sediments removed from erosion control devices; demolition debris; and other construction debris.

B. Mine Waste Materials include cleared vegetation from areas subject to excavation of contaminated soil and sediments.

C. Materials to be disposed of shall be classified as Low Activity Waste/Low Reactivity Waste or Unclassified Waste as defined below:

1. **Low Activity Waste/Low Reactivity Waste**: Low Activity/Low Reactivity Waste includes excavated mine waste materials from the following locations:

a.	Hillside Waste Rock Pile	b.	East Waste Rock Pile
c.	South Waste Rock Pile	d.	Pit 4 Overburden Pile
e.	Central Drainage Sediments	f.	Western Drainage Sediments
g.	Eastern Drainage Sediments	h.	Impacted Foundation Sediments
i.	Access Road Cleanup	j.	South Pond Excavation

2. **Unclassified Waste**

a. Unclassified waste includes higher activity mine wastes excavated from the following locations:

a.	Protore Stockpile 1	b.	Protore Stockpile 2
c.	Ore Stockpile 3	d.	Ore Stockpile 4
e.	Ore & Protore Stockpile 5	f.	Ore & Protore Stockpile 6
g.	Ore Stockpile 7	h.	Lime Protore Stockpile 8
i.	Pit 4 Bottom Sediments	j.	Pit 3 Bottom Sediments
k.	Pit 4 Rockfall/Grading Spoils	l.	Pit 3 Rockfall/Grading Spoils
m.	Adit Pit Waste	n.	PCP Spoils

b. Cleared vegetation from areas subject to excavation of contaminated soils and sediments.

c. Unclassified waste includes demolition and construction debris waste materials including, but not limited to, demolished concrete, reinforcing steel, power poles, demolished pipe, miscellaneous metalwork, refuse, and debris.

1.6 SUBMITTALS

A. Submit in accordance with Section 01300 – Contractor Submittals.

B. Submit CONTRACTOR's Rock Fall Protection Plan as follows:

1. The CONTRACTOR, prior to beginning operations within Pit 3 or Pit 4, shall submit to the ENGINEER, and shall be in receipt of the ENGINEER's written acceptance of, the CONTRACTOR's detailed plan showing the design of provisions for worker protection against the hazard of rock fall.

2. The ENGINEER’s acceptance of said plan shall be for verification of submittal of the plan with this requirement.

C. Submit CONTRACTOR's Detailed Shoring Plan for trench or structure excavations deeper than 4 feet in accordance with Section 02200 Earthwork.

D. Submit CONTRACTOR's Blasting Plan in accordance with Section 02210 Blasting.

E. Submit product Information for imported and on-site processed materials including pertinent information to evaluate proposed materials for compliance with the specifications such as grain-size distribution, soil classification, durability data, and other pertinent material information.

F. Samples: The CONTRACTOR shall submit samples of materials proposed for the WORK, if requested by the ENGINEER.

G. Submit CONTRACTOR proposed procedures for installation of settlement monitoring monuments for ENGINEER review and approval. Installation procedures shall be protective of the underlying geosynthetic liner system and minimize cover material compaction.

PART 2 -- PRODUCTS

2.1 HSWRP PROCESSED MATERIALS

A. General

1. Drain Rock, Drain Gravel and Liner Bedding Material used in underdrain construction shall be obtained by on-site processing of material from the Hillside Waste Rock Pile (HSWRP). HSWRP materials shall be processed by the CONTRACTOR at the location shown in the Drawings.

2. The materials defined in this section shall not be used outside the WCA.

3. Materials shall be screened and/or crushed, sand and gravel; free of shale, clay, friable material and debris

B. Drain Rock

1. Drain Rock shall meet the following gradation requirements:

Sieve Size	Percent Passing (by weight)
6 inch	100
2 inch	0 – 5
No. 200	0 -3

C. Drain Gravel:

1. Drain Gravel shall meet the following gradation requirements:

Sieve Size	Percent Passing (by weight)
3 inch	100
1 ½ inch	100
1 inch	0 - 90
¾ inch	0 - 40
½ inch	0 - 20
3/8 inch	0 -10
No. 4	0 – 5
No. 200	0 – 5

D. Liner Bedding

1. Liner Bedding shall meet the following gradation requirements:

Sieve Size	Percentage Passing
1 1/2-inch	100
1 inch	90 – 100
3/4 inch	40 – 85
1/2 inch	10 – 40
3/8 inch	0 – 15
No. 4	0 – 5

2.2 OVERLINER PROTECTION

A. Overliner Protection material shall be minus ¼-inch in size and shall be obtained from processing of materials from on-site excavations, borrow areas, or shall be imported.

B. Material from on-site excavations shall be classified as Low Reactivity mine waste, or shall meet the soil cleanup standards listed in Section 02200; Part 2.1 A.

2.3 IMPORTED MATERIALS

A. Filter sand and intermediate filter sand shall be imported materials.

B. Drain Sand

1. Filter sand shall be imported material conforming to ASTM C33 Standard Specifications for Concrete Aggregates, Fine Aggregate.

2. Fine filter sand shall have the following grain-size distribution:

Sieve Size	Percentage Passing

3/8 –inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10

C. Intermediate Filter Sand

1. Intermediate filter sand shall be imported material conforming to ASTM C33 Standard Specifications for Concrete Aggregates, No. 67 Coarse Aggregate.

2. Intermediate filter sand shall have the following grain size distribution:

Sieve Size	Percent Passing (by weight)
1 inch	100
¾ inch	90 – 100
½ inch	20 – 55
3/8 inch	0 – 10
No. 4	0 – 5

2.4 DEWATERING RISERS

A. Stainless steel risers shall be threaded, 12-inch, SCH 40 SS Type 304, solid well casing. Pipe lengths shall be 10-ft. Perforations shall be as shown on the Drawings. End treatments shall be as shown on the Drawings.

B. Friction sleeve risers shall be threaded 16-inch, Sch 20, low carbon steel, solid well casing. Pipe lengths shall be 10-ft.

C. Centralizers shall be stainless steel.

D. Friction sleeve liner material shall be 60-mil smooth HDPE geomembrane.

E. Well casing geonet material shall be HDPE with a minimum thickness of 175-mil.

2.5 SETTLEMENT MONITORING MONUMENT

A. Settlement monitoring monuments shall be fabricated by the CONTRACTOR as shown on the Drawings.

2.6 MATERIALS TESTING

A. Testing of on-site processed materials and imported materials to verify conformance to specified standards shall be performed by the CONTRACTOR and submitted to the ENGINEER for approval in accordance with Paragraph 1.6 E

PART 3 -- EXECUTION

3.1 GENERAL

A. Excavated waste soils, including sediments removed from erosion control devices, shall first be considered for use as a component soil in the development of cover if they meet soil cleanup standards defined in Section 02200; Part 2.1 A.

B. The CONTRACTOR shall execute the WORK in a manner that does not result in the re-contamination of areas already remediated or contamination of areas that were previously uncontaminated. Areas where mine wastes have been remediated shall be barricaded, flagged, or otherwise marked as needed to prevent re-contamination from construction traffic.

3.2 WASTE REGRADING

A. Waste rock in the following areas shall be graded to the lines and grades shown in the Drawings to achieve a mounded, free-draining surface:

1. Pit 4 North

2. Area 5

3. Backfilled Pit Area (BPA)

B. Excess material generated from grading shall be disposed of in the WCA.

3.3 MINE WASTE EXCAVATION

A. Above-Grade Mine Wastes include wastes that are piled above the pre-mining topographic surface.

B. Excavation of Above-Grade Mine Waste shall be conducted in phases as shown in the Drawings.

C. Above-Grade Mine Wastes to be excavated as part of Phase 1 include:

1. Pit 4 Ridge grading as shown on the Drawings.
2. Hillside Waste Rock Pile (HSWRP) shall initially be excavated as required to provide material as needed to produce Pit 4 drain material and liner bedding material.
3. Pit 4 Overburden Pile shall be excavated to the native ground contact.
4. Excess material generated during Pit 4 North regrading.
5. Ore/Protore Stockpiles shall be excavated to the native ground contact.
6. The South Waste Rock Pile in the vicinity of the South Pond shall be excavated to provide a level bench as indicated in the Drawings.
7. The uphill portion of the South Waste Rock Pile material located in the Western Drainage, including waste material in Pit 2 and the Adit Pit, shall be excavated to the native ground contact.

8. Other miscellaneous waste piles.

D. Above-Grade Mine Wastes to be excavated as part of Phase 2 include:

1. Pit 3 Ridge grading as shown on the Drawings.
2. Remaining HSWRP material shall be excavated to the native ground contact.
3. Remaining South Waste Rock Pile material in the Western Drainage shall be excavated to the native ground contact.
4. The East Waste Rock Pile shall be excavated to the to the native ground contact.

E. Above-Grade Mine Wastes to be excavated as part of Phase 3 include:

1. Removal of the South Pond.
2. Remaining South Waste Rock Pile material in the Central Drainage shall be excavated to the native ground contact.

F. To the extent practicable, excavated materials shall be direct loaded into haul vehicles, transported, and placed within the mine waste containment areas without stockpiling. When direct haul is not practical, excavated materials shall be temporarily stockpiled at approved locations for impacted soils as shown on the Drawings or as defined by the ENGINEER prior to placement within the mine waste containment areas.

G. Verification of native soils underlying mine waste shall be conducted by the COMPANY. Excavation of native soils shall be conducted according to Paragraph 3.3 of this section.

H. Areas cleared of above-ground mine waste and meeting soil cleanup standards as defined in Section 02200; Part 2.1 A shall be graded to conform to the surrounding topography as shown in the Drawings.

I. Once an area has been excavated to the satisfaction of the ENGINEER, the CONTRACTOR shall barricade or otherwise delineate the area as closed to further activity while verification surveys are conducted by the COMPANY. Activity within these areas shall only be conducted upon the authorization of the ENGINEER.

J. CONTRACTOR shall execute the WORK in a manner that does not result in re-contamination of areas that have been verified as clean. Any area that is re-contaminated due to CONTRACTOR activities will require excavation of contaminated materials and additional verification. The cost of excavation and verification of re-contaminated areas shall be borne by the CONTRACTOR.

3.4 CONTAMINATED SOIL AND SEDIMENT EXCAVATION

A. Contaminated soil and sediment excavation shall be conducted in Phases as shown on the Drawings.

B. To the extent possible, excavation of sediments in the drainages shall only occur during the summer and early autumn in order to avoid flowing water.

C. The actual extent of soil contamination shall be determined during the WORK. In each area of known contaminated soil or sediment, the depth of excavation shall be as directed by the ENGINEER or his designee.

D. To the extent practicable, excavated materials shall be direct loaded into haul vehicles, transported, and placed within the mine waste containment areas without stockpiling. When direct haul is not practical, excavated materials shall be stockpiled at approved locations for impacted soils as shown on the Drawings or as defined by the ENGINEER prior to placement within the mine waste containment areas.

E. Once an area has been excavated to the satisfaction of the ENGINEER, the CONTRACTOR shall barricade or otherwise delineate the area as closed to further activity while verification surveys are conducted by the COMPANY. Activity within these areas shall only be conducted upon the authorization of the ENGINEER.

F. CONTRACTOR shall execute the WORK in a manner that does not result in re-contamination of areas that have been verified as clean. Any area that is re-contaminated due to CONTRACTOR activities will require excavation of contaminated materials and additional verification. The cost of excavation and verification of re-contaminated areas shall be borne by the CONTRACTOR.

G. Areas verified as clean shall be regraded to mimic native slopes and revegetated. Revegetation shall conform to Section 02970 – Revegetation.

3.5 WASTE CONTAINMENT AREAS

A. Waste Containment Areas (WCAs) shall be constructed in Pit 4 and Pit 3 in Phases as shown in the Drawings.

B. Pits shall be dewatered by the CONTRACTOR prior to commencement of pit bottom cleanup. Dewatering shall be conducted in accordance with Section 02140 – Dewatering and Control of Water.

C. **Pit-Bottom Cleanup and Grading**: Upon completion of pit dewatering, sediments and coarse rock material that have accumulated in the pit bottom shall be removed.

1. Prior to excavation, the pit bottom sediments shall be dried by natural evaporation or by adding drying agents. Drying agents and proposed application shall be submitted to the ENGINEER for approval prior to use.

2. Fine-grained sediments remaining after bulk cleanup shall be removed by hydraulic methods. Final cleanup up methods and sediment dewatering methods shall be proposed by the CONTRACTOR for acceptance by the ENGINEER.

3. Material removed during pit-bottom cleanup shall be stockpiled at a temporary location designated by the ENGINEER for replacement in the pit.

4. Upon completion of cleanup, the pit bottom shall be graded to allow water to flow under gravity to an underdrain sump. Areas that do not flow under gravity toward the underdrain sump shall be reworked to the extent practicable without ripping, drilling or blasting.

D. **Underdrain System**: This system collects groundwater before it contacts reactive mine waste disposed of in the pit.

1. Drain Gravel, and Liner-Bedding layers shall be placed in the locations and to the elevations presented in the Drawings.

2. <u>Drain Gravel Placement</u>: Drain Gravel shall be hauled, dumped and spread in uniform horizontal lifts with a thickness that does not result in segregation. No additional compaction of the Drain Gravel is required beyond that which results from spreading and incidental traffic over the waste surface by construction equipment. The final surface of the drain gravel shall be smooth and uniform and shall be approved by the ENGINEER prior to placement of Liner Bedding.

3. Liner Bedding Placement: Liner Bedding shall be hauled, dumped and spread in a single, uniform, horizontal lift with a nominal thickness of 1 foot. No additional compaction of the Liner Bedding is required beyond that which results from spreading and incidental traffic over the waste surface by construction equipment. The Liner Bedding surface shall provide a firm, unyielding foundation for the membrane with no sudden, sharp, or abrupt changes or break in grade. The Liner Bedding surface shall be approved by the ENGINEER prior to placement of the liner system.

4. Underdrain Sump:

    a. An underdrain sump shall be constructed at the location shown in the Drawings. Blasting for rock excavation within the sump shall be in accordance with Section 02210 – Blasting.

    b. Drain Rock for the sump shall be handled, dumped or spread into place in a manner that does not result in segregation and so as to secure a stone mass of the dimensions shown in the drawings.

5. Dewatering Risers: Dewatering risers shall be installed within the sump as shown on the Drawings.

    a. Risers shall be shored and backfilled in a manner that maintains a vertical position and does not result in damage to the pipe. Backfill immediately adjacent to the riser pipes shall be placed in one-foot nominal lifts and compacted with hand operated equipment. Dozer placement of backfill shall not be allowed within 5-feet of riser pipes.

    b. Friction sleeves shall be installed as shown on the Drawings. The ENGINEER shall inspect and approve riser pipe and friction sleeve placement prior to backfilling each segment of pipe.

6. Sub-Waste Liner System: Following placement of Liner Bedding, a sub-waste liner system shall be installed as indicated in the Drawings. The liner cushion shall be installed and in accordance with Section 02274 - Geotextiles. The geomembrane shall be installed in accordance with Section 02272 – Geomembranes.

7. Overliner Protection: Following placement of the sub-waste liner, an Overliner Protection layer with a minimum thickness of 3 feet shall be placed in the locations and to the elevations shown in the Drawings.

    a. Overliner Protection shall be placed in one or more lifts, with the initial lift a minimum of 18 inches thick.

    b. Placement and spreading shall be performed with a low ground pressure bulldozer and compaction of material shall be minimal.

    c. Overliner Protection material shall be placed in a manner that prevents damage to the geomembrane liner.

    d. Compaction effort should be limited to the compaction resulting from passes by the tracked equipment used to place the material. No compactive effort is required or recommended by the use of vibratory or sheepsfoot compactors.

8. **Alternate to Overliner Protection Layer**: CONTRACTOR may replace the overliner protection layer with another liner cushion layer and a 3-foot lift of Liner Bedding at its option.

E. **Pit 4 Infiltration Collectors**: Infiltration collectors are lined channels constructed within native ground to collect water that may infiltrate through the mine waste during construction.

1. Seep collector channels shall be constructed accurately to the cross sections and locations shown on the Drawings.

2. A geosynthetic clay liner (GCL) shall be placed on the bottom and downslope side of the channel subgrade, as shown on the Drawings. GCL placement shall be in accordance with Section 02780 – Geosynthetic Clay Liner.

3. Drain Gravel shall be placed in the channel in a single, uniform lift with a nominal thickness of 1 foot. The drain gravel layer shall be shaped to conform to the cross-sections shown on the Drawings.

F. **Pit 3 Slope Drains:** Slope drains collect water from seeps in the Pit 3 walls.

1. Slope drains for collection of seeps shall be installed in the areas indicated and as shown in the Drawings.

2. Fine grained waste materials shall not be placed in contact with slope drains.

G. **Waste Dewatering Sump**: The dewatering sump collects water that infiltrates through the mine waste during construction.

1. The dewatering sump shall be constructed at the location shown in the Drawings.

2. Drain Gravel, Intermediate Filter, and Filter Sand layers shall be placed in the locations and to the elevations presented in the Drawings.

3. <u>Drain Gravel Placement</u>: Drain Gravel shall be hauled, dumped and spread in uniform horizontal lifts with a thickness that does not result in segregation. No additional compaction of the drain gravel is required beyond that which results from spreading and incidental traffic over the waste surface by construction equipment. The final surface of the drain gravel shall be smooth and uniform and shall be approved by the ENGINEER prior to placement of intermediate filter sand.

4. <u>Intermediate Filter Placement</u>: Intermediate Filter shall be placed and spread evenly and shall be mixed as necessary to promote uniformity of material, with each lift moistened and aerated as necessary. Intermediate Filter shall be placed in a single uniform lift with a nominal compacted thickness of 18-inches and compacted by means of at least 2 passes from a smooth drum vibratory compactor that is capable of obtaining the required density. Compaction shall be 95% of Standard Proctor density at plus or minus 2% of Standard Proctor optimum moisture content (ASTM D 698). The final surface of the intermediate filter shall be smooth and uniform and shall be approved by the ENGINEER prior to placement of filter sand.

5. <u>Filter Sand Placement</u>: Filter sand shall be placed and spread evenly and shall be mixed as necessary to promote uniformity of material, with each lift moistened and aerated as necessary. Filter Sand shall be placed in a single uniform lift with a nominal compacted thickness of 18-inches and compacted by means of at least 2 passes from a smooth drum vibratory compactor that is capable of obtaining the

required density. Compaction shall be 95% of Standard Proctor density at plus or minus 2% of Standard Proctor optimum moisture content (ASTM D 698). The final surface of the filter sand shall be smooth and uniform.

6. Dewatering Risers: Dewatering risers shall be installed within the sump as shown on the Drawings.

   a. Risers shall be shored and backfilled in a manner that maintains a vertical position and does not result in damage to the pipe. Backfill immediately adjacent to the riser pipes shall be placed in one-foot nominal lifts and compacted with hand operated equipment. Dozer placement of backfill shall not be allowed within 5-feet of riser pipes.

   b. Friction sleeves shall be installed as shown on the Drawings. The ENGINEER shall inspect and approve riser pipe and friction sleeve placement prior to backfilling each segment of pipe.

3.6 MINE WASTE PLACEMENT:

A. Mine waste shall be placed according to its classification and to the lines and grades shown in the Drawings.

   1. Only Low Activity/Low Reactivity Waste shall be placed over the sub-waste liner and the side of the pit to a minimum thickness of 20 feet as shown on the Drawings. Unclassified Waste shall not be placed within 20 vertical feet of the sub-waste liner or the pit walls.

   2. Only Low Activity/Low Reactivity Waste shall be placed within 20 vertical feet of the pit cover system as shown on the Drawings. Unclassified Waste shall not be placed within 20 vertical feet of the sub-waste liner or the pit walls.

   3. Excess Low Activity/Low Reactivity Waste may be placed as Unclassified Waste.

B. Wastes shall be hauled, dumped and spread in uniform horizontal lifts with a maximum thickness of 10 feet, except horizontal lifts shall be 2 feet when backfilling demolition waste.

C. No additional compaction of the waste materials is required beyond that which results from spreading and incidental traffic over the waste surface by construction equipment.

D. PHASE 1 Mine waste placed in Pit 4 shall include:

   1. Reject material from HSWRP

   2. Pit 4 Overburden Pile material

   3. Pit 4 North material

   4. Ore and Protore material

   5. Sediments from cleanup of Pit 4 bottom

   6. Pit 4 rockfall debris and pit-bottom grading spoils

   7. South Pond grading and excavation spoils

8. Other South Waste Rock Pile excavation material

E. PHASE 2 Mine waste placed in Pit 3 shall include:

1. Debris from South Pond demolition
2. Pit 3 rockfall debris and pit-bottom grading spoils
3. Sediments from cleanup of Pit 3 bottom
4. Remainder of South Dump material from the Western Drainage
5. Contaminated soil from the Western Drainage cleanup
6. Sediment from Western Drainage cleanup
7. Material from West Access Road cleanup
8. Demolition debris from existing WTP and other structures
9. Materials from East Waste Rock Pile
10. Contaminated soil from East Waste Rock Pile area cleanup
11. Sediment from Eastern and Far East Drainage cleanup
12. Material from East Access Road cleanup
13. Material from other internal mine road and contaminated soil cleanup

F. PHASE 3 Mine waste placed in Pit 3 shall include:

1. Debris from South Pond demolition
2. Remainder of South Waste Rock Pile material and PCP in Central Drainage
3. Material from Central Drainage cleanup
4. Material from other contaminated soil cleanup

3.7 COVER SYSTEM PLACEMENT:

A. Cover System placement for mine waste containment areas and regraded areas shall be in accordance with the following sections:

1. Section 02200 – Earthwork
2. Section 02272 –Geomembranes
3. Section 02280 – Geocomposite Drainage Layers

3.8 SETTLEMENT MONITORING MONUMENT INSTALLATION

A. Install settlement monitoring monuments in the locations shown on the Drawings, or as otherwise directed by the ENGINEER.

B. Monuments shall be installed upon completion of cover placement and drainage work, and prior to revegetation.

C. Monuments shall be installed per the ENGINEER approved installation procedures submitted under PART 1.6 of this Section. Care shall be taken to prevent damage to the underlying geosynthetic cover system.

D. All monuments shall be installed in the presence of the ENGINEER or his designee.

E. Monuments shall be flagged and protected from construction vehicles and equipment.

3.9 FIELD TESTING

A. Field testing shall be performed by the COMPANY or a COMPANY-retained testing laboratory.

B. When test results indicate that compaction is not as specified, remove the material, replace and recompact the tested material to meet Specification requirements. Tests shall be performed on recompacted areas to determine conformance with Specification requirements.

C. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

1. Gradation:

a. Gradation of HSWRP processed materials determined in accordance with ASTM C136 or ASTM D6913 as appropriate for the material being tested.

b. Frequency:

c. **Liner Bedding**: One tests per 5,000 cubic yards of stockpiled or placed material, or, in the determination of the ENGINEER, as source materials change.

d. **Drain Gravel**: One test per 5,000 cubic yards of stockpiled or placed material, or, in the determination of the ENGINEER, as source materials change.

e. **Drain Rock**: One test per 2,500 cubic yards of stockpiled or placed material, or, in the determination of the ENGINEER, as source materials change.

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SECTION 02210 - BLASTING

PART 1 -- GENERAL

1.1 DESCRIPTION

A. This section describes the methods, limitations, and reporting requirements for the use of explosives and blasting conducted during excavation operations.

B. The CONTRACTOR shall comply with all applicable laws, ordinances, safety code requirements, and regulations relative to the handling storage, and use of explosives and the protection of life and property.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Occupational Safety and Health Administration Regulations (Standards-29 CFR) Standard 1926, Subpart U, Blasting and Use of Explosives.

B. National Fire Protection Association NFPA 495--Code for the Manufacture, Transportation, Storage, and use of Explosives and Blasting Agents.

C. RI 8507, "Structure Response and Damage Produced by Ground Vibrations from Surface Blasting," U.S. Bureau of Mines Report of Investigation by D.E. Siskind, M.S. Stagg, J.W. Kipps, and C.H. Dowding.

1.3 DEFINITIONS

A. Blasting Consultant: A person with specialized experience and academic knowledge of commercial explosives, controlled blasting applications, vibration and air-overpressure control; who uses this knowledge to evaluate, plan, and oversee the safe use of explosives in commercial applications in accordance with blasting industry and regulatory standards.

B. Controlled Blasting: Controlled blasting refers to any special blasting methods used to limit the effects of blasting to within the final lines and grades of an excavation. Only controlled blasting will be allowed on the Project.

C. Scaled Distance: The distance from a blast measured in feet divided by the square root of the weight in pounds of the charge per delay period in accordance with the following equation:

$$SD = D/W^{1/2}$$

where

SD = scaled distance

D = distance in feet

W = weight of charge in pounds.

D. Peak Particle Velocity: The maximum of the three velocity components of vibration.

E. Precision Blasting: The use of Presplitting, Smooth Wall, or Cushion Blasting to control the effects of a blast, create a smooth face, and limit damage to rock outside the blast area.

F. Pre-Splitting: The use of a line of small diameter holes on close spacings that are detonated ahead of the main production charge to develop a continuous or semi-continuous fracture between the holes

G. Smooth Wall Blasting: Smooth Wall Blasting: The use of a line of holes on close spacings that are detonated after the main production charge to create a smooth final face. Smooth Wall Blasting requires relief of the perimeter prior to detonation.

H. Cushion Blasting: The use of a line of holes on close spacings that are detonated after the main production charge, or as the last delay of a production charge, to create a smooth final face. Cushion Blasting requires relief of the perimeter prior to detonation

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – Contractor Submittals and shall be as follows:

B. Submit to the ENGINEER a copy of all applicable permits for transportation, storage, and use of explosives 10 days prior to commencing any blasting operations including the drilling of holes for explosives and/or the moving of explosives onsite.

C. **BLASTING PLANS**

1. GENERAL BLASTING PLAN: At least 30 days before commencing blasting operations, the CONTRACTOR shall submit to the ENGINEER, a detailed two-part General Blasting Plan which has been prepared by an independent blasting consultant and reviewed and approved by the CONTRACTOR's safety engineer.

   a. Part 1: Part 1 of the General Blasting Plan shall include a complete summary of personnel, proposed methods for transporting, handling, storage, and use of explosives. The plan shall include a description of the experience record of the responsible blaster and copies of his or her Washington blasting license and any Explosives Permit(s) required by state or local jurisdictions.

   b. Part 2: Part 2 of the conceptual plan shall include the proposed general concept for the blasting and for the control of noise, dust, fly rock, air blast, and vibrations. Test blasts planned by the CONTRACTOR shall be included in Part 2. Part 2 of the General Blasting Plan shall also contain samples of forms to be used.

   c. The ENGINEER shall review and provide comments to the CONTRACTOR in accordance with Section 01300 – Contractor Submittals. CONTRACTOR shall make revisions and resubmit as needed to address ENGINEER comments. No blasting will be allowed to proceed until the CONTRACTOR has received notification from the ENGINEER that the General Blasting Plan has been accepted.

2. SHOT PLANS: Individual shot plans shall be submitted to the ENGINEER such that the plans are received by the ENGINEER at least 24 hours before loading holes with explosives. The individual shot plans shall be prepared by the blasting

consultant in coordination with the CONTRACTOR's blasting supervisor and shall bear the blasting consultant's signature.

a. Individual shot plans shall include, but shall not be limited to:

1) Plans or sketches showing the location and spacing of blast holes and free faces fully dimensioned.

2) Number, diameter, and depth of holes.

3) Weight and type of powder to be loaded in each hole.

4) Total powder to be used in the blast.

5) Delays for each hole to be used in the blast.

6) Method of wiring the blast.

7) Number of pounds of powder per delay.

8) Water Conditions in each hole.

9) Date and time of expected blast.

10) Written descriptions of instrumentation equipment type, locations, and procedures.

11) Any other pertinent data indicating the CONTRACTOR's intent and purpose to produce smooth and sound surfaces of excavation, and to protect adjacent facilities

b. After acceptable standard drilling and blasting procedures have been developed, the subsequent Individual Shot Plans need not repeat these procedures but shall contain as a minimum the location, date, time of round detonation, supervisor's name, and reference with the drawing number of the previously submitted individual plan. All loading deviations from the previous Individual Shot Plan shall be noted to provide an accurate record of blasting operations. If conditions change, requiring modifications to the plan, a revised individual plan (including drilling and blasting procedures) shall be submitted to the ENGINEER.

3. The blasting plan shall be revised if the results of blasting do not conform to the overall project objectives and the technical requirements of these Specifications

4. The CONTRACTOR shall assume complete responsibility to protect the existing facilities and the Work under construction. The ENGINEER's acceptance of the CONTRACTOR's blasting plans and procedures is solely for the benefit of the COMPANY, and shall not relieve the CONTRACTOR of his responsibility to perform the Work in accordance with the Contract Documents and to protect life, property, and the Work under construction. All damage resulting from the blasting operations shall be repaired by the CONTRACTOR at no additional cost to the COMPANY.

5. Review and acceptance of any blasting plan by the ENGINEER shall not relieve the CONTRACTOR of his responsibility for obtaining adequate rock breakage and limiting rock breakage to within the design excavation final lines and grades.

D. POST BLAST REPORT:

1. Submit a Post Blast Report to the ENGINEER within 24 hours following each blast for review by the ENGINEER and a minimum of 4 hours prior to the subsequent blast.

2. ENGINEER review will be required prior to a request for approval of subsequent blasts.

3. Provide actual values of explosives loading, distribution, delay periods, maximum pounds of explosives detonated per delay period, misfires, under or overloaded holes, water in holes, variations in stemming, variations in drill rates, blast location, time of blast, distance to nearest improvement, identification of improvements, scaling time and approval of scaling by the CONTRACTOR's safety representative, an evaluation of the blast indicating advance (length pulled) and areas of significant overbreak or tights, planned adjustments to the blast design for the next blast, and other blast parameters that are typically included for quality control and construction record purposes.

E. Submit qualifications of the Blasting Consultant and Blasting Supervisor meeting the quality assurance requirements specified herein.

1.5 QUALITY ASSURANCE

A. Retain the services of a qualified Blasting Consultant specialist to assist in the preparation of the required blasting plans and verification of reports. The following requirements shall apply to the Blasting Consultant:

1. The CONTRACTOR shall retain an independent Blasting Consultant with at least 15 years of experience in blasting work. The Blasting Consultant shall have directly participated in at least three projects in the previous 5 years that were successfully completed and included controlled blasting and excavation of more than 10,000 cubic yards of material. One project reference shall include controlled blasting and excavation within 50 feet of an existing dam. Each project reference shall include sufficient information to verify conformance with these requirements.

2. The Blasting Consultant shall not be an employee of the CONTRACTOR or any affiliated companies or suppliers of products to the Project and the Blasting Consultant must not have any conflict-of-interest affiliations with the OWNER or other entities involved with the WORK.

B. Blasting Supervisor's Qualifications:

1. Submit to the ENGINEER written qualifications of the CONTRACTOR'S blasting supervisors, including general blasting experience and experience on jobs where they have been in responsible charge of blasting operations. Include project names, the name of a contact person, and their phone number.

2. Certify that the named blasting supervisors are to be in daily responsible charge of the blasting operations, and that these persons will be physically present on the

blasting site for all decisions affecting either the execution of approved plans or any alterations in blasting operations or plans.

3. Such persons shall possess all required federal, state, and local licenses and/or permits. Blasting supervisors shall have, as a minimum, 5 years of blasting experience with 2 years of experience in responsible charge of blasting operations.

PART 2 -- MATERIALS

2.1 GENERAL

A. Furnish all materials, power, equipment and labor required to accomplish the WORK.

B. Handle, transport, use, control, store, and monitor explosives as prescribed by the most stringent of the rules promulgated by the provisions specified in the Federal (OSHA) Standards, these Specifications, and state and local codes and ordinances. Do not leave explosives in an unprotected manner in any area where such explosives could endanger persons or property.

C. Make blasting mats from closely woven galvanized steel mesh of 10-gauge minimum weighing at least 7.5 pounds per square foot. Mats shall be a minimum of 6 feet by 6 feet and shall be equipped with rings at each corner for tying down.

2.2 WARNING SYSTEMS

A. Erect signboards of adequate size stating that blasting operations are taking place in the area. Such signs shall be clearly visible at all points of access to the area. The signs shall clearly describe the audible signal system for warning of impending blasts.

B. Mark all storage places with signs stating clearly and boldly, “DANGEROUS EXPLOSIVES.” Follow all requirements of local, state, and federal agencies.

C. Institute a system of audible signals to warn of impending blasts.

2.3 BLAST MONITORING INSTRUMENTATION

A. Provide and operate approved seismographs at locations approved by the ENGINEER, to record particle velocity simultaneously along three mutually perpendicular axes. The seismographs shall be capable of producing a hard copy of the complete vibration record of particle velocity that can be submitted to the ENGINEER within time limit of the Blast Report.

B. Provide and operate a sound level meter equipped with a "true peak" detector. Limit peak overpressures to 100 dB at the nearest occupied structure. Monitoring locations will be as proposed by the CONTRACTOR and approved by the ENGINEER. Submit a hard copy of the peak overpressure as part of the Blast Report.

PART 3 -- EXECUTION

3.1 GENERAL REQUIREMENTS

A. Signs warning of blasting zones shall be erected on all access points and all roadways within a minimum of 1,000 feet from the blasting area, or longer distance as recommended by the blasting consultant. Schedule detonation with the ENGINEER and all personnel at least 24 hours in advance. Prior to detonation, utilize an audible warning

system to ensure that any personnel in the area are forewarned of the impending detonation of explosives.

B. Notify the ENGINEER 24 hours in advance of loading holes with explosives. Submit an individual shot plan to the ENGINEER at the time of notification.

C. Unless approved by the ENGINEER, all blasting shall occur when a representative of the ENGINEER is present to witness each blast. The CONTRACTOR's blasting consultant shall, at a minimum, directly supervise the first three blasts, the first three blasts for each different blast type (pre-split, production, etc.), any blasts within 1,000 feet of existing facilities. Additionally, the blasting supervisor shall be present on the site to oversee all blasting operations.

D. Do not perform drilling or blasting work until the CONTRACTOR's plan for blasting operations has been submitted to and accepted by the ENGINEER. Limit blasting intensities as required to prevent damage to existing structures and utilities. Do not allow intensities to exceed the safety standards of particle velocity/frequency established by the U.S. Bureau of Mines (RI8507).

E. Prior to blasting, obtain the blasting permits/licenses as required by all applicable agencies having jurisdiction. Investigate these conditions during bid proposal preparation.

F. Conform to all applicable requirements of federal, state, and local regulations and codes for the transporting, handling, storage, and use of explosives. The locations, access and construction of explosive storage magazines shall be in accordance with the American Table of Distances for Storage of Explosives and approved by the presiding fire and law enforcement agencies.

3.2 REPORTING AND NOTIFICATION

A. No blasting shall be permitted until the CONTRACTOR receives notification in writing from the ENGINEER that the blasting plans have been reviewed and until all preblast inspections and reports have been completed

B. Provide two-work days' notice to all utility agencies or stake-holders whose facilities or interests may be influenced by the blasting operation. Provide the ENGINEER with a list of all people and agencies notified. Contact Underground Service Alert (USALERT/ DIGALERT) as required by State Law. Determine the blasting notification requirements of the OWNER and devise a procedure to provide the requested notification.

0.1 BLASTING REQUIREMENTS

A. All blasting shall be performed in accordance with modern practice using methods and techniques that will avoid fly rock, control particle size, and limit fracturing and dislocation of rock outside the shot area.

B. Precision Blasting techniques shall be used to create a smooth surface of all rock faces remaining after blasting. The method of Precision Blasting shall be Presplitting unless approved otherwise by the ENGINEER. The remaining face shall be primarily comprised of unshattered rock without fracturing, opening of existing seams or joints, and without dislocation or movement of the ground. The presence of half-casts will be used as an indication of the effectiveness of Precision Blasting.

C. All rock shattered outside the limits of excavation indicated on the Drawings or as specified herein shall be removed to the limits of undamaged rock. Immediately following blasting, all excavated surfaces shall be scaled of all shattered and loose material.

D. Blasting Limits: Limit blasting, at any one time, to 15,000 square feet of surface area.

E. Hole Depth and Spacing: Hole depth and spacing to be determined by the blasting consultant.

F. Test Shots: Demonstrate the proposed blasting method to the ENGINEER by making a test shot or shots. Test shots for fragmentation of the rock shall be within the interior of the excavation. Test shots shall be so placed that they will pose no threat to existing facilities. The ENGINEER shall be the sole judge as to the acceptability of the proposed method. If the test is unacceptable modify proposed blasting method and perform other tests until the method is acceptable. Unless the proposed method provides acceptable results as reviewed by the ENGINEER, do not use the proposed method of blasting against any final rock faces or in any place where the final face will be damaged by the test blast or blasts. Determine shock wave, best depth, hole spacing, and pounds of explosives to be shot at one time.

G. Stemming of Each Hole or Cover Over Explosives: Provide stemming sufficient to prevent surface blast wave, but in no case less than 42 inches or as modified by the blasting consultant in the Blasting Plan and approved by the ENGINEER.

H. Multiple Holes: Shoot using millisecond delays.

0.2 POST-BLAST REQUIREMENTS

A. Upon completion of blasting activities, the CONTRACTOR shall perform a post-blast survey of the same structures surveyed in the pre-blast survey to determine the effect of the blasting operations. Submit result of the survey to the ENGINEER.

0.3 LIMITATIONS

A. The following limitations are mandatory for all blasting operations:

1. Do not use explosives as a means of transporting material outside the excavation prism.

2. The use of "coyote" holes and sprung holes for concentration of charges is prohibited.

3. "Mud capping," or shaped charges for secondary blasting above ground or the water surface is prohibited.

4. All holes for blasting shall be 3 ½" inches or less in diameter, and such holes shall not be sprung or chambered. All holes greater than 3 inches shall be oversized only to accommodate loading in wet, groundwater conditions and not to increase the load or charge. Hole spacing and size shall be recommended by the blasting consultant and approved by the ENGINEER as part of the Blasting Plan and individual shot plans.

5. Unless controlled by other requirements in these Specifications, sub-drill for final lines and grades shall not be greater than 1.5 feet below excavation grade.

6. Design shots so that the explosive energy is directed toward the developed free face.

7. Explosives shall be of such quantity and quality and shall be used in such a manner as will neither open seams nor otherwise damage rock outside the prescribed limits of excavation. Control the firing systems of general blast holes by the use of delay detonators, and explosives used for any single period of delay, shall be the minimum required.

0.4 SAFEGUARDS

A. Where particle velocity is measured, the total particle velocity shall be the vector sum of the component particle velocities measured at any instant.

B. The first blasting operation at each location shall be monitored by both the CONTRACTOR and the ENGINEER as a test case, and the proper drilling pattern and amount and type of explosive to be subsequently used shall be determined from the results of this initial blasting operation. The scaled distance for test shots shall not be less than 70 using the distance to the nearest structure of concern or as recommended by the blasting consultant and approved by the ENGINEER. Furnish data recorded for each shot to the ENGINEER prior to drilling for the next blast. Make changes in drilling patterns and amount of explosives when records indicate vibration in excess of that specified herein.

C. In reporting a shot, note the distance for the shot to each recorder, amount of explosives used in each delay, the total amount of explosives used, and the time.

D. Prevent fly rock with the use of blasting controls, or cover the area to be shot with blasting mats or overburden material.

E. Give ample warning to all persons within the vicinity prior to blasting, and station men and provide signals warning of danger in suitable places to alert people before firing any blasts.

F. After a blast has been fired, make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation. Correct misfires in accordance with the requirements of the applicable portions of federal, state, and /or local safety codes for blasting. The CONTRACTOR shall be responsible for any and all damages to property or injury to persons resulting from blasting, or accidental or premature explosions that may occur in connection with his use of explosives.

G. Remove all loose and shattered rock or other loose material which may endanger the structure or the workers and make the excavation safe before proceeding with the work. After muck removal and before drilling of blast holes for a new round, clean and thoroughly examine the face for missed holes and unexploded powder. Develop and improve blasting techniques as work progresses. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the CONTRACTOR of the responsibility for removal of such material.

0.7 REPAIR OF DAMAGE

A. Perform blasting activities in such manner that no damage occurs to buildings, structures, pipelines, or facilities onsite of the Work, above or below ground.

B. In case of damage from blasting to any nearby structures, to any portion of the work, or to the material surrounding or supporting the same that is intended to remain, remove such damaged work, repair the work, and replace the material and perform such work for repair or replacement as the COMPANY shall order. Repair promptly, completely, and satisfactorily all damage caused by blasting to existing structures intended to remain, at the CONTRACTOR's sole expense.

0.8 BLASTING RECORDS

A. Maintain a record, similar to the attached Blast Report, of each blast detonated, and submit such record to the ENGINEER along with seismograph records within 24 hours after each blast but no less than 4 hours prior to the next subsequent blast. This record shall include the following:

1. Depth of blast holes and the location of the blast point in relation to project stationing; type and strength of explosives, type of blasting caps, and distribution of delays used; vibration record; total explosive loadings per round and per delay; comments by the blaster in charge regarding any misfires, unusual results or unusual effects; date and firing time of blast; name of person in responsible charge of loading and firing and blaster permit number; signature and title of person making recording entries; and other records required by state, federal, and local codes and/or regulations.

0.9 CLEANUP

A. Immediately collect all spilled or undetonated explosives and dispose in a manner approved by the ENGINEER. No undetonated explosives will be allowed to be disposed of in fills or dissolved in groundwater or runoff.

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SECTION 02223 – ALLUVIAL GROUNDWATER CONTROLS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section details the requirements for Alluvial Groundwater Controls consisting of groundwater extraction trenches (Extraction Trenches) and seepage barrier walls (Barrier Walls), and related work to be constructed in the Far East Seep, Central and Western Drainages as indicated on the drawings. The purpose of the Alluvial Groundwater Controls is to intercept groundwater in the impacted shallow aquifer and convey it to the Site water treatment plant (WTP).

B. The CONTRACTOR shall provide and furnish the necessary plant, labor, equipment, material and expertise for performing operations associated with construction of the alluvial groundwater Extraction Trenches and SLCB Barrier Walls in accordance with this specification and applicable drawings.

C. The Extraction Trenches shall be constructed using the Biopolymer (BP) Slurry Trench method or other approved method of trench stabilization, to the lines and grades shown on the drawings and in these specifications, or as directed by the Engineer.

D. The Barrier Walls shall consist of a series of overlapping wall panels formed by the slurry trench excavation method or other approved method to the lines and grades on the Drawings (Section 7 – Groundwater Controls), described in this specification, or as directed by the Engineer. The barrier wall shall consist of self-hardening slag-cement-bentonite (SLCB) slurry as the wall material. Other suitable methods for construction of deep, low-permeability barrier walls (e.g. Deep Soil Mixing) may be proposed by the Contractor.

1.2 REFERENCES

A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

<u>AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)</u>

API Spec 13A	(2006; Errata 2008) Specification for Drilling-Fluid Material
API RP 13B-1	(2009) Recommended Practice for Field Testing Water-Based Drilling Fluids
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 989	(2009a) Standard Specification for Ground Granulated Blast-Furnace Slag for use in Concrete and Mortars
ASTM D 2166	(2006) Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D 2488	(2009a) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 4380	(1984; R 2006) Standard Test Method for Density of Bentonitic Slurries

ASTM D 4832	(2010) Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
ASTM D 4833	(2013) Test Methods for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 7100	(2011) Standard Test Method for Hydraulic Conductivity Compatability Testing of Soils with Aqueous Solutions

CODE OF FEDERAL REGULATIONS

29 CFR 1910	Occupational Safety and Health Administration – Health and Safety Requirements

1.3 MODIFICATION OF EXTRACTION TRENCH OR BARRIER WALL GEOMETRIES

A. Modification to Groundwater Collection Trench Geometries: The ENGINEER may at any time prior to or during construction require a change in Extraction Trench depth or horizontal alignment. The objective of the Extraction Trenches is to intercept potential seepage through alluvial materials. Performance of the Extraction Trenches may be optimized by increasing or decreasing their depths or horizontal location.

B. Modification to Barrier Wall Geometries. The ENGINEER may at any time prior to or during construction require a change in barrier wall depth or horizontal alignment. The objective of the Barrier Walls is to block potential seepage through alluvial materials. Performance of the Barrier Walls may be optimized by increasing or decreasing their depths or horizontal location.

1.4 DEFINITIONS

A. BP Method of Excavation: A method of excavating a narrow vertical trench using a modification of the slurry trench method to temporarily support the trench walls and permit the placement of drainage features during construction

B. Bio-Polymer Slurry: A suspension of degradable polymer in water. The terms "bio-polymer slurry" and “BP slurry” are used interchangeably in these specifications.

C. Drain Sand: A freely-draining aggregate or gravel used as the final fill for the Groundwater Collection Trench

D. Slurry Specialist: An individual who has had proven and successful experience in slurry trench construction using SCB slurry and BP slurry.

E. Working Surface: The working surface is the top of the working platform as shown on the Drawings, from which the BP trench shall be constructed.

F. Broken or Degraded Slurry: BP slurry, which through natural or artificial means has degraded to water and a minute amount of a non-toxic residual.

G. Drain Activation: The process by which the BP slurry is degraded to permit the free flow of groundwater into and through the groundwater extraction trench.

H. Discharge Header: Vertical casings suitable to accept groundwater pumps for the removal of liquids from the completed trench.

I. Drain Pipe – Slotted flexible HDPE pipe installed near the bottom of the groundwater extraction trench to collect and divert groundwater collected in the trench to the discharge header.

J. Primary/Secondary Panel Excavation Method: The slurry trench excavation method where no two immediately adjacent panels are excavated sequentially. Initially, primary panels are completed, leaving gaps for future excavation of a secondary panel between primary panels. Secondary panels, which connect the primary panels to form a continuous wall, are not excavated until sufficient time has elapsed for the two adjacent primary panels to harden and provide additional support for secondary panel excavation due to arching effects.

K. Slurry Method of Excavation: The slurry method of excavation consists of excavating a vertical walled trench and at the same time keeping the trench filled with slag-cement-bentonite slurry or BP slurry. The purpose of the slurry is to support the walls of the trench while excavating to the design depth. In the case of the SCB barrier wall, and the slurry when hardened, will provide the required barrier wall properties.

L. Slag-Cement-Bentonite (SLCB) Slurry Barrier Wall: The slag-cement-bentonite slurry is used to stabilize the excavation and after hardening forms a low-permeability barrier wall to reduce seepage. The terms "slag-cement-bentonite slurry," “SCB slurry” and “slurry” are used interchangeably in these specifications.

M. Ground Water Level: The ground water level is the piezometric level of the ground water as shown on the exploration logs.

N. Working Surface: The working surface is the top of the working platform as shown on the Drawings, from which the slurry trench shall be constructed.

O. CB Barrier Wall: The term CB barrier wall used in these specifications shall have the same meaning for the term slag-cement-bentonite slurry barrier wall (SLCB slurry barrier wall).

1.5 SUBMITTALS

A. The following submittals shall be submitted in accordance with specification Section 01300 Submittals.

1. Qualifications shall be submitted a minimum of 45 days prior to beginning the work for Extraction Trenches and Barrier Walls.

2. Work Plans shall be submitted a minimum of 21 days prior to beginning work for Extraction Trenches and Barrier Walls.

B. Equipment. The CONTRACTOR shall submit to the ENGINEER a list of all equipment to be used in the performance of the construction work including descriptive data at least 60 days prior to start of the WORK.

C. Permits. A copy of all permits and/or license requirements per the Applicable or Relevant and Appropriate Requirements (ARARs), or other requirements necessary for execution of the WORK. As a minimum, the following requirements shall be met prior to the start of the WORK: all existing utilities shall be field located and the necessary

excavation plans to protect existing utilities shall be submitted to the ENGINEER; all construction personnel shall meet the pertinent health and safety requirements specified in OSHA Standard 29 CFR 1910.120 and copies of personnel training certificates shall be provided.

D. Qualifications. Submit qualifications of personnel and subcontractor(s) utilized to construct both the Extraction Trenches and the Barrier Walls. Qualifications will be reviewed to ensure the CONTRACTOR has sufficient expertise, will employ competent experienced personnel, and will use proven methodologies and equipment to carry out the operations specified.

1. Qualifications for Groundwater Extraction Trench Construction

a. CONTRACTOR and associated SUBCONTRACTOR(s), joint venture partner(s), or merged company shall demonstrate experience and competency for construction of Extraction Trenches using the biopolymer method. Evidence shall include references from at least two similar and successful projects constructed over the last five years. Project descriptions shall include type of slurry used and a description of materials installed.

b. BP Slurry Specialist: Provide name and resume for proposed BP Slurry Specialist who will supervise the BP slurry operations and quality control testing. Proposed individual shall be knowledgeable in: (1) the proper mixing methods employed to mix BP slurry, (2) the use, degrading, testing and control of degradable polymers as a slurry, (3) construction equipment, (4) excavation and backfill operations, and (5) testing for quality control of Extraction Trenches constructed using BP slurry. The BP Slurry Specialist shall have at least five years of experience and two projects in successful construction of BP slurry trenches.

c. Provide qualifications for each excavation equipment operator.

2. Qualifications for Barrier Wall Construction. Provide names and qualifications for the following:

a. The CONTRACTOR, his SUBCONTRACTOR, joint venture partner, or merged company shall have successfully constructed a minimum of two SLCB trench projects in the last 5 years. The qualifications and experience of personnel who shall be responsible for conducting the operations shall include references of the previously completed project with project company name; telephone number; address; and project description including depth, length, and construction method of the CONTRACTOR's previous successful SLCB barrier wall construction projects. An individual's experience from former companies shall not qualify as the present CONTRACTOR’s experience. However this experience can be used as individual experience such as for the Barrier Wall Specialist.

b. Barrier Wall Specialist. The Barrier Wall Specialist shall have experience with at least two projects and five years of experience in all aspects of barrier wall construction which includes, but is not limited to:

1) The use, testing, and control of SLCB slurries

2) The mixing methods required to properly mix SLCB slurry as required

3) Trench excavation, slurry trench filling, and backfilling procedures

4) A thorough knowledge of construction equipment and material testing required for barrier wall construction, including de-sanding methods and equipment

5) Show successful construction of at least two SLCB slurry barrier walls having similar access constraints and at a minimum as deep and at least as long as this project

c. Trench Excavation Equipment Operator – Each trench excavation equipment operator shall have previous successful experience using similar trench excavation equipment to be used for this contract on a minimum of two successfully completed projects of similar or greater length and depth.

d. Trench Logger(s) - The description and classification of the excavated material shall be performed by a geologist, geotechnical engineer, or civil engineer with using field soil classification techniques described in ASTM D 2488. Submit experience that includes project name, phone number of customer and point of contact, date of construction, description of project feature in which classification of material was performed

e. Provide name(s) and resume(s) for Construction Supervisor and Barrier Wall Specialist.

f. Provide names and qualifications of all trench excavation equipment operators.

E. **Submittals Specific to Extraction Trench Construction**

1. Work Plan for Extraction Trench Construction:

The CONTRACTOR shall submit a preconstruction work plan for approval to the ENGINEER in advance of the work as described in 1.5.A.2. The plan shall include, but not be limited to, the proposed method for constructing the working platforms, extraction trenches, slope stability and shoring plan, details on proposed GCL and slotted drainage piping materials, method for the installation of the drainage piping and drain sand backfill, GCL, and methods and equipment proposed for constructing the extraction trenches. Details of specific methods to be employed to control potential environmental contamination or pollution arising from trench construction shall also be included. Specifically, details on on-site staging and storage areas, and disposal of trench spoil. No work shall be performed until the plan has been approved and no deviation from the approved work plan will be permitted without approval from the ENGINEER.

a. The CONTRACTOR shall submit plans, details, and calculations for trench safety and temporary shoring where shoring is to be used in lieu of stabilizing BP slurry. The submittal shall be for information purposes only. This submittal and any review does not relieve the CONTRACTOR of the full responsibility for the adequacy of safety requirements and temporary shoring design.

2. Incorporated Materials: Certificates of compliance; test reports and data; and manufacturer catalog cut sheets for all permanent materials that become part of the final installation including :

a. Drain Sand: Testing data documenting the gradation of the drain sand shall be submitted to the ENGINEER at least 14 days prior to start of the WORK.

b. Geosynthetic Clay Liner: A manufacturer-supplied data sheet and mill results, and other items as indicated in Section 02278 – Geosynthetic Clay Liner.

c. Admixtures

d. Perforated drainage piping materials.

e. Bio-Polymer (BP) Slurry: The name type, and characteristics of the degradable BP slurry intended to be used in construction. Information shall indicate whether the BP slurry is natural or synthetic and any residuals expected after degradation. MSDS for each BP slurry ingredient shall be included.

3. Construction Quality Control Plan: The CONTRACTOR shall submit a Construction Quality Control Plan to the ENGINEER at least 30 days prior to construction. The plan shall include a list of test methods and minimum standards with which to gauge the quality of the work including trench and pipe depth measurements, verification of plumbness of piping assemblies, control of pipe grades, control of GCL extent and overlap. In addition, the plan shall provide a detailed quality control program covering all aspects of the use and degradation of the BP slurry, i.e., limits for BP slurry viscosity and pH, sampling methods, testing frequencies, depth measuring methods, backfill placement controls, rate and pore volumes of pumping during Extraction Trench activation, extraction well spacing for BP slurry degradation, and corrective measures.

4. Cleanup: Site restoration plans, spoils disposal, etc.

5. Schedule: Schedule shall be provided with a bar chart. The following shall be included: starting and ending dates for major segments of the work, estimated production rates, days and hours of operation.

6. Extraction Trench Development Plan. Plan shall include methods and equipment proposed for developing the Extraction Trenches and details of specific methods to be employed to control potential contamination or pollution arising from trench construction shall also be included.

7. Quality Control Testing.

a. The CONTRACTOR shall be responsible to ensure that work is performed to the standards of this specification.

b. Submit test results shall include analyses and interpretation of results. The Quality Control testing, including the BP material, shall be in both hardcopy and digital format. A summary table for the BP material shall be updated and submitted on a weekly basis.

c. Submit shipped materials test reports:

1) Geosynthetic Clay Liner: Mill results shall include date shipped, log number, test results, and roll number.

2) Admixtures: A copy of test results from the admixture manufacturer for each lot of fluidizing agents, retarders, softening agents, or as approved,

shipped to the site and a certificate of compliance stating that the admix complies with all applicable standards.

8. Extraction Trench Construction Diagram: During the construction of each extraction trench, an as-built profile of the trench bottom, and descriptions of material (i.e. soil classification) encountered in the trench excavation shall be continuously maintained by the CONTRACTOR. These records, data and drawings shall be made available daily and shall be furnished no later than 24 hours after the measurements and descriptions have been made.

9. BP Slurry. A record of BP slurry mix quantities, proportions of additives utilized, and adjustments for each production batch including the date mixed, wall panel, and the mixing plant and crew.

10. Closeout Submittals:

    a. As-built Drawing: Upon completion of the Extraction Trench construction, an as-built diagram of the trench shall be recorded by the CONTRACTOR's Construction Supervisor. Information to be provided in the as-built diagram shall include as a minimum the following: project and site names, extraction trench identification and dates of construction; extraction trench location; types of equipment; average trench width; location, thickness and brief description of each stratum; total depth of the completed trench; type and location of drainage piping, collection sump details, including volumes and materials of construction; backfill type and gradation; and the name and signature of the CONTRACTOR's Construction Supervisor. The CONTRACTOR shall prepare a graphic as-built diagram to scale showing the required details.

    b. Field books and notes.

F. **Submittals Specific to Barrier Wall Construction**

1. Work Plan for Barrier Wall Construction:

   The CONTRACTOR shall submit a preconstruction work plan for approval to the ENGINEER, in advance of the work as described in 1.5.A.2. No work shall be performed until the CONTRACTOR has been notified in writing that the plan has been approved by the ENGINEER. No deviation from the approved plan will be permitted written approval from the ENGINEER. The work plan shall at a minimum include the following:

   a. Listing of supervisory personnel: Name and experience of the various persons, their roles and primary responsibilities.

   b. Proposed construction methods, equipment, and schedules, including:

      1) Description of the general work sequence and layout of operations

      2) Baseline schedule for completing Barrier Wall construction

      3) Scale drawings which depict SLCB preparation and storage areas in the layout of operations.

      4) Construction means and methods: List of equipment and capabilities; method of trench excavation; production rates; planned panel dimension;

planned work schedules including number of shifts and hours worked per shift; use or disposal of excavated material; bottom cleaning; SLCB slurry preparation and maintenance; SLCB preparation and placement; and site cleanup. The plan shall include a system for locating stations along the individual barrier wall alignments and relating them to the design drawings.

2. Incorporated Materials: Certificates of compliance; test reports and data; and manufacturer catalog cut sheets for all permanent materials that become part of the final installation including :

    a. Backfill Material: Include information and data that verify the proposed backfill meets project specifications.

    b. Bentonite

    c. Cements and grouts

    d. Deflocculants and other additives

    e. Sampling. Include information on equipment and procedures for collecting samples of backfill material.

3. Construction Quality Control Plan: The plan shall provide a description of quality control equipment, testing equipment, and required test procedures, sample test forms for reporting test results, onsite and/or offsite laboratory proposed for use, sample storage on site and method of transporting samples to laboratory. Laboratory quality control testing procedures shall be included: Information on sample preparation, sample storage, confining pressure application method, methods of checking saturation, samples of test data sheets and sample data reduction to obtain unconfined compressive strength and hydraulic conductivity shall be included.

    a. Reporting schedule for completed SLCB slurry density tests, unconfined compressive strength tests, and permeability tests. Include reporting schedule for offsite independent laboratory.

    b. The plan shall include a written description of the method for verifying vertical tolerances.

4. Samples.

    a. Barrier Wall Key-in Material. Provide sample of barrier wall key-in material upon request to the ENGINEER.

5. Test Reports - Pre-Construction SLCB Slurry Test Report

    a. A report summarizing the procedures and results of the Pre-construction SLCB slurry mix tests.

    b. The report shall include a description of mix proportions, water-cement ratio, water and slurry temperatures, densities, permeability, and unconfined compressive strength and hydraulic conductivity of five (5) samples of the final SLCB slurry mix and mixture with site soils at the anticipated inclusion rates

that may occur within the trench. Mix design testing shall be performed using the cement bentonite, and additives if any, proposed for use.

6. Quality Control Testing

   a. Submit results from required quality control testing to the ENGINEER in a timely manner.

   b. Tests results shall include analysis and interpretation of the results. The Quality Control testing including the SLCB material shall be in both hardcopy and digital format. A summary table for the SLCB material shall be updated and submitted on a weekly basis. The summary table shall include as a minimum the sample ID number, batch number, cast date, station number, depth, hydraulic conductivity, compressive strength test data, and comments relating to interpretation of the results.

   c. Submit test reports for materials delivered to the site:

      1) Bentonite - A copy of the test results from the bentonite powder manufacturer for each lot shipped to the site and a certificate of compliance stating that the bentonite complies with applicable standards.

      2) Portland and Slag Cement: Submit a copy of the test results from the cement manufacturer for each Portland Cement Type I-II and Ground Granulated Blast-Furnace Slag cement lot shipped to the site and a certificate of compliance stating that the cement complies with all applicable standards.

      3) Admixtures: Submit a copy of the test results from the admixture manufacturer for each lot of fluidizing agents, retarders, softening agents, or as approved, shipped to the site and a certificate of compliance stating that the admix complies with all applicable standards.

      4) SLCB Slurry: A record of slag-cement-bentonite slurry mix quantities, proportions of additives utilized, and adjustments for each production batch including the date mixed, wall panel, and the mixing plant and crew.

7. Chain of Custody Form for Quality Control and Quality Assurance – Samples: The CONTRACTOR shall submit a sample of the chain of custody form used to keep track of all Quality Control (QC) and Quality Assurance (QA) samples taken by the CONTRACTOR. The form shall include who formed the samples; transfer of company; ship dates; time; batch number; and location (e.g. stationing, heading number, etc.) of the QC and QA samples.

8. Trench Soundings and Material Description: An as-built profile of the trench bottom, backfill slope including descriptions of material (i.e. soil classification) encountered in the excavation shall be continuously maintained by the CONTRACTOR. These records, data, and drawings shall be made available daily furnished no later than 24 hours after the measurements and descriptions have been made.

9. Closeout Submittals:

   a. As-built Drawing: Submit a scale drawing (CAD drawing) providing a log of the subsurface materials excavated from the trench, and a profile of the completed

slurry trench with bottom elevations. The limits of each batch of CB slurry (with date) shall be delineated as placed in each panel or secondary panel.

b. Final Test Report of SLCB Material: Submit a final test report of SLCB material in both hardcopy and digital format. The test report shall include a summary table for the SLCB material that includes as a minimum the sample ID number, batch number, cast date, hydraulic conductivity, compressive strength test data, and comments relating to interpretation of the results. In additional laboratory test data sheets shall be included in the final test report.

c. Field log books and notes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials delivered and placed in storage from the weather, dirt, dust or other contaminants.

1.7 GEOTECHNICAL SITE CONDITIONS

A. Exploration Borings

1. Subsurface data have been obtained by the COMPANY to provide information regarding the character of materials to be excavated. Locations of borings are shown on the Drawings and included in the Alluvial Groundwater Collection System Geotechnical Report included as Attachment G-4 to Appendix G of the 100% Basis of Design Report. The COMPANY assumes no responsibility for interpretation or deductions made by the CONTRACTOR from the data provided. Local variations in the subsurface materials are to be expected, and if encountered will not be considered as materially different. Soil classifications shown on the logs are the result of field visual classifications. The subsurface material is classified in accordance with the Unified Soil Classification System. The available borings within the limits and proposed depths of this contract are included in the contract drawings. Groundwater levels indicated in the explorations were observed at the time of drilling and can vary depending on time of year and creek stage.

2. Subsurface Conditions

a. The excavation for the Extraction Trenches and Barrier Walls will be from the working platform and extend through alluvium and weathered bedrock. The material to be excavated generally consists of silty sand, clayey sand, and poorly graded gravel with sand. Cobble and boulder-size material may be encountered during excavating.

b. Water levels encountered during drilling are shown on the logs and represent the depth at which water was encountered at the time of drilling.

3. Knowledge of Subsurface Data

a. It is the CONTRACTOR's responsibility to become acquainted and satisfied as to the character, quality, and quantity of surface and subsurface materials by inspecting the site, perform additional borings as necessary for soil classification and mix design formulation, and by evaluate information derived from the exploration work performed for this project and included in the documents referenced in 1.7.A. Failure by the CONTRACTOR to become acquainted with the available information and other site specific conditions such

as utilities will not relieve the CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the work.

1.8 ENVIRONMENTAL PROTECTION

A. The CONTRACTOR shall take all precautions necessary to prevent contaminated water or nuisance water having undesirable physical or chemical characteristics from leaving the site. All waters shall be collected and conveyed to the appropriate storage facility for treatment. All contaminated soil shall be transported to the mine area for disposal.

B. Contractor shall comply with relevant site-wide specific plans including the Construction Spill Prevention Control and Countermeasures Plan; and the Construction Stormwater Pollution Prevention Plan.

C. Excavation equipment shall be free from leaks of fuel, hydraulic fluid, and oil which may contaminate the ground surface. It is expressly understood that toxic and/or contaminating substances shall not be used during trench excavation, piping installation, or trench development process.

D. The raw materials and other supplies used in the construction of the extraction trenches, barrier walls and any spoil disposed of within the project limits shall be non-hazardous to prevent, and provide for abatement and control of, any environmental pollution arising as a part of the work

E. Excess slurry and/or saturated materials shall be allowed to drain from excavated materials or solidify prior to loading and hauling to the designated disposal area to avoid release of slurry onto construction roads or other areas at the Site. If excavated materials must be hauled prior to draining of excess fluids or solidification, they shall be transported in fully lined haul vehicles.

PART 2 -- PRODUCTS

2.1 PRODUCTS SPECIFIC TO GROUNDWATER EXTRACTION TRENCH CONSTRUCTION

A. Polymer. The polymer shall be a natural or synthetic material capable of temporarily supporting slurry trench excavation and later naturally and/or artificially degrading to a non-toxic water solution after backfilling of the trench is complete. The polymer shall have a minimum molecular weight of 1,250,000. The polymer slurry shall be water-based. The slurry and degraded slurry shall not form a filter cake on the trench walls or materially decrease the transmissivity of the backfill or the trench walls. The degraded slurry shall be non-toxic.

B. Water. The water used to make the slurry shall be suitable to provide slurry with adequate viscosity and useful life to complete the extraction trench excavation and groundwater collection system installation and backfilling operations. Fresh water, free of excessive amounts of deleterious substances, especially bio-organisms with natural polymers and certain anions with synthetic polymers, that may adversely affect the properties of the slurry shall be used to manufacture the slurry. It is the responsibility of the CONTRACTOR to ensure that the slurry resulting from the water shall meet the standards of this specification.

C. Slurry. The BP slurry shall consist of a suspension of polymer in water and shall be controlled in accordance with the following requirements:

1. The density and viscosity of the BP slurry shall be sufficient to provide adequate stabilization to complete the trench excavation and backfilling without contamination of drain sand backfill or deformation of extraction trench components due to collapse or deformation of the trench walls.

2. The minimum pH of the slurry shall be 8.5 (this value only appropriate for natural polymer slurries) when in use in the trench

3. When fully degraded, the slurry shall have a maximum viscosity of 30 seconds.

D. Admixtures. Admixtures of the type used in the control of fracturing fluids such as water treatment chemicals, softening agents, dispersants, or bridging agents may be added to the water or the slurry to permit efficient use and proper workability of the slurry. Additives specially designed for used with the particular BP slurry may also be used and these include biocides, bio-starters, and enzyme breakers, sterilants, and oxidizers. The ENGINEER shall be advised of all additives used.

E. Drain Sand. Extraction trench drain sand shall be imported material conforming to ASTM C33 Standard Specifications for Concrete Aggregates, Fine Aggregate. Drain Sand shall not contain any unsuitable material. Drain Sand shall have the following grain-size distribution:

Table 1. Grain Size Distribution

Sieve Size	Percentage Passing
3/8 –inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10

F. Geosynthetic Clay Liner. Geosynthetic clay liner shall conform to Section 02780.

G. Slotted Drainage Piping.

1. Pipe sizing shall as shown on the Drawings (Section 7 – Groundwater Controls).

2. High density polyethylene piping shall conform to Section 02594.

3. The slotted high density polyethylene piping shall have a minimum water inlet opening area of 0.25 square feet (36 square inches) per linear foot of pipe. All measurement of perforation fabrication shall be made with instruments accurate to 0.01 inch.

4. The CONTRACTOR shall be qualified to lay, pull and perform heat fusion joining of the HDPE pipe.

5. Applicable manufacturer requirements including buried polyethylene pipe, bend radius, and allowable tensile loads shall be observed.

6. Connections: Connection fittings shall be HDPE flange adaptors with metal backup rings for full restraining, the connection fittings shall be compatible with the HDPE pipe and the existing valves, piping, or other appurtenances to be tied into.

7. Joints: Pipe sections and fittings shall be joined by heat fusion, except at tie-in points to exiting pipe where flanges or other proven and accepted mechanical joint systems for HDPE pipe.

8. Provision for pipe expansion and contraction should be made. When assembled outside the trench, the pipe should be allowed to cool in the trench before backfilling to minimize stress due to thermal contraction.

H. Riser and Discharge Piping.

1. Solid wall high density polyethylene piping shall conform to Section 02594.

2. Joints: Pipe sections and fittings shall be joined by heat fusion, except at tie-in points to exiting pipe where flanges or other proven and accepted mechanical joint systems for HDPE pipe.

3. Provision for pipe expansion and contraction should be made. When assembled outside the trench, the pipe should be allowed to cool in the trench before backfilling to minimize stress due to thermal contraction.

I. BP Material Storage Facility. The CONTRACTOR shall provide all necessary materials, equipment and personnel to store the BP materials and other additives under conditions to prevent moisture or other contaminants from mixing with the materials prior to use in the slurry plant.

2.2 PRODUCTS SPECIFIC TO BARRIER WALL CONSTRUCTION

A. Portland and Slag Cement. Cement to be used in preparing the SLCB slurry shall be Portland Cement Type I-II and Ground Granulated Blast-Furnace Slag cement Grade 100 or higher in accordance with ASTM C 150 and ASTM C 989. Use of reclaimed cement or cement containing lumps or deleterious matter shall not be allowed.

B. Bentonite. The bentonite shall be sodium cation based montmorillonite powder that conform to API Spec 13A, Section 9. Chemically treated bentonite will not be allowed. No bentonite shall be used prior to acceptance by the ENGINEER. Bentonite not meeting specifications shall be promptly removed from the site at the CONTRACTORs expense. Bentonite shall be protected from moisture during transit and storage.

C. Water. The CONTRACTOR shall supply and condition water required for mixing with cement and bentonite to produce slurry as needed. The water shall be clean, fresh, and comply with the standards specified below. The CONTRACTOR shall furnish water quality test results for water used for mixing the bentonite slurry to assure conformance to these standards. The hardness limit is a recommendation only.

Table 2. Parameters for Water Used in SCB Slurry

Standards	
pH value	7.0 +/- 1.0
Total dissolved solids	<500 ppm
Oil, organics, acids, or other deleterious	<50 ppm each
Hardness	< or = 50 ppm

D. Admixtures. Admixtures such as fluidifiers, defloculants, and retarders may be used as approved for use in preparing the SLCB slurry mixture. Admixtures of softening agents, dispersants, retarder or plugging or bridging agents may be added to the water or the

slurry to permit efficient use of materials and proper workability of the slurry. No additives shall be used except as approved by the ENGINEER after test results show that the performance of the SCB slurry is not adversely affected. CONTRACTOR shall have on file a written statement from the admixture manufacturer regarding the use of the admixture, and its effect on the environment. No other admixture types shall be used unless approved by the ENGINEER.

E. Barrier Wall Backfill.

1. The initial design mix for the barrier wall backfill shall be selected by the CONTRACTOR and approved by the ENGINEER based upon target permeability and strength requirements and advanced testing as specified herein. Modifications to the initial design mix shall be made only with the approval of the ENGINEER

2. Materials shall be thoroughly mixed, and at the time of placement, the backfill material shall conform to the mixing and placement requirements.

F. Material Storage Facility. The CONTRACTOR shall provide all necessary materials, equipment and personnel to store the bentonite, cement and other additives under conditions to prevent moisture or other contaminants from mixing with the materials prior to use in the slurry plant.

G. Disposal Site. Barrier wall trench excavated material shall be disposed of at the Site in an area designated by the ENGINEER.

H. Trench Plates. The minimum plate thickness shall be 1-1/4 inches for the specified trench width. Steel plates also known as steel plate bridging shall consist of steel designed for HS20-44 truck loading

2.3 SLCB SLURRY

A. The SLCB slurry used to support the excavated trench shall consist of a stable colloidal suspension of bentonite, ground granulated blast-furnace slag cement, and Portland cement in water. The SLCB slurry shall have at the time of its introduction into the trench a minimum unit weight of 67.0 pounds per cubic foot, in accordance with the standard test procedures described in API RP 13B-1. The properties of the mix shall be such that the completed slurry trench will provide a continuous low-permeability barrier at the specified horizontal locations and corresponding specified depths, and have the following properties:

1. An unconfined compressive strength (ASTM D4832/D2166) between 25 pounds per square inch (psi) and 300 pounds per square inch when cured for 28 days.

2. A hydraulic conductivity (ASTM D7100) not greater than $5x10^{-7}$ cm/sec when measured at 28 days using site groundwater as the permeant.

B. Trial Mixes

1. Mix design for the SLCB slurry shall be the responsibility of the CONTRACTOR and take into account the subsurface conditions along the project alignment. The CONTRACTOR shall fabricate a sufficient number of cast samples to support the proposed mix design.

2. Minimum number of mix designs shall be three covering a range of percentages with a minimum of 10 percent solids. The SLCB slurry selected for production

work shall undergo a second series of tests in which the range of entrained site soil and groundwater contents that can be expected during Barrier Wall construction are intermixed within the slurry.

3. Only those materials approved shall be used to fabricate the test specimens. These materials include Portland cement, ground granulated blast furnace slag, bentonite, water, and approved admixtures.

4. The CONTRACTOR shall submit a Pre-Construction SLCB Slurry Test report containing the results of the tests as specified. Only mixes meeting or exceeding the test requirements shall be approved for use. The CONTRACTOR shall establish the minimum time required for the CB slurry to harden sufficiently to allow for excavation of adjacent panels through design and results of the trial mixes.

2.4 CONSTRUCTION STAKING

A. The CONTRACTOR shall provide, install and maintain all layout and necessary construction staking to locate centerlines of the groundwater collector trenches and barrier walls within the allowable ranges of installation and the lengths as shown on the contract drawings. Surveyor's caps, appropriately identified and mounted on a 2-inch diameter, 2-foot-long steel pipe, driven into the ground, shall be provided at the ends of each groundwater extraction trench and each barrier wall and at bends in horizontal alignment or at 100-foot maximum intervals between the ends. Coordinates and elevations shall have units consistent with the contract drawings. A tabulated list containing survey control numbers, grid coordinates, and elevations shall be submitted to the COMPANY within five working days of completing each heading. The beginning and ending of the barrier wall and any internal points shall be identified on this list.

B. Permanent Metal Marking Stakes. Upon completion of each groundwater extraction trench or barrier wall, permanent metal marker stakes shall be placed at the trench or barrier wall endpoints. The locations of these markers shall be surveyed and referenced to the corresponding project coordinate system for horizontal and vertical control.

PART 3 -- EXECUTION

3.1 GENERAL CONSTRUCTION REQUIREMENTS

A. The groundwater extraction trenches and the barrier walls shall be constructed to the lines, grades, and cross-sections shown on the drawings and in accordance with these specifications. The ENGINEER may modify the dimensions and quantities of the work as needed to meet project requirements. Final acceptance of the groundwater extraction trenches and barrier walls will be based on results of quality assurance testing as described in this specification.

B. All applicable Federal, State, and local regulations shall be met prior to personnel entering an excavation area. The CONTRACTOR shall take all necessary steps to ensure the safety of personnel. The CONTRACTOR shall detail temporary shoring methods to be employed and these methods shall be approved by the ENGINEER prior to implementation.

C. Working Surface. Groundwater extraction trench and barrier wall construction shall be accomplished from the working platform, as shown on the drawings. The working platform as shown on the drawings shall constitute the top of the groundwater extraction trench or barrier wall.

D. Temporary Working Surface Preparation.

1. Prepare the temporary working surface from which trench excavation, backfill mixing, and backfilling operations are to be performed. The grade in direction of trenching is not to exceed 1 percent. Level the working surface to facilitate excavation of a vertical trench.

2. Maintain control of gravity drainage along the working surface. Maintain the working surface free of excessive amounts of excavated soils and slurry. Maintain CSWPPP BMPs in accordance with the approved plan.

3.2 EXECUTION SPECIFIC TO GROUNDWATER EXTRACTION TRENCHES

A. The groundwater extraction trenches shall be excavated using the biopolymer slurry method or other approved method for trench shoring.

B. Elevation and Depth Measurements. The CONTRACTOR shall survey the elevation of each trench bottom at least every 20 linear feet. All depth measurements shall be made from the working platform to the bottom of the trench. The CONTRACTOR shall generate and maintain on-site an as-built profile of each extraction trench.

C. Construction Equipment for Groundwater Extraction Trenches. The CONTRACTOR shall furnish all necessary equipment for use on this project. The CONTRACTOR shall obtain and maintain at the jobsite a supply of spare critical replacement parts or backup equipment sufficient to allow the extraction trench construction to proceed with minimum loss of time due to mechanical breakdown or equipment failure

1. Trench Excavation Equipment. Excavation of the groundwater extraction trench shall be accomplished by use of any suitable earth-moving equipment, or combination thereof, such as a hydraulic excavator and/or clamshell, so the trench can be carried to its final depth of cut continuously along the trench alignment. The equipment used for excavation shall be capable of excavating to depths of at least 45 feet below the ground surface. The groundwater extraction trench shall be at least 3-feet wide. The width of the excavating tool shall be equal to or greater than the specified minimum width of the groundwater extraction trench.

2. Slurry Mixing Equipment. The plant for mixing the bio-polymer slurry shall include the necessary equipment including a mixer/reductor capable of producing a suspension of polymer in water plus any pumps, valves, hoes, supply lines, and all other equipment as required to adequately mix and supply slurry to the trench. The plant shall be equipped to accept additives in measured amounts. Storage tanks shall be provided (as needed) to store initially mixed slurry, and to retain a reserve in case substantial slurry loss. Slurry shall be recirculated in the storage tanks during working hours to maintain a homogeneous mix. All slurry for use in the trench shall be prepared using a suitable mixer and no slurry is to be made in the trench.

3. Backfill Placement Equipment.

Equipment for handling and placing backfill may consist of any suitable material handling equipment, such as loaders, conveyors, elevators, or trucks that are capable of delivering the backfill to the trench. Placement of the backfill within the extraction trench shall occur using a tremmie pipe or other approved method.

4. Hauling Equipment. Earthwork related hauling equipment shall consist of pneumatic-tired vehicles with bodies suitable for the material being hauled.

5. Pipe Placement Equipment. Equipment for handling and placing the drain pipe shall operate from the surface of the working platform. The equipment shall develop a live load surcharge that will produce no significant contribution to the instability of the trench. The line and grade of the pipe shall be controlled and measured using survey, laser equipment and/or telltales. The pipe shall be centering between the trench walls using equipment or by special device. The pipe shall be fitted with ballast to ensure that buoyancy of the pipe is overcome and the final position of the pipe in the trench is fixed.

D. Excavation. Trench excavation shall be maintained in an open condition by the BP slurry method or other approved trench stabilization method. Excavation shall be conducted in a manner, which provides for a continuous minimum 3-foot wide trench to the required depth along the centerline of the excavation. The ENGINEER may direct the CONTRACTOR to deepen the trench based on examination of spoils and shall approve the depth of the trench immediately after completion of the excavation. The trench shall be constructed without undue interruption until complete.

E. Slurry Use and Trench Stability. Biopolymer slurry shall be prepared and used by the contractor to control trench width and stability. The level of the slurry shall always be maintained at least 3 feet above groundwater level and shall not be permitted to drop more than 2 feet below the surface of the working platform. The amount and quality of the slurry in the trench shall be maintained at a level sufficient to maintain trench stability. The contractor shall have sufficient personnel and equipment ready to raise the slurry level during construction and on call during nights and weekends. The quality of the slurry shall be maintained at all times until the backfill is in place and the slurry is degraded.

F. Backfilling.

1. Backfilling of the trench shall begin as soon as practical after completion of excavation. The backfill shall be placed into the trench from starting at the trench bottom and working in an upward direction using a tremmie pipe or other approved method. Placement shall occur in a manner that avoids inclusions of BP slurry in the backfill, backfill material segregation, or entrainment of fine particles within the backfill. Backfill placement may also require additional equipment to pre-wet the backfill to permit placement through the tremie pipe and avoid suspending fine particles in the slurry. Backfill shall be placed in a uniform manner using controlled methods around wells/sumps and pipes so that the force of the backfill does not disturb their position.

2. The CONTRACTOR shall place and tamp the drain sand in lift thicknesses of one foot.

3. Once backfilling is complete, the drain sand shall be covered with GCL as shown on the Drawings, and the remainder of the trench shall be backfilled to top of grade. Uncontaminated native soil shall be used to bring the trench to the finished grade elevation. Backfill overlying the GCL shall be placed in 12-inch maximum horizontal loose lifts and compacted by bucket tamping with a hydraulic excavator or other approved methods in a manner that does not displace or damage the underlying GCL.

G. Drain Activation and Extraction Trench Development. After completion of drain sand placement and prior to placement of the GCL and soil cover layers, the BP slurry shall be broken down and water used to flushed through the drain sand in order to remove residual material and to ensure satisfactory permeability of the trench media. During breakdown, the BP slurry shall be degraded to water and a minute amount of residual material. Slurry additives shall be used as necessary to destroy the viscosity of the slurry. Broken-down BP slurry shall be made pH neutral. The CONTRACTOR shall pump and flush the extraction trench until at least five pore volumes of the trench have been circulated utilizing water from a source approved by the ENGINEER.

H. Tolerances. The following tolerances shall apply to the groundwater extraction trench dimensions and construction. The tolerances may vary from the designed values if approved by the ENGINEER:

1. The groundwater extraction trench shall be essentially vertical. The working platform and/or excavating equipment may be leveled to be plumb within 1% of vertical.

2. The depth of the groundwater extraction trench shall be measured or surveyed to within 6 inches of the desired elevation.

3. The excavating tool shall be at least as wide as the design width (3 feet) of the groundwater extraction trench.

4. The groundwater extraction trench shall follow the designed alignment within 2 feet of the designated centerline.

5. Construction will not be permitted when the air temperature is below 20 ^{o}F or when severe weather conditions may compromise the quality of the work.

6. The pipe shall be installed in accordance with the manufacturer's recommendations. The elevation of drain pipe installed shall be within $\pm$ 6 inches of the plan elevation without kinks or bends and the elevation of the pipe and recorded at 10 ft intervals. The grade of the pipe shall be continuously maintained without mounds or sharp bends in the line of the pipe

I. As-Built Profile: An as-built profile of the extraction trench bottom, including descriptions of materials encountered in the trench bottom shall be continuously updated and maintained by the CONTRACTOR. This profile shall indicate extent of excavation and the barrier wall profile at the end of each work day. The profile shall include descriptions of materials encountered during excavation and the depth of the trench bottom. This profile shall indicate extent of excavation and the backfill profile at the beginning and end of each work day or shift, as determined from the soundings. The daily profile drawing shall prepared using AutoCAD or in another digital format as approved by the ENGINEER. The material encountered in the trench and bottom of the trench shall be included in the profile. The CONTRACTOR shall furnish profile drawings, individual and summary records of all observations, measurements, and tests performed, identified with the location and time of testing. These records shall be furnished no later than 24 hours after the tests, measurements and/or observations were made.

J. Treatment for Top of Backfill. After the trench is activated, a geosynthetic clay liner (GCL) shall be placed at the top of the Drain Sand backfill and the remaining trench shall be backfilled to the designated finished elevation. A minimum of three feet of soil shall be placed over the GCL to bring the trench to the designated elevation. Prior to completion the working platform shall be regraded and/or resurfaced to promote drainage.

K. Trench Stability. The CONTRACTOR is responsible for maintaining the stability of the excavated trench for its full-length and depth. The trench will be open for a period of time to allow installation and testing of the piping. The CONTRACTOR shall control surcharges from the excavation and backfilling equipment, trench spoil containment and storage area construction, backfill stockpiles, and other loading situations that may affect trench stability. It is expressly understood that the CONTRACTOR is responsible to ensure that any stockpiles do not affect the stability of the open trench. In the event of failure of the trench prior to completion of backfilling, the CONTRACTOR shall re-excavate the trench and remove all material displaced into the trench and take the necessary corrective actions to prevent further deterioration at no additional expense.

L. Geosynthetic Clay Liner Installation. GCL will be installed as follows:

1. The GCL shall be installed in accordance with Section 02780 – Geosynthetic Clay Liner.

2. Damage to the GCL shall be repaired in accordance with Section 02780 – Geosynthetic Clay Liner.

M. Slotted Drainage Piping Placement. Slotted drainage piping shall be laid in a continuous line starting at the lowest elevation and proceeding to the highest elevation to the extent practical. All drainage piping and appurtenances shall be laid to the lines and grades shown on the drawings. The pipe shall be bedded with six inches of drain sand. Drainage piping shall be placed to the design grade within a tolerance of plus or minus 0.2 foot of that shown on the drawings. The pipe shall be centered between the trench walls. The CONTRACTOR shall verify the elevation of the perforated drainage piping after placement by measuring the crown elevation at 10-foot horizontal intervals.

N. Extraction Trench Cleanout Placement. The cleanouts shall be placed in the trench in such a manner that displacement of the drain line will not occur. The cleanouts shall be constructed as shown on the drawings.

O. Cleanup - The CONTRACTOR shall clean up slurry wastes, debris and leftover materials resulting from the extraction trench construction process on a daily basis or more frequently if necessary. Upon completion of the work, the site shall be cleared of debris which may have accumulated in the execution of the work. Spoils generated by the extraction trench construction shall be disposed of at location on within the Site boundary as designated by the ENGINEER.

3.3 EXECUTION SPECIFIC TO BARRIER WALL CONSTRUCTION

A. Construction Tolerances. Construction tolerances presented in the following table shall apply to the Barrier Wall dimensions shown on the drawings.

Table 3. Construction Tolerances

Item/Material	Allowable Tolerance
Horizontal deviation from Vertical[1]	≤2% of the depth of individual wall panels (0.02 times panel design depth in feet)
Note: 1. Deviations in excess of 2% will be cause for rejection for that portion of the slurry trench. Reconstruction of a slurry panel because of excess deviation from vertical shall not be the cause for additional compensation. The CONTRACTOR shall provide written description on method for verifying vertical tolerance and shall be accepted by the ENGINEER 60 days prior to starting the excavation.	

B. All other Barrier Wall construction shall be to tolerances as approved by the Engineer.

C. GENERAL

1. The Barrier Wall shall be constructed to the elevations, lines, grades, and cross sections shown in the drawings and in accordance with these specifications, unless otherwise directed by the Engineer.

2. Final acceptance of the Barrier Wall will be based on the results of laboratory tests of the samples and Barrier Wall measurements described in this Specification.

D. WORKING SURFACE

1. Barrier Wall construction shall be accomplished from the working platform surface as shown on the drawings. The working platform surfaces as shown on the drawings shall constitute the top of the Barrier Wall for the purpose of measurement and payment.

2. Prepare the temporary working platform surface from which Barrier Wall excavation will be performed. Form the working platform surface at least 4 feet above the groundwater table to facilitate constructability. The grade in direction of trenching is not to exceed 1 percent and the working platform surface shall be level in the direction perpendicular to the trench axis to facilitate excavation of a vertical trench.

3. Maintain control of gravity drainage along the working platform surface. Maintain the working platform surface free of excessive amounts of excavated soils and slurry. Maintain SWPPP BMPs in accordance with the Agency approved plan

E. SLURRY PREPARATION AND PLACEMENT

1. Bentonite-water slurry must be a homogenized, stable, colloidal suspension of bentonite in water. Allow freshly mixed slurry to hydrate in storage ponds or tanks. Agitate or recirculate slurry occasionally in the ponds or tanks until bentonite is fully hydrated, as indicated by stabilized Marsh funnel viscosity readings and homogeneous appearance of the slurry. A minimum of 12 hours is generally required for bentonite to be hydrated after it is mixed with water.

2. Introduce slag-cement-bentonite slurry into the trench when excavation begins. Maintain the slurry level in the trench at least 3 feet above the groundwater table and within 1 foot of the temporary working surface. Minimize dilution of the slurry by surface water. Maintain the slurry level in the trench at all times, including nights, weekends, and holidays.

3. Slurry in the trench must conform to specified requirements at all times.

F. SLURRY TRENCH EXCAVATION

1. The excavation shall begin from the working platform surface and shall provide a vertical (within 2 percent) continuous 36-inch minimum width trench to the required depth along the centerline of the excavation. The equipment shall have a configuration and orientation that reduces live load and dead load surcharge to an amount that will produce no significant contribution to the instability of the trench.

2. No equipment travel over recently excavated and backfilled trench shall be permitted. The slurry trench shall be constructed using the panel method if

construction cannot be completed prior to thickening and initial set of the slurry. The objective will be to avoid hardening of the SCB slurry as defined below. If the CONTRACTOR elects to partially excavate any panel, then the hardened SCB slurry shall be removed and disposed, and replaced with fresh SCB slurry in the trench. During excavation the CONTRACTOR shall rotate the excavator in a direction away from any surface water bodies to avoid spillage of slurry into surface water. During excavation, sufficient time shall be allowed for the excavator bucket to drain excess slurry to minimize slurry loss before loading excavated material into haul trucks.

3. Panel excavations shall be performed in a primary/secondary sequence unless otherwise approved by the Engineer. Unless otherwise approved by the Engineer, secondary panel excavation shall not commence until adjacent primary panels have achieved sufficient unconfined compressive strength to avoid displacement or damaged of the hardened slurry in the primary panels.

4. During excavation, slurry losses will be monitored by tracking slurry additions needed to maintain slurry levels for each panel. An estimate of slurry losses will be recorded for each panel in daily QC reports. Excess slurry losses (as indicated by unusually high slurry makeup requirements needed to maintain slurry levels in the trench) will immediately be brought to the attention of the ENGINEER. Visual monitoring of adjacent surface water bodies or other low-lying areas will commence immediately upon identifying excess slurry losses and be performed continuously throughout the remainder of the panel excavation or until slurry losses diminish to a normal level. If slurry discharge is observed on low-lying ground surfaces, stream banks, or in surface water bodies, the excavation will be discontinued immediately, the trench will be backfilled with native soil, and the slurry will be allowed to harden sufficiently prior to re-excavating the panel. In addition, sediment control measures will be installed immediately upon observing emerging slurry leaks to control migration of slurry and prevent slurry from reaching surface water bodies or other sensitive areas.

5. Bottom cleanout and all soundings for bottom acceptance and bottom cleanup shall be completed for each panel before the end of the work day.

6. SCB slurry in completed panels shall be allowed to harden sufficiently to be self-supporting prior to starting excavation of adjacent panels. Panel joints shall be formed by overlapping the excavation of new panels into the hardened slurry of previously excavated panels by 3 feet at each end.

7. Depth measurements in completed panel excavations shall be made every 20 feet along the Barrier Wall alignment.

    a. The bottom of the slurry trench will be to the grade shown on the drawings or as directed by the ENGINEER. The ENGINEER may direct the CONTRACTOR to modify the depth based on examination of trench cuttings of foundation Material. When the bottom of the wall panel is reached, the bottom surface shall be probed along the trench centerline, using a weighted tape, cable, or other approved device, to determine that the contract depth is obtained. Probing shall be used to determine if there is debris or excessive sediment on the trench bottom that shall be removed prior to acceptance of the panel bottom.

    b. Cleaning of the bottom of the trench shall be achieved by successive light passes of the excavation bucket over the bottom surface until the bucket

returns free of debris or sediments. Removal of material from the walls of the trench shall be avoided during cleaning of the trench bottom.

8. After completion of a panel, fill the barrier wall trench to within 1 foot of the ground surface. After initial setting of the slurry, any free water or disturbed slurry from the top of the wall shall be removed and fresh SCB slurry added to the top of the slurry trench grade. Prior to placement of the trench cover, temporary cover shall be placed to protect the slurry wall and prevent desiccation. The cover shall prevent desiccation prior to the time when the slurry has hardened. If the desiccation requirement is not achieved with the cover materials then plastic sheeting may also be used to cover the trench. Temporary cover material shall be placed over the top surface of a panel within two (2) days after the wall panel is completed. Heavy construction equipment and machinery shall not travel over or adjacent to the slurry trench until the SCB has hardened, and the trench covered in such a manner to withstand such traffic without damage to the backfill.

9. Premature Hardening of SCB Slurry: SCB slurry shall be placed in the trench in a fluid, stable, colloidal state of suspension at the density and quality described in the above paragraphs. In the event that the slurry hardens prematurely, the hardened slurry shall be removed to the full depth and replaced with fresh slurry. Premature hardening resulting in re-excavation shall not be the basis for a claim of extra work and additional compensation. Trial mix results shall determine working time and slurry hardening time per paragraph 1.11B Trial Mixes.

G. Trench Logging and Soil Sampling:

1. The trench logging shall be performed during excavation at both ends of each panel, or at 20 foot length intervals, whichever is less, by the slurry trench logger. The slurry trench logger shall be onsite during excavation operations and describe and classify the excavated soils in accordance with ASTM D2488.

2. Samples of the base of the Barrier Wall shall be taken at minimum interval of 20 feet of excavation, or once per panel, whichever is shorter in length or as directed by the ENGINEER. The materials from the base of the wall shall be described and classified in accordance with ASTM D2488. The date, time, station, depth, and panel number shall be recorded and the sample description and classification performed by the CONTRACTOR'S Trench Logger and confirmed by the ENGINEER. After examining these results, the ENGINEER will either approve the termination of excavation at the minimum excavation shown on the Drawings or require additional or less excavation. If additional excavation is required, additional samples shall be furnished by the CONTRACTOR as specified above. All samples shall be properly identified and labeled, placed in sealed plastic bags, and stored in a location designated by the OWNER.

H. Cleanup: The CONTRACTOR shall continually clean up slurry wastes, debris and leftover materials resulting from the Barrier Wall construction process. Upon completion of the work, the site shall be cleared of debris which may have accumulated in the execution of the work. Spoils generated by the Barrier Wall construction shall be disposed of at a location designated by the OWNER.

I. AS-BUILT PROFILE

1. A recorded profile of the Barrier Wall trench bottom, including descriptions of materials encountered in the trench bottom shall be continuously updated and

maintained by the CONTRACTOR. This profile shall indicate extent of excavation and the barrier wall profile at the end of each work day. The profile shall include descriptions of materials encountered during excavation and the depth of the trench bottom. This profile shall indicate extent of excavation and the slag-cement-bentonite backfill profile at the beginning and end of each work day or shift, as determined from the soundings. The daily profile drawing shall prepared using AutoCAD or in another digital format as approved by the ENGINEER. The material encountered in the trench and bottom of the trench, as described by the approved Slurry Trench Logger, shall be included in the profile. The CONTRACTOR shall furnish profile drawings, individual and summary records of all observations, measurements, and tests performed, identified with the location and time of testing. These records shall be furnished no later than 24 hours after the tests, measurements and/or observations are made.

3.4 QUALITY CONTROL AND QUALITY ASSURANCE

A. Quality Control and Quality Assurance Specific to Groundwater Extraction Trench Construction

1. Quality Control (Extraction Trench)

   a. General. The CONTRACTOR shall be responsible for Quality Control under the direction of the BP Slurry Specialist. Observations, tests, and measurements described in this Section shall be performed throughout the groundwater extraction trench construction.

   b. Trench Dimensions - The CONTRACTOR shall be responsible for demonstrating to the satisfaction of the ENGINEER that the trench is the proper width, continuous and excavated to the specified depth. The depth of the trench shall be sounded in horizontal increments no greater than 20 feet.

   c. Slurry Materials - The CONTRACTOR shall test the slurry at least four times per day. Samples of the slurry shall be obtained from both the trench and the mixing plant for testing. The CONTRACTOR shall supply equipment and personnel for performing these tests.

   d. Drain Sand backfill material - The CONTRACTOR shall submit evidence that the Drain Sand backfill is the specified gradation and quality. Samples shall be obtained and tested at least every 500 tons and submitted to the ENGINEER.

   e. Discharge Header - The CONTRACTOR shall record the station and control the location and verticality of the headers until completely backfilled. The verticality of the headers shall be measured with a carpenter's level to ensure that the headers will permit unimpeded installation of pumps. If the alignment of the header is inadequate, the CONTRACTOR shall install a replacement header using well drilling methods, at no additional cost to the COMPANY.

   f. Drain Pipe - The CONTRACTOR shall verify and record the elevation of the pipe as it is installed. The line and grade of the pipe shall be maintained until completely backfilled.

   g. Records - All quality control records, tests, and inspections shall be documented by the CONTRACTOR and available for review by the ENGINEER. The CONTRACTOR shall record all measurements and test results for submittal to the ENGINEER each day.

2. **Quality Assurance (Extraction Trench)**

The ENGINEER may collect and perform quality assurance testing on the BP slurry using the laboratory and equipment furnished by the CONTRACTOR. The CONTRACTOR shall provide the equipment and laboratory space to ENGINEER on request and these services shall be considered a subsidiary obligation of the BP construction. Testing by the ENGINEER will in no way relieve the CONTRACTOR of the responsibility of performing tests necessary to meet the construction requirements. All routine testing procedures being conducted by the CONTRACTOR shall be available for inspection by the ENGINEER at any time.

B. **Quality Control and Quality Assurance Specific to Barrier Wall Construction**

1. **Quality Control Testing (Barrier Wall)**

a. General - The CONTRACTOR shall be responsible for Quality Control under the direction of the Barrier Wall Specialist. Observations, tests, and measurements described in this Section shall be performed throughout the barrier wall construction. Final acceptance of the Barrier Wall will be based on the trench measurements and from the results of tests performed on samples collected during the barrier wall work.

b. Daily Field Tests - The CONTRACTOR QC personnel shall sample and test the SLCB slurry density. All sampling and testing shall be performed on the production SLCB slurry, in accordance with the approved Preconstruction Testing Plan and Slurry Trench Implementation Plan. The density of the SLCB slurry shall be determined using a mud balance. Density results shall be measured at least twice per day at each wall panel and at the mixing plant

c. Barrier Wall Construction Records - The CONTRACTOR shall maintain daily construction records with results of visual inspections, measurements of progress and wall panel measurements, quantities of materials used, and all field tests. All records shall be incorporated into the Daily QC Report to be provided to the COMPANY by the following work day.

d. Access to Work Site. The CONTRACTOR shall allow time during the excavation cycle for inspection of the trench work by QC personnel and the ENGINEER. The CONTRACTOR shall provide:

1) Suitable means of access to the excavated trench for observation and depth measurement.

2) CONTRACTOR personnel to probe the depth of the trench and allow observation by the COMPANY.

3) A depth measuring device with prominent high visibility markers at 1/2-foot intervals.

e. Barrier Wall Measurements - Within four hours of placement of the SLCB slurry, the trench excavation to the head of the excavation will be sounded at a maximum horizontal interval of 20 feet, or a at least two locations for each panel, whichever results in a greater number of soundings, unless otherwise specified along the trench centerline using a weighted tape, cable or other device approved by the COMPANY.

f. Elevation of Trench Bottom - The CONTRACTOR shall determine the elevation of the trench bottom after the trench has been cleaned in accordance with the specifications. This elevation is subject to approval by the ENGINEER.

g. Mixing Plant Testing - SLCB slurry shall be sampled at the mixing plant at least twice per day. At a minimum, sampling shall occur near the beginning, and near the end of the shift. SLCB slurry shall be sampled and tested in accordance with API RP 13B-1 for slurry density, Marsh funnel viscosity, filtrate loss, and other parameters as needed to verify conformance of the as-mixed slurry with the mix design.

h. SLCB Slurry Trench Sampling- Sampling of the SLCB slurry within the trench shall occur two times per shift for each active panel. One set of samples shall be obtained near the beginning and one set of samples shall be obtained near the end of the shift.

Samples shall be obtained from two different depths within the panel during each trench sampling event: one at a depth within ten feet below the slurry surface, one at a depth within ten feet above the bottom of the trench. Sampling shall be performed in accordance with API RP 13B-1.

Each slurry trench sample shall be tested in accordance with the test method and frequency requirements of Table 4 for Viscosity and density.

i. Trench Sampling for Unconfined Compressive Strength and Hydraulic Conductivity Testing:

1) Two bulk samples of the SLCB slurry will be taken from each panel upon the completion of excavation. The bulk samples shall be taken from a depth within ten feet below the slurry surface, a depth within ten feet above the bottom of the trench.

2) For each bulk sample, plastic molds shall be used to cast cylindrical specimens that are at least 2 inches in diameter and 4 inches in height. The bulk samples shall be poured into the plastic molds and rodded or vibrated to remove trapped air pockets and then sealed. From each bulk sample, the CONTRACTOR shall cast six (6) cylindrical specimens for Quality Control purposes and three cylindrical specimens for the ENGINEER'S Quality Assurance purposes.

3) Each specimen prepared shall be labeled with the location, panel number, sampling date and time, depth, batch number, mixing plant, test type to be performed, and time to be cured before testing.

4) The CONTRACTOR shall then select one of the bulk samples from each panel for testing. The selected sample shall be from an alternate depth than the most recent selected bulk sample depth.

5) The CONTRACTOR shall test the selected Quality Control specimens from the selected bulk sample. Three of the samples shall be tested for hydraulic conductivity and three shall be tested for unconfined compressive strength testing. The three (3) Quality Assurance specimens from that sample shall then be retained and properly stored by the CONTRACTOR for Quality Assurance testing by the ENGINEER.

6) The CONTRACTOR shall store and retain the remaining Quality Control and Quality Assurance specimens from the remaining two bulk samples for possible future testing. The CONTRACTOR shall store the Quality Assurance specimens until they are transported by the ENGINEER's Quality Assurance laboratory.

7) All specimens shall be labeled and stored at a constant temperature (equivalent to average ground temperature), and in a damp environment, until tested or until otherwise directed by the ENGINEER.

j. Unconfined Compressive Strength and Hydraulic Conductivity Testing:

1) Testing Laboratory – An independent testing laboratory, approved by the OWNER, shall perform the CONTRACTOR's laboratory testing including hydraulic conductivity and unconfined compressive tests. The independent Quality Control testing laboratory selected by the CONTRACTOR shall submit a testing program and information relating to equipment used for testing.

2) Unconfined Compressive Strength Testing

a) Unconfined compressive strength testing shall be performed on three of the QC specimens cast from each selected bulk sample.

b) The specimens shall be removed from plastic cylinders in accordance with ASTM D4832.

c) Unconfined compressive strength testing shall be performed in accordance with ASTM D2166. Tests shall be performed on samples cured for 7 days, 14 days, and 28 days.

d) In the event a required specimen is damaged or test parameters are not met by the 28 day specimen, a reserve specimen may be tested at 35 days, or at another elapsed time interval as directed by the ENGINEER. In the event a bulk sample fails to meet testing requirements, testing of specimens from other samples may be required as directed by the ENGINEER. The compressive strength tests shall be performed on specimens from the same randomly selected bulk sample as the hydraulic conductivity test sample.

e) Testing shall be performed in accordance with the test method and frequency requirements of Table 4.

3) Hydraulic Conductivity Testing:

a) Hydraulic conductivity testing shall be performed on three of the QC specimens cast from each selected bulk sample.

b) The specimens shall be removed from plastic cylinders in in accordance with ASTM D4832.

Hydraulic conductivity testing shall be performed in accordance with ASTM D7100. Testing shall be performed on samples cured for 7 days, 14 days, and 28 days. The tests shall be performed in a flexible-walled permeability cell. Testing shall be performed in

accordance with the following parameters: Average effective confining stress = 5 pounds per square inch.

c) Maximum hydraulic gradient = 10.

If samples have a permeability of less than 1×10^{-7} cm/sec such that testing at a hydraulic gradient of 10 is impractical, then a hydraulic gradient of up to 40 will be allowed with the ENGINEER'S review and approval.

Permeate shall be site groundwater provided by the OWNER or synthetically derived to simulate key components (pH and sulfate In the event a required specimen is damaged or test parameters are not met by the 28 day test specimens, a reserve specimen may be tested at 35 days, or at another elapsed time interval as directed by the ENGINEER. In the event a bulk sample fails to meet testing requirements, testing of specimens from other samples may be required as directed by the ENGINEER.

4) Testing shall be performed in accordance with the test method and frequency requirements of Table 4.

Table 4
Minimum Required QC Field and Laboratory Testing Methods and Frequencies – Barrier Wall SLCB Trench Properties

Material	Test Name	Testing Method	Minimum QC Testing Frequency	Additional Requirements
SLCB Slurry				
SLCB Mixing Plant Samples[1]	Density (Unit Weight)	API RP 13B-1 ASTM D 4380	Twice per shift minimum	See Section 3.4.B.1.g
	Viscosity	API RP 13B-1		
	Filtrate Loss	API 13A, 13B		
SLCB Slurry Trench Samples	Density (Unit Weight)	API RP 13B-1 ASTM D 4380	1 test per sample (2 sampling events per shift with three samples per event)	See Section 3.4.B.1.i
	Viscosity	API RP 13B-1		
	Sand Content	API RP 13B-1		
	Filtrate Loss	API-13A 13B		
	Unconfined Compressive Strength	ASTM D 2166 ASTM D4832	1 set of 3 tests (at 7, 14 and 28 days) per sample (1 sampling event per shift)	See Section 3.4.B.1.j
	Hydraulic Conductivity	ASTM D7100	1 test (at 28 days) per sample (1 sampling event per shift)	
Note 1: Other testing to be performed as needed to verify conformance of the as-mixed slurry with the mix design.				

2. Quality Assurance (Barrier Wall). The ENGINEER may collect and perform quality assurance testing on the barrier wall using the laboratory and equipment furnished

by the CONTRACTOR. The CONTRACTOR shall provide the equipment and laboratory space to ENGINEER on request and these services shall be considered a subsidiary obligation of the Barrier Wall construction. Testing by the ENGINEER will in no way relieve the CONTRACTOR of the responsibility of performing tests necessary to meet the construction requirements. All routine testing procedures being conducted by the CONTRACTOR shall be available for inspection by the ENGINEER at any time.

- END OF SECTION -

SECTION 02272 –GEOMEMBRANES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall supply all labor, equipment, materials, and appurtenances for the complete installation of geomembranes as per contract documents.

B. Sufficient geomembrane material shall be furnished to cover all lined areas, including seam overlaps and anchor trenches. One percent shall be added to the length of each panel to allow for shrink and wrinkles. The geomembrane shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation.

1.2 SUBMITTALS

A. The submittals indicated below shall conform to Section 01300 – Contractor Submittals.

B. Prior to installation of geomembrane material, the CONTRACTOR shall submit the following for the ENGINEER's approval:

1. Resin Data, including a certification stating that the resin meets the specification requirements (see Paragraph 2.1.B).

2. Statement certifying that geomembrane materials have been tested and inspected in accordance with Paragraph 1.5.

3. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).

4. Specification sheet stating that the geomembrane meets the specification requirements (see Paragraph 2.1.E)

5. Installation layout drawings showing the proposed panel layout to cover the lined area shown, with proposed size, number, position, and sequence of placing all sheets and indicating the location and direction of all field joints and penetrations. Installation layout drawings shall also show complete details and/or methods for anchoring, field joints, seals at existing structures, etc.

6. Four 8-inch x 10-inch samples of the material proposed for the lining

7. A Statement of Qualifications for the geomembrane manufacturer and installation contractor with sufficient detail to satisfy the experience requirements of Paragraph 1.3.

8. Installation Contractor's Quality Control Plan.

C. Placement of geomembrane material shall not commence until the submittals required in Paragraph 1.2 B have been approved by the ENGINEER.

D. Upon completion of geomembrane installation, the CONTRACTOR shall submit the following:

1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.

2. Material and installation warranties

3. As-built drawings showing actual geomembrane placement and seams including complete details.

1.3 QUALIFICATIONS

A. **Qualifications of Manufacturer:** The manufacturer shall have at least five years continuous experience in manufacturing polyethylene geomembrane and/or experience totaling not less than 5 million square feet of manufactured polyethylene geomembrane.

1. The following manufacturers are approved by the COMPANY:

   a. Agru America

   b. GSE Environmental

B. **Qualifications of Installation Contractor:** The installation contractor shall be the manufacturer, or shall be trained to install the manufacturer's material, and shall have experience of not less than 3 projects and not less than 1,000,000 square feet of successfully installed polyethylene geomembrane.

1. Field Installation Supervisor: Installation shall be performed under the constant direction of a Field Installation Supervisor who shall remain on site and be responsible, throughout the geomembrane installation, for layout, seaming, testing, repairs, and all other activities by the Installer. The Field Installation Supervisor shall have installed or supervised the installation of not less than 1,000,000 square feet of polyethylene geomembrane.

2. Master Seamer: Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor) who has seamed not less than 1,000,000 square feet of polyethylene geomembrane, using the same type of seaming apparatus specified for this project. The Field Installation Supervisor and/or Master Seamer shall be present whenever seaming is performed.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

ASTM D1004	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1505	Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1603	Test Method for Carbon Black in Olefin Plastics
ASTM D3895	Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D4218	Standard Test Method for Determination of Carbon Black in Polyethylene Compounds
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D5596	Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D5994	Standard Test Method for Measuring Core Thickness of Textured Geomembranes
ASTM D6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
ASTM D6693	Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
ASTM D7240	Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)
GRI GM 13	Test Methods, Test Properties, and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
GRI GM 14	Standard Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
GRI GM 17	Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.5 QUALITY CONTROL

A. All WORK shall be constructed, monitored and tested in accordance with the requirements of the Installation Contractor's Quality Control Plan (CQP), which shall be submitted in accordance with Paragraph 1.2 B.

B. The CONTRACTOR shall be aware of all activities outlines in the CQP, and the CONTRACTOR shall account for these activities in the construction schedule. No additional costs to the COMPANY shall be allowed by the CONTRACTOR as a result of the performance of the CQP activities.

1.6 QUALITY ASSURANCE

A. The COMPANY shall conduct quality assurance monitoring and testing of the geomembrane installation under the direction of the ENGINEER.

1.7 WARRANTY

A. The CONTRACTOR shall procure and provide copies of the manufacturer's warranty for the geomembrane system and all appurtenances. The warranty shall cover materials for a period of 5 years and workmanship for a period of 1 year from the date of the COMPANY's acceptance of the project. The warranty must specifically include effects of ultraviolet irradiation and the normal wear and aging associated with installation in the environmental conditions similar to eastern Washington. The warranty shall not be prorated, but shall be a full replacement value warranty. Should defects or premature loss of use within the scope of the above warranty occur, repair and/or replacement of damaged material shall be performed by the CONTRACTOR at no cost to the COMPANY.

PART 2 -- PRODUCTS

2.1 SCHEDULE OF GEOMEMBRANES

TABLE 1 – SCHEDULE OF GEOMEMBRANES

Application	Geomembrane
West Water Management Pond Primary and Secondary Liner	60-mil HDPE, Textured (Double Side)
South Water Management Pond Primary and Secondary Liner	60-mil HDPE, Textured (Double Side)
Decontamination Area Pond Liner	60-mil HDPE, Textured (Double Side)
Pit 3/Pit 4 Subwaste Liner	80-mil HDPE, Smooth
Pit 3/Pit 4 Cover Geomembrane	40-mil LLDPE, Textured (Double Side)
Area 5 Cover Geomembrane	40-mil LLDPE, Textured (Double Side)
Mine Waste Dewatering Risers	See Section 02575

2.2 APPROVED GEOMEMBRANE PRODUCTS

A. 60-mil HDPE, Textured (Double Side)

1. GSE HD Textured

2. Agru America HDPE Super Gripnet Liner

B. 80-mil HDPE, Smooth

1. GSE HD Smooth

2. Agru America Smooth HDPE Liner

C. 40-mil LLDPE, Textured (Double Side)

1. GSE UltraFlex Textured

2. Agru America LLDPE Super Gripnet Liner

2.3 "OR EQUAL" PRODUCTS

A. CONTRACTOR shall provide the COMPANY approved geomembrane products listed in Paragraph 2.2, or provide "or equal" products that meet the requirement indicated below.

B. **LLDPE Interface Shear Strength**: LLDPE geomembrane products shall have a minimum interface friction angle of 23 degrees between the LLDPE geomembrane and the geocomposite drainage layer. CONTRACTOR shall provide documentation of interface friction angle testing for review and approval by the ENGINEER.

C. **Materials:** The material shall be black, coextruded high-density polyethylene (HDPE) geomembrane or black, coextruded linear low density polyethylene (LLDPE) geomembrane as listed below and as shown on the Contract Drawings.

D. The geomembrane shall be manufactured from new, first quality resin produced in the United States and shall be compounded and manufactured specifically for producing geomembrane. Natural resin (without carbon black) shall meet requirements listed in Table 2:

TABLE 2 – RESIN PROPERTIES

Property	Test Method	HDPE Value	LLDPE Value
Density (g/cm3)	ASTM D 1505	$\geq$0.932	$\leq$0.926
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	$\leq$1.0	$\leq$1.0
OIT (minutes)	ASTM D 3895 (1 atm/200^{0}C)	$\geq$100	$\geq$100

Reprocessed materials shall not be acceptable. No post-consumer resin of any type shall be added to the formulation.

E. **Fabrication:** The geomembrane shall have a minimum 20-foot seamless width. The geomembrane shall be supplied in rolls with labels identifying the thickness of material, the length and width of the roll, the lot and roll numbers, and the name of the manufacturer.

F. Properties:

1. The geomembrane shall not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.

2. The geomembrane shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

3. The finished product shall be uniform in color, thickness, and surface texture and shall meet the **minimum** average specifications listed in Table 3.

G. Manufacturer Quality Control

1. All resins and additives used in the fabrication of the geomembrane shall be sampled, tested, and approved by the MANUFACTURER before being eligible for use.

2. All roll goods shall be inspected for defects and impurities. Geomembrane thickness shall be measured for each roll.

3. All geomembrane sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Paragraph 2.1.E and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

4. The geomembrane shall be tested by the MANUFACTURER for the listed properties provided in the tables in Part 2. A log shall be maintained showing the testing date, time and results. Any rolls not meeting the visual inspection or requirements of the specification shall be rejected.

5. Certification that the material has been inspected, tested, and meets all requirements shall be submitted to the ENGINEER. Test results shall be made available to the ENGINEER upon request.

TABLE 3 – GEOMEMBRANE PROPERTIES

Tested Property	Test Method	Frequency	Minimum Average Value		
			Textured HDPE	Smooth HDPE	Textured LLDPE
Thickness, (minimum average) mil (mm); Lowest individual reading (-10%)	ASTM D 5994	every roll	60 (1.50) 54 (1.35)	80 (2.00) 72 (1.80)	40 (1.00) 36 (0.90)
Density, g/cm^3	ASTM D 1505	200,000 lb	0.94	0.94	0.94
Tensile Properties (each direction) Strength at Yield, lb/in-width (N/mm) Strength at Break, lb/in-width (N/mm) Elongation at Yield, % Elongation at Break, %	ASTM D 6693, Type IV Dumbell, 2 ipm G.L. 1.3 in (33 mm) G.L. 2.0 in (51 mm)	20,000 lb	126 (22) 90 (16) 12 100	168 (29) 304 (53) 12 700	N/A 60 (11) N/A 250
Tear Resistance, lb (N)	ASTM D 1004	45,000 lb	42 (187)	56 (249)	22 (100)
Puncture Resistance, lb (N)	ASTM D 4833	45,000 lb	90 (400)	144 (640)	44 (200)
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)	Note(1)
Asperity Height, mil (mm)	ASTM D 7466	second roll	18 (0.45)	N/A	18 (0.45)
Notched Constant Tensile Load(2), hr	ASTM D 5397, Appendix	200,000 lb	300	300	N/A
Oxidative Induction Time, min	ASTM D 3895, 200° C; O_2, 1 atm	200,000 lb	>100	>100	>100

NOTES:
(1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
*Modified

PART 3 -- EXECUTION

3.1 STORAGE

A. After delivery, all roll goods shall be stored so as to be protected from puncture, dirt, grease, moisture and excessive heat. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface and should not be stacked more than two rolls high.

3.2 INSTALLATION

A. **General:** The geomembrane shall be installed in accordance with the following specifications and approved procedures submitted with the shop drawings.

B. Subgrade Preparation and Inspection:

1. Surfaces to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the membrane with no sudden, sharp, or abrupt changes or break in grade.

2. The CONTRACTOR shall, on a daily basis, approve the surface on which the geomembrane shall be installed. The surface shall be smooth, clean and free of foreign material, sharp objects, frost, standing water or excessive moisture. Installation shall proceed only if the surface conditions are found satisfactory.

C. Equipment:

1. Welding equipment and accessories shall meet the following requirements:

a. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.

b. An adequate number of welding apparati shall be available to avoid delaying work.

c. Power source must be capable of providing constant voltage under combined line load.

D. Deployment:

1. Each panel shall be assigned a simple and logical identifying code.

2. The coding system shall be subject to approval by the ENGINEER and shall be determined at the job site.

3. The CONTRACTOR shall visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

4. Deployment of geomembrane panels shall be performed in a manner that shall comply with the following guidelines:

a. Geomembranes shall be installed according to site-specific specifications and MANUFACTURER recommendations.

b. The geomembrane shall be placed in such a manner as to assure minimum handling.

c. Only those sheets of material which can be anchored and sealed together that same day shall be unpackaged and placed in position.

d. Deployment of the geomembrane shall proceed between ambient temperatures of 32° F and 104° F. Placement can proceed below 32° F only after it has been verified by the ENGINEER that the material can be seamed according to the specification. Placement shall not be done during any precipitation, in the presence of excessive moisture (fog, rain, dew) or in the presence of excessive winds. In areas where wind is prevalent, installation should be started at the upwind side of the project and proceed downwind. The leading edge of the geomembrane shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

e. Geomembrane shall be unrolled using methods that shall not damage geomembrane and shall protect underlying surface from damage (spreader bar, protected equipment bucket).

f. Ballast (commonly sandbags) which shall not damage geomembrane shall be placed on geomembrane to prevent wind uplift.

g. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking shall not be permitted on the geomembrane.

h. Heavy vehicular traffic shall not be allowed directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 8 psi.

i. Geomembrane shall be protected in areas of heavy traffic by placing protective cover over the geomembrane

5. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

E. Lining sheets shall be closely fitted and sealed around inlets, outlets, and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor or as approved by the ENGINEER. All piping, structures, and other projections through the lining shall be sealed with approved sealing methods.

F. Field Seams:

1. Seams shall meet the following requirements:

a. To the maximum extent possible, seams shall be oriented parallel to line of slope, i.e., down and not across slope.

b. The number of field seams in corners, odd-shaped geometric locations and outside corners shall be minimized.

c. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

d. Be designated using a sequential seam numbering system compatible with panel numbering system, and that is agreeable to the ENGINEER.

e. Seam overlaps shall be aligned to be consistent with the requirements of the welding equipment being used.

2. During welding operations provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

3. Extrusion Welding

a. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.

b. Clean geomembrane surfaces by disc grinder or equivalent.

c. Purge welding apparatus of heat-degraded extrudate before welding.

4. Hot Wedge Welding

a. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.

b. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.

c. Protect against moisture build-up between sheets.

5. Trial Welds

a. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

b. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

c. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

d. Cut four, one-inch wide by six-inch long test strips from the trial weld.

e. Quantitatively test specimens for peel adhesion, and then for shear strength.

f. Trial weld specimens shall pass when the results shown in the Table 3 are achieved in both peel and shear test:

TABLE 4 – SEAM PROPERTIES

Property	Test Method	Minimum Values		
		60-mil HDPE	80-mil HDPE	40-mil LLDPE
Peel Strength (fusion) ppi (kN/m) (1), (2)	ASTM D6392	98 (17.2)	130 ()	48 ()
Peel Strength (extrusion) ppi (kN/m) (1), (2)	ASTM D6392	78 (13.7)	104 ()	50 ()
Shear Strength (fusion and ext.) ppi (kN/m)	ASTM D6392	121 (21.2)	162 ()	60 ()

Notes:
1) The break, when peel testing, occurs in the geomembrane material itself, not through peel separation (FTB).
2) The break is ductile.

g. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

h. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

i. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the geomembrane installation. CONTRACTOR shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

j. Defects and Repairs

1) Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

2) Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

G. **Anchor Trench:** The geomembrane shall be placed and secured in an earth anchor trench as indicated in the Contract Drawings. The installer shall coordinate with the earthwork contractor regarding excavation and backfilling of the anchor trench. Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. If damage occurs, it shall be repaired prior to backfilling.

3.3 SEAM TESTING

A. Field Destructive Testing

1. Destructive seam tests shall be performed to evaluate bonded seam strength. The frequency of sample removal shall be one sample per 500 linear feet of seam. Location of the destructive samples shall be selected by the ENGINEER. Field testing shall take place as soon as possible after completion of the seam.

    a. At the sole discretion of the ENGINEER, destructive seam tests may be reduced in frequency by following the procedures of GRI GM 14.

2. Sample labeling shall be the responsibility of the ENGINEER and shall include test number, seam number, seaming machine number, job number, date welded, and welding tech number.

3. The samples shall be approximately 12 inches x 25 inches. The samples shall then be cut into two samples approximately 12 inches x 12 inches: one for field testing and one for archiving or independent testing.

4. The sample for field testing shall have ten coupons cut and be tested with a tensiometer adjusted to a pull rate as shown below. The strength of four out of five specimens shall meet or exceed the values below, and the fifth value must meet or exceed 80% of the value below.

    a. Seam must exhibit film tear bond (FTB). Welds shall have less than 25% incursion into the weld.

    b. Peel and shear values shall meet or exceed the values in Table 4 (at 2 inches/minute)

5. All destructive weld test data shall be logged by the ENGINEER.

6. If a test fails, additional samples shall be cut, approximately ten feet on each side of the failed test, and retested. This procedure shall be repeated until a sample passes. Then the area of the failed seam between the two tests that pass shall be capped or reconstructed.

B. Non-Destructive Testing

1. The CONTRACTOR shall non-destructively test all seams their full length for continuity using an air pressure or vacuum test.

2. Air Pressure Testing

    a. Air pressure testing shall be performed on all seams welded with a double seam fusion welder.

    b. The equipment used for air pressure testing shall consist of an air tank or pump capable of producing a minimum of 35 psi and a sharp needle with a pressure gauge attached to insert into the air chamber.

    c. Both ends of the seam to be tested shall be heated and squeezed together.

    d. The needle with gauge shall be inserted into the air channel and the channel shall be pressurized to 30 psi.

    e. If the pressure in the air channel drops by more than 3 psi over a period of five minutes, then the seam has failed.

f. If the seam fails the air pressure test, the leak shall be located and the area cut away. Air pressure testing shall be performed on the remaining portions of the seam until all portions of the seam pass the test.

g. The area cut away shall be repaired with a patch. The patch shall be tested according to the procedures outlined below for vacuum testing.

3. Vacuum Testing

a. Vacuum testing shall be performed on all seams welded with an extrusion welder.

b. The equipment used for vacuum testing shall consist of a vacuum pumping device, a vacuum box, and a foaming agent in solution.

c. The section of seam to be tested shall be wetted with a foaming agent and the vacuum box shall be placed over the wetted area. Air shall be evacuated from the vacuum box until a seal between the box and the geomembrane has been formed.

d. The minimum vacuum shall be equivalent to 5 psi (10 inches of mercury).

e. If fusion welded seams are being tested, the overlap flap must be cut off prior to testing.

f. The seam shall be observed through the viewing window for bubbles emitting from the seam.

g. If no bubbles are observed, the box shall be moved on to the next area for testing. If bubbles are observed, the area of the leak shall be marked for repair.

h. After completion of repairs, the repair seam shall be retested according to the requirements of paragraph 3.3B.

3.4 INSPECTION AND REPAIR

A. **Field Inspection:** All seals to penetrations as well as all seams and non-seam areas of the geomembrane shall be inspected for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection. Each suspect location shall be non-destructively tested as appropriate and repaired accordingly.

B. Repair Procedures:

1. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

2. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

3. CONTRACTOR shall be responsible for repair of defective areas.

4. Agreement upon the appropriate repair method shall be decided between ENGINEER and CONTRACTOR by using one of the following repair methods:

a. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

b. Abrading and Re-welding- Used to repair short section of a seam.

c. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

d. Capping- Used to repair long lengths of failed seams.

e. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.

f. Remove the unacceptable seam and replace with new material.

5. The following procedures shall be observed when a repair method is used:

a. All geomembrane surfaces shall be clean and dry at the time of repair.

b. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

c. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

6. Repair Verification

a. Number and log each patch repair (performed by ENGINEER).

b. Non-destructively test each repair using methods specified in this Specification.

7. The CONTRACTOR shall also keep detailed record drawings showing the location, size, type, and frequency of all repairs made during the installation of the geomembrane. These record drawings shall be updated by the CONTRACTOR on a daily basis and submitted to the COMPANY upon completion of the project. Inspection of these record drawings shall be made available to the ENGINEER or the COMPANY for verification and review at any time during the construction period.

3.5 ACCEPTANCE

A. The CONTRACTOR shall retain all ownership and responsibility for the geomembrane system until acceptance by the ENGINEER. Final acceptance shall occur when the following conditions are met:

1. Installation is finished.

2. Verification of the adequacy of all field seams and repairs is complete.

3. Submittals required in Paragraph 1.2 D have been accepted by the ENGINEER.

- END OF SECTION –

SECTION 02273 – RIPRAP

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide riprap, including associated earthwork, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

ASTM D 5240	Standard Test Method for Testing Rock Slabs to Evaluate Soundness of Riprap by use of Sodium Sulfate or Magnesium Sulfate
ASTM D 5519	Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D 6825	Standard Guide for Placement of Riprap Revetments
ASTM C 88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 535	Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
AASHTO T 85	Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
AASHTO T 210	Method of Test for Aggregate Durability Index.

1.3 CONTRACTOR SUBMITTAL

A. Furnish submittals in accordance with Section 01300 – Contractor Submittals.

B. Proposed source of riprap and riprap bedding.

C. Test Certifications from a qualified testing agency shall be submitted prior to acceptance of the rock source to verify the conformity to the requirements of the Contract Documents.

PART 2 -- PRODUCT

2.1 TEMPORARY RIPRAP AND FILTER IN CONTAMINATED AREAS

A. Riprap and filter for temporary use within contaminated areas may be processed material from the Hillside Waste Rock Pile or from other suitable sources.

1. South Pond Spillway riprap and filter layers.

2. Other temporary erosion protection within contaminated areas

2.2 PARTICLES FOR RIPRAP

A. Particles shall be graded in size to produce a reasonably dense mass. Riprap shall consist of dense, natural rock fragments. Rock pieces shall be angular or sub-angular rock fragments with at least 90 percent of the face area freshly broken. Particles shall be resistant to weathering and to water action; free from overburden, spoil, shale, and organic material; and shall meet the gradation requirements below. Shale and particles with shale seams are not acceptable.

B. Riprap shall conform to the size types as follows:

1. Type 0 (3-inch Average Size):

D-*sizes* Percent Passing	**Minimum Diameter (in)**	**Maximum Diameter (in)**
d_{15} 15% Passing	1.0	2.0
d_{50} 50% Passing	3.0	3.5
d_{85} 85% Passing	3.5	4.0
d_{100} 100% Passing	N/A	5.0

2. Type I (6-inch Average Size):

D-*sizes* Percent Passing	**Minimum Diameter (in)**	**Maximum Diameter (in)**
d_{15} 15% Passing	2.5	3.0
d_{50} 50% Passing	5.5	8.0
d_{60} 60% Passing	6.0	9.5
d_{85} 85% Passing	8.0	12.5
d_{100} 100% Passing	NA	14.5

3. Type II (9-inch Average Size):

D-*sizes* Percent Passing	**Minimum Diameter (in)**	**Maximum Diameter (in)**
d_{15} 15% Passing	4.7(5)	5.6(6)
d_{50} 50% Passing	9.0	10.8(11)
d_{60} 60% Passing	10.2(10)	12.3(12.5)
d_{85} 85% Passing	13.3(13.5)	16.0
d_{100} 100% Passing	NA	18.2(18)

4. Type III (12-inch Average Size):

D-*sizes* Percent Passing	**Minimum Diameter (in)**	**Maximum Diameter (in)**
d_{15} 15% Passing	6.3 (6)	7.5(8)
d_{50} 50% Passing	12.0	14.4 (14.5)
d_{60} 60% Passing	13.6(13.5)	16.4(16.5)
d_{85} 85% Passing	17.7(18)	21.3(21.5)
d_{100} 100% Passing	NA	24.2(24)

5. Type V (24-inch Average Size):

D-*sizes* Percent Passing	**Minimum Diameter (in)**	**Maximum Diameter (in)**
d_{15} 15% Passing	15.0	23.0
d_{50} 50% Passing	23.0	28.0
d_{60} 60% Passing	25.0	30.0
d_{85} 85% Passing	31.0	37.0
d_{100} 100% Passing	NA	48.0

C. The greatest dimension of 50 percent of the particles shall be at least two-thirds but not more than 1-1/2 times the diameter of the average size. Neither the breadth nor thickness of any piece of riprap shall be less than one-third its length. Material shall be of shapes which will form a stable protection structure of required depth. Rounded boulders or cobbles shall not be used.

D. Particles shall consist of durable, sound, hard, angular rock meeting the following requirements for durability absorption ratio, soundness test, and abrasion test:

Characteristics Test	**Criterion**	**Standard**
Sodium Sulfate Soundness	<10% weight loss after 5 cycles	ASTM D5240
Bulk Specific Gravity	≥2.5	ASTM C127
Absorption	≤ 2%	ASTM C127
Durability Index	≥ 51	ASTM C127
Durability Adsorption Ratio	≥ 10	ASTM C127
Hardness	Hardest available (comparative)	ASTM D5873
LA Abrasion Durability	≤ 20% loss	ASTM C535
Point Load Index Strength	Hardest available (comparative)	ASTM D5731

E. Control of gradation shall be by visual inspection. The CONTRACTOR shall furnish a sample of the proposed gradation of at least 5 tons or 10 percent of the total riprap

weight, whichever is less. If approved, the sample may be incorporated into the finished riprap at a location where it can be used as a frequent reference for judging the gradation of the remainder of riprap.

F. The acceptability of the stones and gradation will be determined by the ENGINEER prior to placement. Any difference of opinion between the ENGINEER and the CONTRACTOR shall be resolved by dumping and checking the gradation of two random truckloads of particles. Arranging for and the costs of mechanical equipment, a sorting site, and labor needed in checking particles and gradation shall be the CONTRACTOR's responsibility.

2.3 RIPRAP FILTER FABRIC

A. Riprap filter fabric shall conform to the requirements of Section 02274 - Geotextiles

2.4 FILTER MATERIAL

A. Filter material shall be clean and free from organic matter. It shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall conform to the following gradation:

1. Type I

Size	Percentage Passing
¼-inch	70-100
No. 4	50-100
No. 7	25-55
No. 16	0-15

2. Type II

Size	Percentage Passing
2-inch	80 – 100
1 1/4-inch	35-100
1-inch	20-70
¾-inch	5-45
½-inch	0-15

3. Type III

Size	Percentage Passing
3-inch	70-100
2-inch	40-70
½-inch	0-15

2.5 SURFACE PREPARATION

A. Surfaces to receive riprap shall be smooth and firm, free of brush, trees, stumps, and other objectionable material identified by the ENGINEER, and shall be brought to the line and grade indicated.

B. If a boulder is encountered during excavation of areas where large riprap is to be placed, the CONTRACTOR shall excavate around the boulder. If the boulder is larger than the largest allowable stone size for that area, the CONTRACTOR shall break up the boulder to an acceptable size or remove it entirely.

C. Prior to placement of the geomembrane, the surface shall be prepared to a smooth condition free of debris, depressions, or obstructions which may damage the geomembrane. The geomembrane shall be overlapped a minimum of 2-feet at longitudinal and transverse joints. Upstream sheets shall overlap downstream sheets. For slope placement, each strip shall overlap the next downhill strip. The geomembrane shall be anchored using key trenches or aprons at the crest and toe of the slope. In no instance shall the geomembrane be left exposed to sunlight longer than 7 days. Overexposed geomembrane shall be removed and replaced.

2.6 PLACEMENT OF FILTER BLANKET

A. Area of riprap placement shall be excavated to the bottom of the filter blanket as indicated and in accordance with Section 02200 – Earthwork. After the excavation has been completed, the top 12-inches of exposed surface shall be scarified, brought to optimum moisture content, and compacted to 95 percent of relative density. The finished grade shall be even, self-draining, and in conformance with the slope of the finished grade.

B. Filter material shall be placed, spread, and compacted in lifts of a minimum of 6-inches. Where filter material is indicated to be 12-inches thick or greater, lift placement shall not exceed 12-inches.

C. The CONTRACTOR shall remove any portion of the filter blanket that has been disturbed to the degree that the layers become mixed. Replace the removed portion with the required sizes.

D. No filter material is required if riprap is placed directly on bedrock.

2.7 PLACEMENT OF RIPRAP

A. Placement of riprap shall begin at the toe of the slope and proceed up the slope. The particles may be placed by dumping and may be spread by bulldozers, excavators, or other suitable equipment as long as the underlying material is not displaced. Particles shall be placed so as to provide a minimum of voids. Smaller particles shall be uniformly distributed throughout the mass. Sufficient hand work shall be done to produce a neat and uniform surface, true to the lines, grades, and sections indicated.

B. Provide laborers during placement for rearrangement of loose rock fragments, ”chinking” of void spaces and hand placement as necessary to create a well-keyed and stable layer of rock riprap.

C. Where riprap is placed over a GCL or Geotextile, the riprap shall be placed so as to avoid damage to the GCL or Geotextile. Particles shall not be dropped from a height greater than 3-feet, nor shall large particles be allowed to roll downslope.

2.8 GROUTED RIPRAP

A. After wetting the riprap, the remaining volume of the interstices shall be filled with a well-mixed, relatively high slump grout composed of 1 part Portland cement and 3 parts of sand, mixed to a workable consistency. The grout shall be injected using a grout pipe.

The grout shall be kept wet by sprinkling or covering with wet material for at least 3 Days. The grout shall be protected from stream water or any other disturbance during this curing period, and shall not be placed in freezing weather or when conditions are unfavorable.

- END OF SECTION -

SECTION 02274 - GEOTEXTILES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide and install geotextiles as shown on the Drawings.

B. **Definitions:** The following definitions apply to the WORK of this Section:

1. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.

2. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile provided.

3. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile provided.

4. Nondestructive Sample: Sample representative of finished geotextile, prepared for testing without destruction of geotextile.

5. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

6. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.

7. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.

8. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following standards are referenced in this Section:

ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D 4354	Standard Practice for Sampling of Geosynthetics for Testing ASTM D 4595 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D 4759	Standard Practice for Determining the Specifications Conformance of Geosynthetics
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4884	Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Sewn Geotextiles
ASTM D 4886	Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method)
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. Prior to material delivery to project site, the CONTRACTOR shall provide the ENGINEER with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.

PART 2 -- PRODUCTS

2.1 NONWOVEN GEOTEXTILE

A. Nonwoven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.

B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.

C. **Minimum Nominal Weight per Square Yard:**

Application	Geotextile
Liner Cushion (Pit 3 and Pit 4)	32 oz/sy
Riprap Filter Fabric and Drainage Channel Applications	16 oz/sy
Drain Gravel/Overliner Protection Separation Fabric (Pit 3 and Pit 4 Waste Rock Dewatering Sump)	8 oz/sy

D. **Geotextile Edges:** Selvaged or finished to prevent outer material from separating from sheet.

E. **Unseamed Sheet Width:** Minimum 12-feet.

F. **Physical Properties:** Conform to requirements below.

Tested Property	Test Method	Frequency	MARV		
			32 oz/sy	16 oz/sy	8 oz/sy
Mass per Unit Area, oz/sy	ASTM D 5261	90,000 sf	32	16	8
Grab Tensile Strength	ASTM D 4632	90,000 sf	600	390	220
Grab Elongation, %	ASTM D 4632	90,000 sf	50	50	50
CBR Puncture Strength, lb	ASTM D 6241	90,000 sf	2,287	1,125	575
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000 sf	270	150	90
UV Resistance, % retained after 500 hrs	ASTM D4355	90,000 sf	70	70	70
Apparent Opening Size, Sieve No. (mm)	ASTM D 4491	540,000 sf	N/A	100 (0.150)	80 (0.180)
Water Flow Rate, gpm/sf	ASTM D 4491	540,000 sf	N/A	45	95
Permitivity, sec^{-1}	ASTM D 4491	540,000 sf	N/A	0.60	1.30

2.2 SEWING THREAD

A. Sewing thread shall be polypropylene, polyester, or Kevlar thread with durability equal to or greater than durability of geotextile sewn.

2.3 SECURING PINS

A. Securing pins shall be steel rods or bars conforming to the following:

1. 3/16-inch diameter.
2. Pointed at one end; head on other end, sufficiently large to retain washer.
3. Minimum Length: 12-inches.

B. Steel washers for securing pins shall be:

1. Outside Diameter: Not less than 1-1/2 inches.
2. Inside Diameter: 1/4-inch.
3. Thickness: 1/8-inch.

C. Steel Wire Staples

1. U-shaped.

2. 10-gauge.

3. Minimum 6-inches long.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll with sufficient information attached to identify manufacturer and product name or number.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in a way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

3.2 LAYING GEOTEXTILE

A. Notify the ENGINEER whenever geotextiles are to be placed. Geotextile shall not be placed prior to obtaining ENGINEER's approval of the underlying surface.

B. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.3 ORIENTATION ON SLOPES

A. Orient geotextile with long dimension of each sheet parallel to direction of slope.

B. Geotextile may be oriented with long dimension of sheet transverse to direction of slope only if sheet width, without unsewn seams, is sufficient to cover entire slope and anchor trench and extend at least 18-inches beyond the toe of slope.

3.4 JOINTS

A. Unseamed Joints

1. Unseamed joints shall be overlapped to the following dimensions unless otherwise indicated:

a. Foundation/Subgrade Stabilization: Minimum 18-inches.

b. Riprap: Minimum 18-inches.

c. Drain Trenches: Minimum 18-inches, except overlap shall equal trench width if trench width is less than 18-inches.

d. Other Applications: Minimum 12-inches.

B. Sewn seams shall be used wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by ENGINEER, also may be used instead of overlap at joints for applications that do not require stress transfer.

1. Seam efficiency shall be minimum 70 percent, verified by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile provided. Test according to ASTM D 4884.

2. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.

3. Stitch Count: Minimum 3 to maximum 7 stitches per inch.

4. Stitch Type: Double-thread chainstitch, Type 401, Federal Standard No. 751a.

5. Stitch Location: 2-inches from geotextile sheet edges, or more if necessary to develop required seam strength.

6. Sewing Machines: Capable of penetrating 4 layers of geotextile.

3.5 SECURING GEOTEXTILE

A. Secure geotextile during installation as necessary with sand bags or other means approved by ENGINEER.

B. Securing Pins

1. Insert securing pins with washers through geotextile, midway between edges of overlaps and 6-inches from free edges.

2. Spacing

Slope	Maximum Pin Spacing, feet
Steeper than 3:1	2
3:1 to 4:1	3
Flatter than 4:1	5

3. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.

4. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

3.6 PLACING PRODUCTS OVER GEOTEXTILE

A. Notify ENGINEER before placing material over geotextile. Do not cover installed geotextile prior to receiving approval of the geotextile installation from the ENGINEER.

B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as indicated below.

3.7 INSTALLING GEOTEXTILE IN TRENCHES

A. Place geotextile in a way that will completely envelop granular drain material to be placed in trench and with indicated overlap at joints. Overlap geotextile in direction of

flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.

B. After granular drain material is placed to grade, fold geotextile over top of granular drain material, unless otherwise indicated. Maintain overlap until overlying fill or backfill is placed.

3.8 SILT FENCE APPLICATIONS

A. Install geotextile in one piece or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in toe trench.

B. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.

C. Securely fasten geotextile to a wire mesh backing and each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.

D. Promptly repair or replace silt fence that becomes damaged.

3.9 REPAIRING GEOTEXTILE

A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile. Repair damaged geotextile by placing patch of undamaged geotextile over damaged area plus at least 18-inches in all directions beyond damaged area. Remove interfering material as necessary to expose damaged geotextile for repair. Secure patches with pins and washers, as indicated above for securing geotextile, or by other means approved by ENGINEER.

3.10 REPLACING CONTAMINATED GEOTEXTILE

A. Protect geotextile from contamination that would interfere with its intended function. Remove and replace contaminated geotextile with clean geotextile as directed by ENGINEER.

- END OF SECTION –

SECTION 02275 - GEONET

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall supply all labor, equipment, materials, and appurtenances for the complete installation of geonet as per contract documents.

B. Sufficient geonet material shall be furnished to cover all lined areas, including seam overlaps and anchor trenches as shown on the Drawings. One percent shall be added to the length of each panel to allow for shrink and wrinkles. The geonet shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation.

1.2 SUBMITTALS

A. Prior to ordering geonet material, the CONTRACTOR shall submit the following for the ENGINEER's approval:

1. Certification stating that the geocomposite meets the specification requirements (see Subsection 2.1)

2. A list of similar projects completed in which the manufactured material has been successfully used. The list shall provide sufficient detail to satisfy the experience requirements of Paragraph 1.3

1.3 QUALIFICATIONS

A. **Qualifications of Manufacturer:** The manufacturer shall have at least five years continuous experience in manufacturing polyethylene geonet and/or experience totaling not less than 5 million square feet of manufactured polyethylene geonet.

B. **Qualifications of Installation Contractor:** The installation contractor shall be the manufacturer or a dealer trained to install the manufacturer's material and shall have experience of not less than 3 projects and not less than 200,000 square feet of successfully installed polyethylene geonet.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

ASTM D1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1603	Standard Test Method for Carbon Black in Olefin Plastics
ASTM D4716	Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D5035	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

A. Relevant publications from the Environmental Protection Agency (EPA):

Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.5 QUALITY ASSURANCE

A. All resins and additives used in the fabrication of the geonet shall be sampled, tested, and pass a pre-approval process before being eligible for use. All roll goods shall be inspected for defects and impurities. A log shall be maintained showing the testing date, time and results. Any rolls not meeting the visual inspection or requirements of the specification shall be rejected. Certification that the material has been inspected, tested, and meets all requirements as well as test results shall be made available to the ENGINEER upon request.

1.6 WARRANTY

A. The CONTRACTOR shall procure and provide copies of the manufacturer's warranty for the geonet. The warranty shall cover materials for a period of 5 years and workmanship for a period of 1 year from the date of the COMPANY's acceptance of the project. The warranty must specifically include effects of ultraviolet irradiation and the normal wear and aging associated with installation in the environmental conditions similar to eastern Washington. Unless otherwise stated, the warranty shall not be prorated but shall be a full replacement value warranty. Should defects or premature loss of use within the scope of the above warranty occur, repair and/or replacement of damaged material shall be performed at no cost to the COMPANY.

PART 2 -- PRODUCTS

2.1 GEONET

A. **Materials:** The material shall be high-density polyethylene (HDPE) geonet as shown on the Drawings.

B. The geonet shall be manufactured from new first quality, compounded polyethylene resin. Natural resin (without carbon black) shall meet the following requirements:

PROPERTY	TEST METHOD	TESTING FREQUENCY	VALUE
Density (g/cm3)	ASTM D1505	Once Per Resin Lot	>0.94
Melt Flow Index (g/10 min)	ASTM D1238	Once Per Resin Lot	≤ 1.0

C. **Properties:**

1. The geonet shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure.

2. The geonet shall have properties that meet or exceed the values listed in the following table:

PROPERTY	TEST METHOD	MINIMUM FREQUENCY	MINIMUM AVERAGE VALUE
Transmissivity, gal/min/ft (m^2/sec)	ASTM D4716	1/1,000,000 ft^2	9.6 (2 x 10^{-3})
Density g/cm^3	ASTM D1505	1/50,000 ft^2	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D5035/7179	1/50,000 ft^2	45 (7.9)
Carbon Black Content, %	ASTM D1603/4218	1/50,000 ft^2	2.0

3. The geonet shall be tested according to the methods and frequencies listed below (or equivalent, as approved by the ENGINEER):

CHARACTERISTICS	TEST METHOD	MINIMUM FREQUENCY
Resin		
Polymer Density	ASTM D1505	Once Per Lot
Melt Flow Index	ASTM D1238	Once Per Lot
Geonet Test		
Thickness	ASTM D5199	1/50,000 ft^2
Carbon Black	ASTM D4218	1/50,000 ft^2
Tensile Strength, MD	ASTM D4595	1/50,000 ft^2
Transmissivity	ASTM D4716	1/1,000,000 ft^2

4. All geonet rolls sheets produced at the factory shall be inspected prior to shipment for defects.

D. **Manufacturer product, or equal:**

1. GSE, Hypernet 200-mil

PART 3 -- EXECUTION

3.1 STORAGE

A. After delivery, all roll goods shall be stored so as to be protected from puncture, dirt, grease, moisture and excessive heat. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface and should not be stacked more than two rolls high.

3.2 INSTALLATION

A. **General:** The geonet shall be installed in accordance with the following specifications and approved procedures submitted with the shop drawings.

B. **Inspection:**

1. Prior to implementing any of the work in the Section to be covered with geonet, the CONTRACTOR shall carefully inspect the installed work of all other Sections and

verify that all work is complete to the point where the installation of the Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed work of other Sections, he shall notify the ENGINEER.

C. **Material Placement:**

1. The geonet roll shall be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.

2. In the presence of wind, all geonets shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until installation of geomembrane liner necessitates removal of the sandbags.

3. The geonet shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geonet.

D. **Seams and Overlaps:**

1. Each component of the geonet will be secured to the like component at overlaps.

2. Adjacent edges along the length of the geonet roll shall be overlapped a minimum of 6 inches or as recommended by the ENGINEER.

3. The overlapped edges shall be joined by tying the geonet structure with plastic cable ties. These ties shall be spaced every 5 feet along the roll length.

4. Adjoining rolls across the roll width should be shingled down in the direction of the slope and joined together with cable ties spaced every foot along the roll width.

E. **Anchor Trench:** The geonet shall be placed and secured in an earth anchor trench as shown on the Drawings. Care shall be taken when backfilling the trenches to prevent any damage to the geonet. If damage occurs, it shall be repaired prior to backfilling.

3.3 INSPECTION AND REPAIR

A. **Repair Procedures:**

1. Prior to covering the deployed geonet, the geonet shall be inspected for damage resulting from construction and approved by the ENGINEER.

2. Any rips, tears or damaged areas on the deployed geonet shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Paragraph 3.2.D.

- END OF SECTION –

SECTION 02280 – GEOCOMPOSITE DRAINAGE LAYERS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall supply all labor, equipment, materials, and appurtenances for the complete installation of geocomposite drainage layers (GDL) as per contract documents.

B. Sufficient GCDL material shall be furnished to cover all lined areas, including seam overlaps and anchor trenches as shown on the Drawings. One percent shall be added to the length of each panel to allow for shrink and wrinkles. The GCDL shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation.

1.2 SUBMITTALS

A. Prior to ordering geonet material, the CONTRACTOR shall submit the following for the ENGINEER's approval:

1. Certification stating that the geonet meets the specification requirements.

2. Certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.

3. Four 8-inch x 10-inch samples of the material proposed.

4. A Statement of Qualifications for the manufacturer and installation contractor with sufficient detail to satisfy the experience requirements of Paragraph 1.3.

B. Placement of geocomposite material shall not commence until the submittals required in Paragraph 1.2 A have been approved by the ENGINEER.

C. Upon completion of installation, the CONTRACTOR shall submit the following:

1. Certificate stating the GDL has been installed in accordance with the Contract Documents.

2. Material and installation warranties

1.3 QUALIFICATIONS

A. **Qualifications of Manufacturer:** The manufacturer shall have at least five years continuous experience in manufacturing polyethylene geocomposite materials and/or experience totaling not less than 10 million square feet of manufactured polyethylene geonet.

1. The following manufacturers are approved by the COMPANY:

a. GSE Environmental

B. **Qualifications of Installation Contractor:** The installation contractor shall be the manufacturer or a dealer trained to install the manufacturer's material and shall have

experience of not less than 3 projects and not less than 200,000 square feet of successfully installed polyethylene geocomposite materials.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

ASTM D 1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D 1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4716	Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D 4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D 4759	Standard Practice for Determining the Specifications Conformance of Geosynthetics
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4884	Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Sewn Geotextiles
ASTM D 4886	Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method)
ASTM D 5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles

A. Relevant publications from the Environmental Protection Agency (EPA):

Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.5 QUALITY ASSURANCE

A. All resins and additives used in the fabrication of the geonet shall be sampled, tested, and pass a pre-approval process before being eligible for use. All roll goods shall be inspected for defects and impurities. A log shall be maintained showing the testing date,

time and results. Any rolls not meeting the visual inspection or requirements of the specification shall be rejected. Certification that the material has been inspected, tested, and meets all requirements as well as test results shall be made available to the ENGINEER upon request.

1.6 WARRANTY

A. The CONTRACTOR shall procure and provide copies of the manufacturer's warranty for the geocomposite. The warranty shall cover materials for a period of 5 years and workmanship for a period of 1 year from the date of the COMPANY's acceptance of the project. The warranty must specifically include effects of ultraviolet irradiation and the normal wear and aging associated with installation in the environmental conditions similar to eastern Washington. Unless otherwise stated, the warranty shall not be prorated but shall be a full replacement value warranty. Should defects or premature loss of use within the scope of the above warranty occur, repair and/or replacement of damaged material shall be performed at no cost to the COMPANY.

PART 2 -- PRODUCTS

2.1 GEOCOMPOSITE

A. The geocomposite shall be double geotextile sided and shall meet the following requirements:

PROPERTY	TEST METHOD	TESTING FREQUENCY	VALUE
Transmissivity, gal/min/ft (m^2/sec)	ASTM D4716	1/1,000,000 ft^2	4.3 (9 x 10^{-4})
Melt Flow Index (g/10 min)	ASTM D1238	Once Per Resin Lot	≤ 1.0

2.2 GEONET CORE

A. **Materials:** The material shall be high-density polyethylene (HDPE) geonet as shown on the Drawings.

B. The geonet shall be manufactured from new first quality, compounded polyethylene resin. Natural resin (without carbon black) shall meet the following requirements:

PROPERTY	TEST METHOD	TESTING FREQUENCY	VALUE
Density (g/cm3)	ASTM D1505	Once Per Resin Lot	>0.94
Melt Flow Index (g/10 min)	ASTM D1238	Once Per Resin Lot	≤ 1.0

C. **Properties:**

1. The geonet shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure.

2. The geonet shall have properties that meet or exceed the values listed in the following table:

PROPERTY	TEST METHOD	MINIMUM FREQUENCY	MINIMUM AVERAGE VALUE
Transmissivity, gal/min/ft (m^2/sec)	ASTM D4716	1/1,000,000 ft^2	38.6 (8 x 10^{-3})
Density g/cm^3	ASTM D1505	1/50,000 ft^2	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D5035/7179	1/50,000 ft^2	75 (13.3)
Carbon Black Content, %	ASTM D1603/4218	1/50,000 ft^2	2.0

2.3 GEOTEXTILE

A. Nonwoven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.

B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.

C. **Physical Properties:** Conform to requirements below.

Tested Property	Test Method	Frequency	MARV
			8 oz/sy
Mass per Unit Area, oz/sy	ASTM D 5261	90,000 sf	8
Grab Tensile Strength	ASTM D 4632	90,000 sf	220
Grab Elongation, %	ASTM D 4632	90,000 sf	50
CBR Puncture Strength, lb	ASTM D 6241	90,000 sf	575
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000 sf	90
UV Resistance, % retained after 500 hrs	ASTM D4355	90,000 sf	70
Apparent Opening Size, Sieve No. (mm)	ASTM D 4491	540,000 sf	80 (0.180)
Water Flow Rate, gpm/sf	ASTM D 4491	540,000 sf	95
Permitivity, sec^{-1}	ASTM D 4491	540,000 sf	1.30

2.4 APPROVED PRODUCTS:

1. GSE, FabriNet 300 mil, double sided

2. Agru America 300-mil Geocomposite

3. Or Equal.

PART 3 -- EXECUTION

3.1 STORAGE

A. After delivery, all roll goods shall be stored so as to be protected from puncture, dirt, grease, moisture and excessive heat. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface and should not be stacked more than two rolls high.

3.2 INSTALLATION

A. **General:** The geocomposite shall be installed in accordance with the following specifications and approved procedures submitted with the shop drawings.

B. **Inspection:**

1. Prior to implementing any of the work in the Section to be covered with geocomposite, the CONTRACTOR shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of the Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed work of other Sections, he shall notify the ENGINEER.

C. **Material Placement:**

1. The geonet roll shall be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.

2. If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope.

3. In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until installation of geomembrane liner necessitates removal of the sandbags.

4. The geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.

D. **Seams and Overlaps:**

1. Each component of the geocomposite shall be secured to the like component at overlaps.

2. Adjacent edges along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.

3. The overlapped edges shall be joined by tying the geonet structure with plastic cable ties. These ties shall be spaced every 5 feet along the roll length.

4. Adjoining rolls across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-inches across the roll width and joined together with cable ties spaced every 6-inches along the roll width.

E. **Anchor Trench:** The geocomposite net shall be placed and secured in an earth anchor trench as shown on the Drawings. Care shall be taken when backfilling the trenches to prevent any damage to the geocomposite. If damage occurs, it shall be repaired prior to backfilling.

3.3 INSPECTION AND REPAIR

A. **Repair Procedures:**

1. Prior to covering the deployed geocomposite, the geocomposite shall be inspected for damage resulting from construction and approved by the ENGINEER.

2. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geocomposite by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geocomposite shall be joined in accordance with Paragraph 3.2.D.

- END OF SECTION –

SECTION 02460 – HOT MIX ASPHALT PAVEMENT AND BASE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall construct hot mix asphalt (HMA) pavement and base, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. All WORK performed under this section shall be subject to and conform to the requirements of the Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction 2014 (Amended April 6, 2015, or most current edition). Herein referred to as WSDOT Standard Specifications.

B. Commercial Standards

AASHTO M 82	Cut-Back Asphalt (Medium Curing Type)
AASHTO M 140	Emulsified Asphalt
AASHTO M 208	Cationic Emulsified Asphalt
AASHTO M 226	Viscosity Graded Asphalt Cement
ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 692	Coarse Aggregate for Bituminous Paving Mixtures
ASTM D 977	Emulsified Asphalt
ASTM D 1073	Fine Aggregate for Bituminous Paving Mixtures
ASTM D 1188	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D 1557	Moisture-Density Relations of Soils and Soil - Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (45-mm) Drop7
ASTM D 2027	Cutback Asphalt (Medium Curing Type)
ASTM D 2397	Cationic Emulsified Asphalt
ASTM D 2726	Bulk Specific Gravity and Density of Compacted Bituminous Mixtures using Saturated Surface-Dry Specimens.
ASTM D 3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3515	Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

1.3 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit, in writing, materials testing reports, proposed HMA mix (refer to Part 2), and other pertinent information satisfactory to the ENGINEER demonstrating that materials and methods CONTRACTOR proposes to utilize will comply with the provisions of this Section. Submittals shall be in accordance with Section 01300 - Contractor Submittals.

B. **Suitability Tests of Proposed Materials:** Tests for conformance with the Specifications shall be performed prior to start of the WORK. The samples shall be identified to show the name of the material, aggregate source, name of the supplier, and contract number. Results of all tests shall be submitted to the ENGINEER for approval. Materials to be tested shall include aggregate base, coarse and fine aggregate for paving mixtures, mineral filler, and asphalt materials.

PART 2 -- PRODUCTS

2.1 AGGREGATE BASE COURSE

A. Base course shall be Crushed Aggregate Base Course as defined in Specification 02200 – Earthwork, Part 2.

B. Surface course shall be Crushed Aggregate Surface Course as defined in Specification Section 02200 – Earthwork, Part 2.

2.2 ASPHALT MATERIALS

A. Asphalt materials shall meet the requirements of WSDOT Standard Specifications and shall conform to Section 9-0.2.1.

2.3 AGGREGATES FOR HOT MIX ASPHALT

A. Aggregates for HMA shall meet the requirements of WSDOT Standard Specifications Section 9-03.8

2.4 HMA MIX DESIGN

A. The CONTRACTOR shall submit a mix design listed on the WSDOT Qualified Products List (QPL), appropriate for the indicated application, for ENGINEER review and approval. The intent of this specification is for the CONTRACTOR to use an available and existing WSDOT approved HMA mix in lieu of developing a new project specific mix design.

1. HMA Class shall be ½”

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. The subgrade shall be prepared as specified in the Section 02200 - Earthwork as applicable to Structural Fill. The surface of the subgrade after compaction shall be hard, uniform, smooth and true to grade and cross-section. Subgrade for base material shall not vary more than 0.04-foot from the required grade and cross section.

3.2 BASE COURSE

A. Aggregate base shall be provided as indicated on the drawings and to the thickness indicated. Imported aggregate bases shall be delivered to the Site as uniform mixtures and each layer shall be spread in one operation. Segregation shall be avoided and the base shall be free of pockets of coarse or fine material. Where the required thickness is 6-inches or less, the base materials may be spread and compacted in one layer. Where the required thickness is more than 6-inches; the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 6-inches. The relative compaction of each layer of aggregate base shall be not less than 95 percent of maximum density when measured in accordance with ASTM D 1557. The compacted surface of the finished aggregate shall be hard, uniform, smooth and at any point shall not vary more than 0.02 foot from the indicated grade or cross-section.

3.3 TACK COAT

A. A tack coat shall be applied to existing paved surfaces where new hot mix asphalt is to be placed on existing pavement. It shall also be applied to the contact surfaces of all cold pavement joints, curbs, gutters, manholes and the like immediately before the adjoining asphalt pavement is placed. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new hot mix asphalt pavement. Diluted emulsified asphalt shall be applied at the rate of 0.05 to 0.15 gal/sq. yd. Undiluted emulsified asphalt shall be applied at the rate of 0.025 to 0.075 gal/sq. yd. Paving asphalt shall be applied at the rate of approximately 0.05 gal/sq. yd.

3.4 HOT MIX ASPHALT

A. At the time of delivery to the Site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather.

B. Hot mix asphalt shall not be placed when the atmospheric temperature is below 40 degrees F or during unsuitable weather.

C. The hot mix asphalt shall be evenly spread upon the base to such a depth that, after rolling, it will be of the required cross section and grade of the course being constructed.

   1. Hot mix asphalt shall be placed in 2 lifts, with a minimum compacted thickness of 2-inches per lift.

D. The depositing, distributing, and spreading of the hot mix asphalt shall be accomplished in a single, continuous operation by means of a self-propelled mechanical spreading and finishing machine designed specially for that purpose. The machine shall be equipped with a screed or strike-off assembly capable of being accurately regulated and adjusted to distribute a layer of the material to a definite pre-determined thickness. When paving is of a size or in a location that use of a self-propelled machine is impractical the ENGINEER may waive the self-propelled requirement.

E. Spreading, once commenced, shall be continued without interruption.

F. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, vibratory roller, or a pneumatic-tired roller shall follow the paver as closely as possible. If needed, intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall

eliminate marks from previous rolling. In areas too small for the roller a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

G. Upon completion the pavement shall be true to grade and cross-section. When a 10-ft straightedge is laid on the finished surface parallel to the center of the roadway, the surface shall not vary from the edge of the straightedge more than 1/8-in except at intersections or changes of grade. In the transverse direction, the surface shall not vary from the edge of the straightedge more than 1/4-in.

H. The relative density after compaction shall be 95 percent of the density obtained by using ASTM D 1188 or D 2726. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted hot mix asphalt, or slabs or cores may be laboratory tested in accordance with ASTM D 1188.

- END OF SECTION -

SECTION 02567 - CORRUGATED PIPE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide corrugated metal and HDPE pipe and appurtenant WORK, complete in place, in accordance with the Contract Documents.

B. Corrugated pipe shall include round pipe, round stand-pipe, pipe arch, and underdrain pipe, with or without a paved invert, and including fittings, couplings, stand-pipe lids, and related accessories

C. Corrugated metal pipe shall include corrugated steel.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following standards are referenced in this Section:

AASHTO M-36	Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
AASHTO M-252 Type C	Specification for Corrugated High Density Polyethylene (3" - 10") single wall w/ plain ends for downdrains
AASHTO M-252 Type S	Specification for Corrugated High Density Polyethylene (3" - 10") double wall, w/ plain end "soil tight" or bell/spigot "water tight" ends for sewers and drains
AASHTO M-294 Type C	Specification for Corrugated High Density Polyethylene (12" - 24") single wall w/ plain ends for downdrains
AASHTO M-294 Type S	Specification for Corrugated High Density Polyethylene (12" - 48") double wall, w/ plain end "soil tight" or bell/spigot "water tight" ends for sewers and drains
ASTM D2321	Installation of HDPE
ASTM D3212	Water-tight Joint Testing Specification
ASTM D3350	HDPE Resin Specification
ASTM F477	Gasket Specification

1.3 CONTRACTOR SUBMITTALS

A. Shop Drawings and catalog data submittals shall be made in accordance with Section 01300 - Contractor Submittals.

B. A manufacturer's or fabricator's Certificate of Compliance shall be furnished stating that samples representing each lot have been tested and inspected in accordance with the Contract Documents and have been found to meet the requirements for the material described.

PART 2 -- PRODUCTS

2.1 CORRUGATED STEEL PIPE

A. Corrugated steel pipe and coupling bands and fittings for each type, shall conform to the requirements of AASHTO M-36, and shall be fabricated from zinc-coated steel sheet with nominal size as indicated in the Drawings.

B. Requirements: Unless otherwise indicated, Corrugated metal pipe shall meet the following requirements:

1. Type of pipe: Circular

2. Pipe material: Steel

3. If steel, type of coating: Zinc

4. Size: As Indicated

5. Wall thickness: 0.064-inch (16 gage)

6. Corrugation dimension: 2-2/3” x ½” for pipe less than 48-inch diameter; 3”x1” for pipe 48-inch diameter or greater, or as otherwise indicated

7. Fittings and bends shall be manufacturer standard products.

2.2 CORRUGATED HDPE PIPE

A. M252 Type C and Type S Pipes

1. Corrugated Polyethylene drain pipe, couplings and fittings shall meet the requirements of AASHTO M 252 Type C (Single Wall - corrugated both inside and outside w/ plain ends) or Type S (Double Wall - corrugated outer wall and smooth inner liner). The maximum size pipe shall be 10" in diameter.

2. HDPE pipe with plain ends and split couplers shall meet the requirements of "soil tight".

3. HDPE pipe with Bell & Spigot ends shall meet the requirements of ASTM D3212 water tight joint testing specification (10.8 psi).

4. Fittings and bends shall be manufacturer standard products.

B. M294 Type C and Type S Pipes

1. Corrugated Polyethylene drain pipe, couplings and fittings shall meet the requirements of AASHTO M 252 Type C (Single Wall - corrugated both inside and outside w/ plain ends) or Type S (Double Wall - corrugated outer wall and smooth inner liner). Pipe diameter shall be 12" through 48".

2. HDPE pipe with plain ends and split couplers shall meet the requirements of "soil tight".

3. HDPE pipe with Bell & Spigot ends shall meet the requirements of ASTM D3212 water tight joint testing specification (10.8 psi).

4. Fittings, bends, and end sections shall be manufacturer standard products.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Pipeline trench excavation shall be in accordance with the requirements of Section 02200 - Earthwork, including the situation where pipelines are to be installed in embankment or structure fills.

B. Pipe bedding shall be in accordance with the requirements of Section 02200 - Earthwork, and shall have a thickness of 6 inches under the pipe, unless otherwise indicated.

C. All pipe shall be transported, stored, and handled with care. It shall not be rolled or dragged over gravel or rock, and during placement, shall be prevented from striking rock or other hard objects. Special care shall be taken in handling and placing coated pipe to avoid damaging the coating.

D. Pipe laying shall begin at the downstream end of the line and proceed upstream. Pipe shall be laid carefully and true to line and grade. Pipe shall be placed with longitudinal seams at the sides and with outside laps of circumferential joints upgrade.

E. Pipe sections shall be laid in the trench with a maximum spacing between sections of 1-1/2 inches. Pipe bends shall be located and installed as to not produce excessive strain on connected sections. Connecting bands shall be placed with clamping angles and bolts at top of the pipe. The pipe coupling corrugations or projections shall properly engage the pipe sections before bolts are tightened. Care shall be taken to ensure that dirt or other particles do not get between the outside of the pipe and the coupling. For watertight joints, the band and gasket material shall be placed in accordance with the manufacturer's recommendations.

F. Pipe trench backfill shall be in accordance with the requirements of Section 02200 - Earthwork. Particular care shall be taken to assure that specified compaction is attained under the haunches of the pipe.

G. End sections shall be installed in a careful workmanship like manner. The strap or rod shall be securely tightened around the pipe. The toe wall shall be placed in narrow trench. The invert of the end section shall be supported evenly by the bedding. The alignment of the end section shall match that of the pipe. The installation shall be completed by proper compaction of the backfill around the end section.

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SECTION 02570 – MULTI-PLATE ARCH PIPE

PART 1 -- GENERAL

1.1 THE REQUIRMENT

A. The CONTRACTOR shall provide design, manufacturing and installation of the multi-plate arch pipe bridge crossings detailed in the plans, and appurtenant WORK, complete in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following standards are referenced in this Section:

ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A449	Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A796	Standard Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications
ASTM A807	Standard Practice for Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications

1.3 CONTRACTOR SUBMITTALS

A. Shop Drawings, design calculations, and product data submittals shall be made in accordance with Section 01300 - Contractor Submittals and Part 2 of this Section.

B. A manufacturer's or fabricator's Certificate of Compliance shall be furnished stating that samples representing each lot have been tested and inspected in accordance with the Contract Documents and have been found to meet the requirements for the material described.

PART 2 -- PRODUCTS

2.1 DESIGN

A. Design of each multi-plate arch pipe bridge shall be provided by the MANUFACTURER, under contract with the CONTRACTOR, and submitted for review and approval by the ENGINEER in accordance with Section 01300 - Submittals. Final design submittal shall be a minimum of 60-days prior to construction of the structural plate culverts.

B. Design Criteria: The design of the structure shall be in accordance with ASTM A796 Standard Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches and Arches for Storm and Sanitary Sewers and Other Buried Applications.

C. Design Load: Design live load shall be H-20.

1. Materials and extents of the foundations and backfill material shall be as shown on the Drawings, or as otherwise provided by the ENGINEER.

D. Foundation Design: Footings shall be reinforced concrete designed by the CONTRACTOR. Geotechnical parameters required for use in the footing design shall be provided by the ENGINEER.

E. Shop Drawings: Shop drawings and design calculations shall be prepared and submitted in accordance with Section 01300 – Submittals.

F. The CONTRACTOR shall be responsible for verification of all field dimensions prior to fabrication.

2.2 MATERIALS

A. **Structural Plate**: Galvanized steel structural plate shall consist of plate and appurtenant items as shown on the plans and shall conform to the requirements of ASTM A761 and Table 1

Table 1 – 6x2 Corrugated Structural Plate Section Properties

Gage	Nominal Thickness (in)	Uncoated Thickness (in)	Moment of Inertia (in^4/in)	Section Modulus (in^3/in)	Radius of Gyration (in)	Area of Section (in^2/ft)
12	0.111	0.1046	0.0604	0.0574	0.682	1.556
10	0.138	0.1345	0.0782	0.0733	0.684	2.003
8	0.168	0.1644	0.0962	0.0888	0.686	2.449
7	0.188	0.1838	0.1080	0.0989	0.688	2.739
5	0.218	0.2145	0.1269	0.1147	0.690	3.199
3	0.249	0.2451	0.1462	0.1302	0.692	3.658
1	0.280	0.2758	0.1658	0.1458	0.695	4.119
5/16	0.318	0.3125	0.1900	0.1640	0.698	4.671
3/8	0.380	0.3750	0.2320	0.1950	0.704	5.613

1. All manufacturing processes including corrugating, punching, curving, special fabrication and galvanizing shall be performed at a common location.

2. All raw materials shall be traceable and certified by the mill for material composition and physical properties.

B. **Hot Dip Galvanizing**: Galvanizing shall conform to ASTM A153

C. **Fasteners**: Nuts and bolts shall conform to ASTM A449, Type 1 (bolts) and A563, Grade C (nuts).

D. **Select Granular Backfill**: Select granular material shall be Structural Fill as defined in Section 02200 – Earthwork, except with a maximum particle size of 3-inch, or as otherwise required by the MANUFACTURER design as approved by the ENGINEER.

2.3 APPROVED SUPPLIERS

A. Pre-Approved MANUFACTURER:

Contech Engineered Solutions LLC
700 Tech Drive
Winchester, KY 40391

B. Suppliers other than those listed above may be used upon approval by the ENGINEER.

1. Proposed suppliers must have at least ten (10) years' experience designing these types of structures and a minimum of ten (10) successful projects, of similar shape and construction as specifically written in these specifications and drawings, each of which has been in service at least three (3) years. List the location, shape, size, owner, and a contact for reference for each project.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Assembly: The structure shall be assembled in accordance with the shop drawings and plate layout provided by the MANUFACTURER. Bolts shall be tightened to an applied torque between 100 and 300 ft-lbs., or as otherwise specified by the MANUFACTURER.

B. Installation: The structure shall be installed in accordance with ASTM A807, MANUFACTURER's specifications, and the Drawings.

C. Concrete: Reinforced concrete for footings shall conform to Section 3300 – Cast-In-Place Concrete.

D. Backfill: The structure shall be backfilled using Select Granular Backfill.

E. Backfill materials shall be placed in symmetrical lifts on each side of the structure. The differential between the lifts on either side shall not exceed 24 inches. Each layer of soil shall be placed in 6 to 8 inch loose lifts and compacted to a minimum of 90% density per ASTM D698 (Standard Proctor), or as otherwise specified by the MANUFACTURER.

F. Backfill soils shall be free of rocks exceeding 3 inches, frozen lumps, ice, organic matter and foreign materials that could cause hard spots or decompose to create voids.

G. Non-woven geotextile (8 oz./sy) shall be placed as a separation layer between the Select Granular Backfill and native soils or General Fill, as shown on the Drawings. Geotextile materials and placement shall conform to Section 02274 – Geotextiles.

H. During backfilling operations, only small tracked construction equipment (such as a D-4 dozer or smaller) shall be near the structure as fill progresses above the crown and to the minimum height of cover. After adequate cover and compaction is achieved, live loads may increase at the direction of the ENGINEER.

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SECTION 02593 – HDPE MANHOLES AND VALVE BOXES

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide high density polyethylene (HDPE) manholes, valve boxes, and structures, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/AWWA C901	Polyethylene (PE) Pressure Pipe and Fittings, 1/2 Inch Through 3 Inch, for Water Distribution and Transmission
ANSI/AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch Through 63 Inch, for Water Distribution and Transmission
AWWA M55	Manual of Water Supply Practices, PE Pipe–Design and Installation
AWWA M55	Manual of Water Supply Practices, PE Pipe–Design and Installation
PPI	Handbook of Polyethylene Pipe – 2008 (2nd Edition)
PPI TR 33	Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
PPI TN-42	Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
ASTM C 1147	Standard Practice for Determining the Short Term Tensile Weld Strength of Chemical-Resistant Thermoplastics
ASTM F 1759	Standard Practice for Design of High-Density Polyethylene (HDPE) Manholes for Subsurface Applications
ASTM F 2620	Heat Fusion Joining of Polyethylene Pipe and Fittings
ASTM D 2837	Hydrostatic Design Basis for Thermoplastic Pipes.
ASTM D 3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350-08	Polyethylene Plastics Pipe and Fittings Materials

1.3 CONTRACTOR SUBMITTALS

A. **General:** Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. **Shop Drawings**:

1. Show dimensions, position of inlets and outlets, manways, ladders, special features, etc.

2. Structural design calculations for vaults, signed by a registered professional engineer in the State of Washington. The manholes shall be designed for:

   a. Ring Compressive Strain

   b. Combined Ring Compressive and Ring Bending Strain

   c. Ring Buckling

   d. Axial Stain

   e. Axial Buckling

   f. Thickness of the bottom based on depth and groundwater. Thickness should be based on acceptable stress and deflection amounts.

C. Certifications:

1. Provide documentation showing the manufacturer has at least 10 years of experience of manufacturing and production of single and dual contained manholes and/or valve boxes and related fittings.

2. Furnish a certified affidavit of compliance for pipe and other products or materials furnished under this Section:

   a. Hydrostatic proof test reports.

   b. Sustained pressure test reports.

   c. Burst strength test reports.

3. Furnish a certified affidavit of compliance from the fabricator indicating that manholes meet the requirements of ASTM F 1759, “Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications”.

4. Furnish a certification of manhole leak testing.

1.4 QUALITY CONTROL

A. Each manufacturer shall have an approved in-house QA/QC program for compliance to the testing specifications and requirements of AWWA C901 or C906 for both pipe and fittings.

B. Affirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.

C. Inspection: Manholes and Valve Boxes shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The CONTRACTOR shall notify the

ENGINEER in writing of the manufacturing start date not less than 14 calendar days prior to the start of any phase of manufacture.

D. During manufacture of the manholes and/or valve boxes, the ENGINEER shall be given access to areas where manufacturing is in process confirm compliance with the Specifications.

E. Tests: Except as modified herein, materials used in the manufacture of the manholes and/or valve boxes shall be tested in accordance with the requirements of this Section and in the referenced standards, as applicable. Expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR as part of the WORK

F. The fabrication technician shall perform work in accordance to butt fusion of high-density polyethylene per ASTM F 2620 and for extrusion and hot air welding per ASTM C 1147. The fabricator shall submit the written quality assurance program used during fabrication of the manholes. The fabricator may be required to submit their overall QA/QC program for fabricating thermoplastic structures, the welding certification program for the fabrication technician, and the facility safety program.

G. The manholes and pipe shall be tested with water or air when required. A written certification shall be sent to the engineer certifying the manholes are leak free. The test results shall become part of the submittals. An identification plate indicating, the job number, testing data, and when built and by whom, shall be attached to the manhole.

H. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness testing conducted by the CONTRACTOR, provided that the CONTRACTOR'S schedule will not be delayed for the convenience of the ENGINEER.

I. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the COMPANY. The additional samples shall be furnished as part of the WORK.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Pipes and fittings:** Any required pipes and/or pipe fittings shall conform with Section 02594.

2.2 CONSTRUCTION

A. The HDPE manholes and/or valve boxes shall be constructed of HDPE pipe with nominal OD and wall thickness as designated in of the drawings. Calculations must be provided to verify the wall thickness is adequate for burial and loading.

B. The bottom thickness of the manholes and/or valve boxes will be determined in accordance with ASTM F 1759. Calculations must be provided to justify the thickness of the bottom.

C. The inlets and outlets shall be extrusion welded on the inside and outside of the structure using good welding practice. Gussets shall be attached at 90 degrees, 180 degrees, 270 degrees, and 360 degrees around the inlets and outlets unless impractical.

D. All manhole connections larger than 4” nominal OD pipe shall be butt fusion welded, electrofusion welded, or flanged connections. For 4” OD pipe and smaller threaded transition fittings can also be used as well as the acceptable connections listed. All butt fusion welds shall be made as described in ASTM F 2620 and all butt fusion welds using hydraulically operated butt fusion equipment shall be recorded using a **McElroy Manufacturing DataLogger**, or approved equal. The fabricator shall maintain records of the temperature, pressure, and graph of the fusion cycle.

E. Manholes shall be factory tested with water or with air. The hydrostatic test shall be conducted by filling the structure with water and checking for leaks. Minimum test duration will be one hour. If air is used, a minimum of 1 PSI shall be used for 30 minutes. Manholes with a 72” inside diameter or smaller may be tested to 2 PSI. Data showing the structure to be leak-free will be supplied. The COMPANY or his representative may request to observe the test.

F. Valve boxes shall be factory tested for leaks by filling the box with water to 1.5 times the depth of the outlet pipe invert. This water level shall be maintained for a period of 24-hours.

G. Manholes and/or valve boxes shall be capable of operating under ambient temperatures from 0 degrees Fahrenheit to 120 degrees Fahrenheit. The ladders in the manholes, if specified, shall conform to OSHA requirements.

H. Top of the manhole shall be built to the requirements of the drawings. If testing is required, flanged tops or manways will be required, and additional bolts may be needed to withstand test conditions. Reinforced concrete pads spanning the HDPE manhole will be required when HDPE manholes are used in traffic areas. A traffic rated frame and cover will be required. A professional engineer shall approve the design of the concrete pad. Those calculations must be included in the submittal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Laying, jointing, and testing for defects and for leakage shall be performed in the presence of the ENGINEER and shall be subject to approval before acceptance. All material found to be defective will be rejected and the CONTRACTOR shall promptly remove such materials from the Site.

B. Installation shall conform to AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 HANDLING AND STORAGE

A. Handling: Manholes and/or valve boxes shall be carefully inspected before and after installation and those found defective will be rejected. Pipe and fittings shall be free from fins and burrs. Before placing in position, clean pipe, fittings, and accessories, and maintain them in a clean condition. Proper methods shall be used for lowering manholes and/or valve boxes into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger

persons or property. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

B. Storage: Manholes and/or valve boxes shall be stored, if possible, at the Site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to the manholes and/or valve boxes. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.

3.3 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to Section 02200 - Earthwork.

3.4 FLANGED FITTINGS

A. Flange adapters (where shown in the drawings) shall be attached to HDPE manhole inlets and outlet stubs during fabrication by butt fusion welding per ASTM F 2620. A ductile iron back up ring will be used with each flanged connection. The rings will use a standard ANSI 150# bolt pattern. Check the drawings for materials required for corrosive conditions.

1. Bolts shall be tightened in a “star pattern” to recommended torque values.

2. Bolts must be tightened a second time after 24 hours to insure a positive seal.

3. Gaskets are not required on HDPE to HDPE connections.

3.5 JOINING

A. Prior to installation of any manhole and/or valve box, the manufacturer shall provide training in the recommended butt fusion and saddle fusion procedures, testing procedures, and any other installation methods required by the WORK. Training shall include the CONTRACTOR’S installation personnel, COMPANY’S representative, the ENGINEER’S representative, and any other personnel chosen by the COMPANY. The CONTRACTOR shall record the names of trained personnel.

B. Fusion of pipe should conform to Section 02954.

3.6 INSTALLATION

A. Manhole and valve box Installation shall conform to Sections 02200 and 02954.

B. H-20 Highway Loads- Reinforced concrete pads spanning the HDPE manhole will be required when HDPE manholes are used in traffic areas. A traffic rated frame and cover will be required. A drawing showing key design features must be submitted as indicated in Section 1.3 of this specification.

C. Any cuts shall be made by means of saws, power driven abrasive wheels, pipe cutters, or other manufacturer recommended methods that will produce a clean, square cut.

D. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing shall be replaced.

E. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined

deflection at any coupling shall be in accordance with the manufacturer's recommendations.

- END OF SECTION -

SECTION 02594 – HIGH DENSITY POLYETHYLENE PIPE

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide high density polyethylene (HDPE) pressure and non-corrugated drain pipe, complete and in place, in accordance with the Contract Documents.

B. Pipe sizing and pressure rating were calculated based on the final alignments. Contractor shall verify that sizing shown in the drawings is adequate for the temporary system throughout the project.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

PPI	Handbook of Polyethylene Pipe – 2009 (2ndEdition)
PPI TR 33	Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
PPI TN-42	Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In Through 63 In, for Water Distribution and Transmission
AWWA M55	Manual of Water Supply Practices, PE Pipe–Design and Installation
ASTM F 2620	Heat Fusion Joining of Polyethylene Pipe and Fittings
ASTM D 3350	Polyethylene Plastics Pipe and Fittings Materials

1.3 CONTRACTOR SUBMITTALS

A. CONTRACTOR shall provide initial system layout and sizing to the ENGINEER for review and modifications shall be reviewed by the field engineer.

B. Furnish Shop Drawings of pipe, fittings, and appurtenances in accordance with Section 01300 - Contractor Submittals.

C. **Certifications:** Furnish a certified affidavit of compliance for pipe and other products or materials furnished under this Section:

1. Hydrostatic proof test reports.

2. Sustained pressure test reports.

3. Burst strength test reports.

D. Expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR as part of the WORK.

E. CONTRACTOR shall submit field fusing reports at the end of each week.

F. CONTRACTOR shall submit in writing a pipeline pressure testing plan and schedule, including methods for water source, water conveyance, sequence, control, and disposal. The testing plan shall be subject to review and approval by the ENGINEER.

G. CONTRACTOR shall submit a Marine Installation Plan for marine installation of the effluent pipeline outfall in Lake Roosevelt in accordance with Section 01XXX – Marine Installation Requirements. This plan shall be submitted a minimum of 60 days in advance of commencement of any excavation or work adjacent to or within Lake Roosevelt.

H. CONTRACTOR shall submit a Construction Dewatering Plan in accordance with Section 02140 – Dewatering and Control of Water.

1.4 QUALITY ASSURANCE

A. Each manufacturer shall have an approved in-house QA/QC program for compliance to the testing specifications and requirements of AWWA C906 for both pipe and fittings.

B. **Inspection:** Pipe shall be subject to inspection at the staging area in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The CONTRACTOR shall notify the ENGINEER in writing of the manufacturing start date not less than 14 calendar days prior to the start of any phase of manufacture.

C. During manufacture of the pipe, the ENGINEER shall be given access to areas where manufacturing is in process to confirm compliance with the Specifications.

D. **Tests:** Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section and in the referenced standards, as applicable.

E. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness testing conducted by the CONTRACTOR, provided that the CONTRACTOR'S schedule will not be delayed for the convenience of the ENGINEER.

F. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the COMPANY. The additional samples shall be furnished as part of the WORK.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Scope:** The pipe shall meet the specifications and requirements of AWWA C 906. Pipe shall be in iron pipe sizes (IPS).

B. **Materials:** Pipe and fittings shall be made from prime virgin resins exhibiting a cell classification of PE 345444C as defined in ASTM D 3350, with an established hydrostatic-design basis of 1600 psi for water at 73 degrees F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "Listing of Plastic Pipe Compounds.

C. **Non-Corrugated HDPE Drain Pipe** shall have a wall thickness of DR 19.0 or thicker. Pipe shall be provided in laying lengths of 40-ft standard. Perforations or slots shall conform to the design drawings.

D. **Pipe and Fittings:** Pipe supplied shall have the Iron Pipe Size (IPS) OD shown below and shall meet ASTM D 3350. Laying lengths shall be 40-ft standard. Molded and fabricated fittings shall have the same OD, pressure and SDR ratings as the pipe. All molded fittings shall be manufactured per ASTM D3261.

Pipe SDR Sizing	Minimum Pressure Rating (PSI)
9	200
11	160
17	100
26	65

E. **Joints:** The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

F. **Mechanical:** Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters, HDPE flange adapters with stainless steel back-up rings, or other devices as specified on the drawings and shall be in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training within the past year. This training shall be on the equipment and pipe components to be utilized for this project

G. **Marking:** Pipe and fittings shall be marked as prescribed by AWWA C906 and NSF. Pipe markings shall include nominal size, OD base (i.e.: 12-inch ductile iron pipe sizing, DIPS), dimension ratio, pressure class, AWWA C906, manufacturer's name, manufacturer's production code including day, month, and year extruded, manufacturer's plant and extrusion line, and NSF - pw logo.

2.2 PIPE MARKING

A. The pipeline shall be marked with detectable identification tape in accordance with Section 02200.

PART 3 -- EXECUTION

3.1 GENERAL

A. Laying, jointing, and testing for defects and for leakage shall be performed in the presence of the ENGINEER and shall be subject to approval before acceptance. All material found to be defective will be rejected and the CONTRACTOR shall promptly remove such materials from the Site.

B. Installation shall conform to AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications herein. Wherever

the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

C. Excavation shall be performed prior to the preparation of Shop Drawings for connections and before the fabrication and installation of the pipe.

3.2 HANDLING AND STORAGE

A. **Handling:** Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective will be rejected. Pipe and fittings shall be free from fins and burrs. Before placing in position, clean pipe, fittings, and accessories, and maintain them in a clean condition. Proper methods shall be used for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

B. **Storage:** Pipe shall be stored, if possible, at the Site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to the pipe. Pipe shall be stored in such a way as to prevent sagging or bending, and it shall be protected from exposure to direct sunlight by covering with an opaque material that allows adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

3.3 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to Section 02200 - Earthwork.

3.4 JOINING

A. Prior to installation of any pipe, the manufacturer shall provide training in the recommended butt fusion and saddle fusion procedures, testing procedures, and any other installation methods required by the WORK. Training shall include the CONTRACTOR'S installation personnel, a COMPANY'S representative, the ENGINEER'S representative, and any other personnel chosen by the COMPANY. The CONTRACTOR shall record the names of trained personnel.

B. On every day that butt fusion joints are to be made, the first fusion of the day shall be a test. The test fusion shall be allowed to cool completely, then fusion test straps shall be cut out. Test strap length shall be 12-inches (min) or 30 times the wall thickness with the fused area in the center and width shall be 1-inch (min) or 1.5 times the wall thickness. The CONTRACTOR shall bend the test strap until the ends of the strap touch. If the test strap fails at the joint, the CONTRACTOR shall perform a new test to be cooled completely and bent as before. The CONTRACTOR shall not commence installation of pipe until a test fusion has passed the bent strap test.

C. The fusion machine used in the joining of the pipe shall incorporate a data logging device that records information related to each individual joint for the construction of the entire pipeline. The recorded information shall include at least the date and time of the fusion, the employee ID of the machine operator, the machine ID, the machine model, the piston area, pipe material, pipe size, the interfacial pressures (including heat, soak, fuse, cool), recommended gauge pressures (including heat, soak, fuse, cool), drag pressure, data logger probe temperature, and the external probe temperature.

3.5 INSTALLATION

A. Trench shall be graded in straight lines, taking care to avoid formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with wood blocks or bulkheads.

B. Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed.

C. Pipe shall be cut by means of saws, power driven abrasive wheels, pipe cutters, or other manufacturer recommended methods that will produce a clean, square cut.

D. Pipe shall be supported uniformly and firmly at its proper elevation. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the soil, with recesses to accommodate joints and couplings. Anchors and supports shall be provided where necessary and where indicated for fastening WORK into place. Fittings shall be independently supported.

E. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing shall be replaced.

F. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.

3.6 PNEUMATIC TESTING OF PIPELINES

A. Pneumatic (compressed air) leakage testing of pressure system HDPE piping is prohibited for safety reasons.

3.7 HYDROSTATIC TESTING OF PIPELINES

A. All pipelines shall be tested. All testing operations shall be performed in the presence of the ENGINEER.

B. All test equipment, plugs, temporary valves, bulkheads, and other water control equipment, shall be as determined by the CONTRACTOR to accomplish the testing. No materials shall be used which would be injurious to the WORK.

C. Water for testing pipelines shall be furnished by the CONTRACTOR:

   1. Utilize treated effluent water from the on-site water treatment plant for pressure testing of pipelines.

D. Disposal of testing water shall be by methods acceptable to the ENGINEER and in accordance with all permit requirements.

E. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate.

F. The CONTRACTOR shall test pipelines in sections as defined by isolation valves or manholes. Where isolation valves or manholes do not exist, pipeline shall be tested in sections of 2500 LF maximum.

G. The CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing when isolation valves are not present. The test shall be made by closing valves, of placing bulkheads or plugs and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. The CONTRACTOR shall provide sufficient temporary tappings in the bulkhead fittings to allow for trapped air to exit. Care shall be taken that air relief valves are open during filling.

H. The upper most test segment of the pipeline shall be filled and tested first. Water from the first test segment may be transferred to the next lowest test segment and so on until all segments have been tested. The CONTRACTOR shall be responsible for providing all temporary piping and valves necessary to transfer water from one test segment to another.

I. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. Visible leaks that appear during filling shall be repaired in a manner acceptable to the ENGINEER.

J. **Initial Expansion Phase**: After the pipeline or section thereof has been filled, gradually pressurize the test section to test pressure, and maintain test pressure for three (3) hours. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the initial expansion phase. It is not necessary to monitor the amount of water added during the initial expansion phase.

K. **Test Phase**: Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test liquid. If test pressure remains within 5% of the target value for one (1) hour, no leakage is indicated.

L. The total time for initial pressurization and time at test pressure shall not exceed eight (8) hours. If the test is not completed within this time, the test section shall be depressurized for at least eight (8) hours before repeating the test.

M. In the case of pipelines that fail to pass the leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

3.8 TEST PRESSURES

A. The test pressure for piping shall be as indicated measured at the lowest point of the pipeline section being tested.

B. Pressure pipelines shall be hydrostatically tested at 1.5 times the working pressure for a pressure system.

C. The test pressure for gravity draining pipe shall be at least 5 ft of head pressure above the highest point in the system. If the pipeline is tested in sections, then the test pressure in all sections shall equal 5 feet plus the differential elevation between the section being tested and the highest point in the system.

- END OF SECTION -

SECTION 02596 – HDPE DUAL CONTAINMENT PIPE
(AWWA C901 and C906, MODIFIED)

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide high density polyethylene (HDPE) dual containment system of pipe, structures, and leak detection, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

AWWA C901	Polyethylene (PE) Pressure Pipe and Fittings, 1/2 Inch Through 3 Inch, for Water Distribution and Transmission
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch Through 63 Inch, for Water Distribution and Transmission
AWWA M55	Manual of Water Supply Practices, PE Pipe–Design and Installation
PPI	Handbook of Polyethylene Pipe – 2008 (2nd Edition)
PPI TR 33	Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
PPI TN-42	Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
ASTM F 2620	Heat Fusion Joining of Polyethylene Pipe and Fittings
ASTM D 2837	Hydrostatic Design Basis for Thermoplastic Pipes.
ASTM D 3261	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350-08	Polyethylene Plastics Pipe and Fittings Materials
ASTM F 1473	Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins

1.3 CONTRACTOR SUBMITTALS

A. Furnish Shop Drawings of pipe, fittings, and appurtenances in accordance with Section 01300 - Contractor Submittals.

B. Provide documentation showing the manufacturer has at least 10 years of experience of manufacturing and production of dual contained piping and related fittings.

C. **Certifications:** Furnish a certified affidavit of compliance for pipe and other products or materials furnished under this Section:

1. Hydrostatic proof test reports.

2. Sustained pressure test reports.

3. Burst strength test reports.

D. Expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR as part of the WORK.

E. CONTRACTOR shall submit field fusing reports at the end of each week.

1.4 QUALITY ASSURANCE

A. Each manufacturer shall have an approved in-house QA/QC program for compliance to the testing specifications and requirements of AWWA C901 or C906 for both pipe and fittings.

B. Affirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.

C. **Inspection:** Pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards as supplemented by the requirements herein. The CONTRACTOR shall notify the ENGINEER in writing of the manufacturing start date not less than 14 calendar days prior to the start of any phase of manufacture.

D. During manufacture of the pipe, the ENGINEER shall be given access to areas where manufacturing is in process confirm compliance with the Specifications.

E. **Tests:** Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section and in the referenced standards, as applicable.

F. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness testing conducted by the CONTRACTOR, provided that the CONTRACTOR'S schedule will not be delayed for the convenience of the ENGINEER.

G. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the COMPANY. The additional samples shall be furnished as part of the WORK.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Scope:** The pipe shall be the nominal sizes shown on the drawings, meeting the specifications and requirements of AWWA C901 or C 906. Pipe shall be in steel pipe sizes (IPS).

B. **Materials:** Pipe and fittings shall be made from prime virgin resins exhibiting a minimum cell classification of PE 334434C as defined in ASTM D 3350, with an established hydrostatic-design basis of 1600 psi for water at 73 degrees F when tested in accordance with ASTM D2837. The Slow Crack Growth Resistance shall be greater than 100 hours per ASTM F 1473 (PENT Test). The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "Listing of Plastic Pipe Compounds.

C. **Pipe and Fittings:**

1. Pipe shall be pre-fabricated prior to shipment to the jobsite. No on-site fabrication to the pipe, fittings of system shall be allowed without the express written consent of the ENGINEER and the piping supplier.

2. Pipe joints and fittings shall be supplied to the jobsite ready for simultaneous butt-fusion. The fabricator shall show that the materials are capable of butt-fusion and shall provide a procedure to consistently produce sound welds.

3. Pipe supplied shall have the Iron Pipe Size (IPS) OD shown below and shall meet ASTM D 3350. Laying lengths shall be 40-ft standard. Molded and fabricated fittings shall have the same OD as the carrier and containment pipe and shall have a pressure rating equal to the carrier pipe unless otherwise specified on the plans. All fittings shall meet the pressure requirements of the system as specified and based on ASTM D2837. All molded fittings shall be manufactured per ASTM D3261.

Pipe SDR Sizing	Minimum Pressure Rating (PSI)
9	200
11	160
17	100
26	65

D. **Joints:** The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

E. **Carrier Pipe:** Carrier pipe shall be with full round centralizers welded to the Carrier pipe. Centralizer support spacing shall be per the Plastic Piping Institute standards. Centralizers shall be either molded or machined from HDPE Pipe Grade resins or sheet. Centralizers shall have at least two openings that will permit the flow of liquid between the carrier pipe and the containment pipe. The centralizers shall be thermally bonded to the primary carrier pipe, and maintain position and alignment of the primary carrier pipe in relation to the secondary containment piping. Each end of pipe will have a centralizer that is thermally bonded to both the OD of the primary carrier and the ID of the secondary containment piping and designed such that movement will be restrained between the two piping systems during the butt fusion process.

F. **End Termination Fittings:** End Termination fittings shall be used to seal the system at both ends. The fitting shall be simultaneously butt fused to the carrier and containment pipe to seal the annular space. Terminations that are not butt fused in the system will not be allowed. This fitting will also provide the transition to single wall piping.

G. **Mechanical:** Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters, HDPE flange adapters with stainless steel back-up rings, or other devices as specified on the drawings and shall be in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6. Mechanical coupling shall be made by qualified technicians. Qualification of the field technician shall be demonstrated by evidence of mechanical coupling training within the past year. This training shall be on the equipment and pipe components to be utilized for this project.

H. **Marking:** Pipe and fittings shall be marked as prescribed by AWWAC901 or C906. Pipe markings shall include nominal size, OD base (i.e.: 12-inch iron pipe sizing, IPS), dimension ratio, pressure class, AWWA C901 or C906, manufacturer's name, manufacturer's production code including day, month, and year extruded, manufacturer's plant and extrusion line.

2.2 PIPE MARKING

A. The pipeline shall be marked with detectible identification tape in accordance with Section 02200.

PART 3 -- EXECUTION

3.1 GENERAL

A. Laying, jointing, and testing for defects and for leakage shall be performed in the presence of the ENGINEER and shall be subject to approval before acceptance. All material found to be defective will be rejected and the CONTRACTOR shall promptly remove such materials from the Site.

B. Installation shall conform to AWWA M55, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 HANDLING AND STORAGE

A. **Handling:** Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective will be rejected. Pipe and fittings shall be free from fins and burrs. Before placing in position, clean pipe, fittings, and accessories, and maintain them in a clean condition. Proper methods shall be used for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

B. **Storage:** Pipe shall be stored, if possible, at the Site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to the pipe. Pipe shall be stored in such a way as to prevent sagging or bending, and it shall be protected from exposure to direct sunlight by covering with an opaque material that allows adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

3.3 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to Section 02200 - Earthwork.

3.4 JOINING

A. Prior to installation of any pipe, the manufacturer shall provide training in the recommended butt fusion and saddle fusion procedures, testing procedures, and any other installation methods required by the WORK. Training shall include the CONTRACTOR'S installation personnel, a COMPANY'S representative, the ENGINEER'S representative, and any other personnel chosen by the COMPANY. The CONTRACTOR shall record the names of trained personnel.

B. Section of pipe shall be joined into continuous lengths following the guidelines of ASTM F2620, using simultaneous butt fusion as the method of joining.

C. On every day that butt fusion joints are to be made, the first fusion of the day shall be a test. The test fusion shall be allowed to cool completely, then fusion test straps shall be cut out. Test strap length shall be 12-inches (min) or 30 times the wall thickness with the fused area in the center and width shall be 1-inch (min) or 1.5 times the wall thickness. The CONTRACTOR shall bend the test strap until the ends of the strap touch. If the test strap fails at the joint, the CONTRACTOR shall perform a new test to be cooled completely and bent as before. The CONTRACTOR shall not commence installation of pipe until a test fusion has passed the bent strap test.

D. The fusion machine used in the joining of the pipe shall incorporate a data logging device that records information related to each individual joint for the construction of the entire pipeline. The recorded information shall include at least the date and time of the fusion, the employee ID of the machine operator, the machine ID, the machine model, the piston area, pipe material, pipe size, the interfacial pressures (including heat, soak, fuse, cool), recommended gauge pressures (including heat, soak, fuse, cool), drag pressure, data logger probe temperature, and the external probe temperature.

3.5 INSTALLATION

A. Trench shall be graded in straight lines, taking care to avoid formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At the end of each day's work, open ends of pipe shall be closed temporarily with wood blocks or bulkheads.

B. Segments of pipe having cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed.

C. Pipe shall be cut by means of saws, power driven abrasive wheels, pipe cutters, or other manufacturer recommended methods that will produce a clean, square cut.

D. Pipe shall be supported uniformly and firmly at its proper elevation. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the soil, with recesses to accommodate joints and couplings. Anchors and supports shall be provided where necessary and where indicated for fastening WORK into place. Fittings shall be independently supported.

E. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing shall be replaced.

F. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.

3.6 HYDROSTATIC TESTING OF PIPELINES

A. All pipelines shall be tested. All testing operations shall be performed in the presence of the ENGINEER.

B. All test equipment, plugs, temporary valves, bulkheads, and other water control equipment, shall be as determined by the CONTRACTOR to accomplish the testing. No materials shall be used which would be injurious to the WORK.

C. Water for testing pipelines shall be furnished by the CONTRACTOR:

1. Utilize treated effluent water from the on-site water treatment plant for pressure testing of pipelines.

D. Disposal of testing water shall be by methods acceptable to the ENGINEER and in accordance with all permit requirements.

E. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate.

F. The CONTRACTOR shall test pipelines in sections as defined by isolation valves or manholes. Where isolation valves or manholes do not exist, pipeline shall be tested in sections of 2500 LF maximum.

G. The CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing when isolation valves are not present. The test shall be made by closing valves, of placing bulkheads or plugs and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. The CONTRACTOR shall provide sufficient temporary tappings in the bulkhead fittings to allow for trapped air to exit. Care shall be taken that air relief valves are open during filling.

H. The upper most test segment of the pipeline shall be filled and tested first. Water from the first test segment may be transferred to the next lowest test segment and so on until all segments have been tested. The CONTRACTOR shall be responsible for providing all temporary piping and valves necessary to transfer water from one test segment to another.

I. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. Visible leaks that appear during filling shall be repaired in a manner acceptable to the ENGINEER.

J. **Initial Expansion Phase**: After the pipeline or section thereof has been filled, gradually pressurize the test section to test pressure, and maintain test pressure for three (3) hours. Add water to restore the test pressure if the pressure decreases 5 psi below test

pressure during the initial expansion phase. It is not necessary to monitor the amount of water added during the initial expansion phase.

K. **Test Phase**: Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test liquid. If test pressure remains within 5% of the target value for one (1) hour, no leakage is indicated.

L. The total time for initial pressurization and time at test pressure shall not exceed eight (8) hours. If the test is not completed within this time, the test section shall be depressurized for at least eight (8) hours before repeating the test.

M. In the case of pipelines that fail to pass the leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

3.7 PNEUMATIC TESTING OF CONTAINMENT PIPE

A. The annular space between the carrier and containment pipe shall be tested at 10 psi air pressure. Air pressure shall be allowed to equalize for 10 minutes, then monitor the pipe for the test period of 10 minutes, during which no drop in pressure shall be allowed.

B. Pneumatic leakage testing of the carrier piping is prohibited for safety reasons.

3.8 TEST PRESSURES

A. Pressure pipelines shall be hydrostatically tested at 1.5 times the working pressure for a pressure system.

B. The hydrostatic test pressure for gravity draining pipe shall be at least 5 ft of head pressure above the highest point in the system. If the pipeline is tested in sections, then the test pressure in all sections shall equal 5 feet plus the differential elevation between the section being tested and the highest point in the system.

C. Pneumatic test pressure for the annular space between the carrier pipe and the containment pipe shall be 10 psi.

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SECTION 02780 – GEOSYNTHETIC CLAY LINER (GCL)

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall provide a geosynthetic clay liner (GCL), complete and in place, in accordance with the Contract Documents.

B. This specification covers the technical requirements for the furnishing and installation of the geosynthetic clay liner described herein. All materials used shall meet the requirements of this specification, and all work shall be performed in accordance with the procedures provided herein and in the drawings.

1.2 DEFINITIONS

A. The following definitions apply to the WORK of this Section:

1. Geosynthetic Clay Liner: A factory manufactured hydraulic barrier consisting of granular sodium bentonite clay, sandwiched between, supported and encapsulated by two geotextiles, held together by needle punching.

2. Geotextile - A semi-permeable woven or nonwoven fabric used to contain the bentonite used in a GCL.

3. Minimum Average Roll Value (MinARV): The minimum average value of the material in a particular lot calculated as the mean of the tested values minus two standard deviations providing a 95% confidence level.

4. Needlepunching - A GCL manufacturing process whereby boards of barbed needles incorporate the staple fibers from a nonwoven geotextile, through a sodium bentonite clay layer, into the matrix of a second geotextile layer.

5. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

6. Sodium Bentonite - The high swelling clay component of GCLs consisting primarily of the mineral montmorillonite.

7. Thermal Fusing - A needlepunching enhancement process utilizing heat to bond the needlepunched fibers and more permanently lock them into the second geotextile to increase the internal shear strength characteristics.

8. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.

9. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.

10. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The following standards are referenced in this Section:

ASTM D 4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D 5261	Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
ASTM D 5321	Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
ASTM D 5887	Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
ASTM D 5888	Standard Guide for Storage and Handling of Geosynthetic Clay Liners
ASTM D 5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D 5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
ASTM D 5993	Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners
ASTM D 6243	Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method
ASTM D 6495	Standard for Acceptance Testing Requirements for Geosynthetic Clay Liners
ASTM D 6496	Standard Test Method for Determining Average Bond Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
ASTM D 6768	Standard Test Method for Tensile Strength of Geosynthetic Clay Liners
GRI-GCL3	Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)

1.4 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - CONTRACTOR Submittals.

B. Prior to ordering materials:

1. Specification sheets for all proposed GCL products.

2. Samples: One-piece, minimum 3” x 5” of proposed GCL. Label each with brand name and furnish documentation of lot and roll number from which each sample was obtained.

3. A Statement of Qualifications for the geomembrane manufacturer and installation contractor with sufficient detail to satisfy the experience requirements of Paragraph 1.5.

4. Installation Contractor’s Quality Control Plan.

C. Prior to shipping material to site:

1. Certification of quality control tests from manufacturer on GCL product

2. Certification of quality control tests from manufacturer on Bentonite

D. Prior to installing GCL:

1. Certification signed by the CONTRACTOR and ENGINEER of subgrade inspection and approval.

E. Upon completion of GCL installation:

1. Certification by CONTRACTOR that the GCL was installed per project specifications

2. Material and Installation Warranties

3. As-built drawings showing actual GCL placement

1.5 QUALIFICATIONS

A. Manufacturer:

1. The GCL shall be manufactured by the following:

a. CETCO.

b. ENGINEER approved equal

B. Installer:

1. Installation shall be performed by one of the following companies:

a. CETCO.

b. ENGINEER approved equal

2. Installer shall have experience installing GCLs on at least 5 projects and have installed a minimum of 2 million square feet of GCL materials.

1.6 CONSTRUCTION QUALITY CONTROL (CQC)

A. All WORK shall be constructed, monitored and tested in accordance with the requirements of the Installation Contractor's Quality Control Plan (QCP), which shall be submitted in accordance with Paragraph 1.4B.

B. The CONTRACTOR shall be aware of all activities outlines in the CQP, and the CONTRACTOR shall account for these activities in the construction schedule. No additional costs to the COMPANY shall be allowed by the CONTRACTOR as a result of the performance of the CQA activities.

C. The CONTRACTOR shall deliver GCL to the site at least 14 days prior to installation to allow sufficient time for testing required in the CQP or as required by the COMPANY.

D. The GCL rolls that do not meet the requirements of this Specification shall be rejected. The CONTRACTOR shall replace rejected material with new material that conforms to the specification requirements, at no additional cost to the COMPANY.

1.7 CONSTRUCTION QUALITY ASSURANCE (CQA)

A. The COMPANY shall conduct quality assurance monitoring and testing of the GCL installation under the direction of the ENGINEER.

B. If CQA testing and inspection indicates WORK does not meet the requirements of the specification, the ENGINEER shall establish the extent of the nonconforming area. The nonconforming area shall be removed and replaced at no additional cost to the COMPANY.

PART 2 -- PRODUCTS

2.1 GCL PROPERTIES

A. The GCL material shall be in accordance with the test methods, test frequencies and material physical properties as listed in Table 02274-1.

B. In addition to the property values listed in Table 02274-1, the GCL material shall meet the following requirements:

1. The GCL shall be manufactured by mechanically bonding the geotextiles using a needle punching or stitching process to create frictional and shear strength characteristics.

2. In order to maintain these characteristics, no glues, adhesives or other non-mechanical bonding processes shall be used in lieu of the needle punch or stitching process. Their use to enhance the physical properties of the GCL is not permitted.

3. <u>Interface Shear Testing of Proposed Equal Materials:</u> Interface shear tests (ASTM D 5321) shall be performed by the Geosynthetic Laboratory under the direction of the ENGINEER. Interface shear testing shall be performed on fully hydrated GCL samples using a 12 inch by 12 inch shear box under test conditions described by the ENGINEER. The number of tests to be performed is based on a ratio of one test per 100,000 ft^2 of material. All costs related to testing and evaluation of proposed equal materials is the responsibility of the CONTRACTOR.

4. Interface Shear Testing for QA Conformance Samples: Interface shear tests (ASTM D 5321) shall be performed by the Geosynthetic Laboratory under the direction of the CQA ENGINEER using test procedures determined by the ENGINEER. Tests shall be performed at a frequency of one test per 100,000 ft^2 of material. All costs related to testing and evaluation of conformance samples is the responsibility of the CQA ENGINEER.

5. Accessory Bentonite: Any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same bentonite as used in the production of the GCL itself.

Table 1 REQUIRED GCL PROPERTIES

Property	Test Method	Manufacturers Test Frequency	Required Values
Nonwoven Mass/Unit Area	ASTM D 5261	1/ 200,000 sq. ft. (1/20,000 sq. m)	6.0 oz./yd^2 MARV
Woven	ASTM D 5261	1/ 200,000 sq. ft. (1/20,000 sq. m)	3.1 oz./yd^2 MARV
BENTONITE			
Swell Index	ASTM D 5890	1 per 50 tonnes	24 mL/2g min.
Fluid Loss	ASTM D 5891	1 per 50 tonnes	18 mL max.
FINISHED GCL			
Bentonite Mass Per Unit Area[1]	ASTM D 5993	40,000 sq. ft. (4,000 sq. m)	0.75 lb./sq. ft. (3.6 kg/m^3) min
GCL Grab Strength[2]	ASTM D 6768	200,000 sq. ft. (20,000 sq. m)	50 lbs./in (88 N/cm) MARV
GCL Peel Strength	ASTM D 6496	40,000 sq. ft. (4,000 sq. m)	3.5lbs/in (6.1 N/cm) min
GCL Index Flux	ASTM D 5887	Weekly	1 x 10^{-8} cm/sec max
GCL Hydraulic Conductivity	ASTM D 5887	Weekly	5 x 10^{-10} cm/sec max
GCL Hydrated Internal Shear Strength	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24kPa) typ @ 200 psf

[1] Bentonite mass/area reported at zero (0) percent moisture content

[2] All tensile strength testing is performed in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496.

2.2 MANUFACTURING QUALITY CONTROL

A. The CONTRACTOR shall require that the GCL Manufacturer sample and test the GCL, at the frequencies outlined in Table 1 the tests shall demonstrate that the GCL properties conform to the values specified in Table 1. All Quality Control testing required by these Specifications and/or conducted at the discretion of the CONTRACTOR shall be the responsibility of the CONTRACTOR. GCL rolls that do not have acceptable manufacturing quality control test results shall be rejected by the COMPANY.

B. Quality Control certificates shall be issued by the GCL manufacturer to the ENGINEER for each delivery of material. The certifications shall be signed by the quality control manager of the GCL manufacturer or other responsible party and shall include the following information:

1. Shipment Packing List and Bill of Lading - Lists indicating the rolls shipped on a particular truckload.

2. Letter of Certification - The letter indicating the material is in conformance with the physical properties specified.

3. Physical Properties Sheet - The material specification for the GCL supplied in accordance with this specification.

C. Quality Control submittals shall be issued by the GCL MANUFACTURER to the ENGINEER, for each lot of material if necessary. The submittals shall include the following information:

1. Bentonite Manufacturer Certification - Bentonite manufacturer quality documentation for the particular lot of clay used in the production of the rolls delivered.

2. Geotextile Manufacturer Certification - Geotextile manufacturer quality control documentation for the particular lots of geotextiles used in the production of the rolls delivered.

3. GCL Manufacturer Tracking List - Cross referencing list delineating the corresponding geotextile and bentonite lots for the materials used in the production of the rolls delivered.

4. Manufacturing Quality Control Data - The manufacturing quality control test data indicating the actual test values obtained when tested at the appropriate frequencies for the properties specified in Table 02274-1.

2.3 LABELING

A. The geomembrane shall be labeled with the following information

1. Length and wide of the roll or factory panel

2. Name of Manufacturer

3. Product Identification

4. Lot number

5. Roll or Factory Panel Number

2.4 TRANSPORTATION

A. Transportation of the GCL is the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to materials prior to and during transportation to the site. The CONTRACTOR shall replace any damaged rolls at no additional cost to the COMPANY.

2.5 HANDLING AND STORAGE

A. Handling, storage, and care of the GCL prior to and following incorporation in the work are the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to the material incurred prior to final acceptance of the installation by the COMPANY. The CONTRACTOR shall repair any damage in accordance with this Section and at no additional cost to the COMPANY.

B. The CONTRACTOR shall be responsible for storage of the GCL at the site. The GCL shall be protected from water, dirt, puncture, cutting, or other damaging or deleterious conditions. The GCL shall also be stored in accordance with any additional requirements of the GCL Manufacturer, COMPANY, or ENGINEER.

1. GCL should be stored no higher than the height at which the handling apparatus may be safely handled by installation personnel. Stacks or tiers of rolls should be situated in a manner that prevents sliding or rolling by chocking the bottom layer of rolls.

2. Rolls shall not be stacked on uneven or discontinuous surfaces as this may cause bending or deformation of the rolls and in turn damage the GCL or cause difficulty inserting the core pipe.

3. An additional tarpaulin or plastic sheet shall be used over the stacked rolls to provide extra protection for GCL material stored outdoors.

4. Bagged bentonite material shall be stored and tarped next to GCL rolls unless other more protective measures are available. Bags shall be stored on pallets or other suitably dry surface which will prevent undue prehydration.

C. GCL must be supported during handling to ensure worker safety and prevent damage to the liner. Under no circumstances should the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or pushed to the ground from the delivery vehicle.

1. The ENGINEER shall verify that suitable handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the GCL material itself. Typical handling equipment is described below:

a. Spreader Bar Assembly - A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the GCL core while the spreader bar beam shall prevent chains or straps from chafing the roll edges.

b. Stinger - A stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.

c. Roller Cradles - Roller cradles consist of two larger diameter rollers spaced approximately 3 inches apart which both support the GCL roll and allow it to be freely unrolled. The use of roller cradles shall be permitted if the rollers support the entire width of the GCL roll.

d. Straps - Straps may be used to support the ends of the spreader bars but are not recommended as the primary support mechanism. As straps may damage the GCL where around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. **Compaction**: Site specific compaction requirements should be followed in accordance with the project drawings and specifications. At a minimum, the level of compaction should be such that no rutting is caused by installation equipment or other construction vehicles which traffic the area of deployment.

B. **Clearing**: The surfaces to be lined shall be smooth and free of any debris, vegetation, roots, sticks, sharp rocks, or other deleterious materials larger than one inch, as well as free of any voids, large cracks, standing water, or ice.

C. **Grading:** Directly prior to deployment of the GCL, the subgrade shall be final graded to fill remaining voids or desiccation cracks, and smooth drum rolled to eliminate sharp irregularities or abrupt elevation changes. The surfaces to be lined shall be maintained in this smooth condition.

3.2 SUBGRADE INSPECTION

A. **Inspection:** Prior to GCL deployment the, the earthen base layer shall be approved by the ENGINEER.

1. The earthen subgrade shall be continuously inspected, approved and certified by the ENGINEER prior to GCL placement.

2. Upon approval by the ENGINEER, it shall be the installer's responsibility to indicate to the ENGINEER any change in the condition of the subgrade that could cause it to be out of compliance with any of the requirements of this section or the project specific specification.

3.3 ANCHOR TRENCH

A. **Excavation:** An anchor trench shall be excavated by the earthwork CONTRACTOR or liner installer to the lines and grades shown on the project drawings.

1. The anchor trench shall be constructed free of sharp edges or corners and maintained in a dry condition. No loose soil shall be permitted beneath the GCL within the trench.

B. **Inspection:** The anchor trench shall be inspected as well as approved by the ENGINEER prior to the GCL placement, back-filling and compaction of the anchor key material.

3.4 GCL PLACEMENT

A. **GCL Orientation:** In the absence of specific guidelines, GCL panels should be placed with the non-woven side up on slopes to maximize the shear strength characteristics.

B. **GCL Panel Position**: Where possible, all slope panels should be installed parallel to the maximum slope while panels installed in flat areas require no particular orientation. No horizontal GCL panel seams shall be allowed on slopes steeper than 3H:1V.

C. **Panel Deployment:** GCL materials shall be installed in general accordance with the procedures set forth in this section, subject to site specific conditions which would necessitate modifications.

D. **Reinforced GCL**: Reinforced GCL shall be used on both slopes as well as the flat areas to ensure the GCL withstands the rigors of the installation and subsequent low load hydration.

1. Deployment should proceed from the highest elevation to the lowest to facilitate drainage in the event of precipitation.

2. The GCL may be deployed on slopes by pulling the material from a suspended roll, or securing a roll end into an anchor trench and unrolling each panel as the handling equipment slowly moves backwards.

3. Deployment on flat areas shall be conducted in the same manner as that for the slopes, however, care should be taken to minimize dragging the GCL. Slip-sheet may be used to facilitate positioning of the liner while ensuring the GCL is not damaged from underlying sources.

4. Overlaps shall be a minimum of 6 inches and be free of wrinkles, folds or fishmouths.

5. The CONTRACTOR shall only install as much GCL as can be covered at the end of the day. No GCL shall be left exposed overnight. The exposed edge of the GCL shall be covered by a temporary tarpaulin or other such water resistant sheeting until the next working day.

E. **Anchoring:** All GCL material installed on slopes greater than 3H:1V shall be anchored to prevent potential GCL panel movement.

1. Standard Anchor - The GCL shall be placed into and across the base of the excavated trench, stopping at the back wall of the excavation as shown on the drawing.

F. **Seaming:** A 6-inch lap line and a 9-inch match line shall be imprinted on both edges of the upper geotextile component of the GCL to assist in installation overlap quality control. Lines shall be printed as continuous dashes in easily observable non-toxic ink.

1. Overlap seams shall be a minimum of six inches on panel edges and one foot on panel ends.

2. Bentonite should be placed between panels at a rate of 1/4 pound per linear foot of seam.

G. **Detailing:** Detail work, defined as the sealing of the liner to appurtenances, shall be performed as recommended by the ENGINEER and the GCL MANUFACTURER.

H. **Damage Repair:** Prior to geomembrane material placement, damage to the GCL shall be identified and repaired by the CONTRACTOR. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.

1. Rip and Tear Repair (Flat Surfaces) - Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum of overlap of 12 inches on all edges.

2. Rip and Tear Repair (Slopes) - Damaged GCL material on slopes shall be repaired by the same procedures above. The minimum overlap of 12 inches on all edges may be increased as recommended by the ENGINEER.

3. Displaced Panels - Displaced panels shall be adjusted to the correct position an orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

4. Premature Hydration - If the GCL is subjected to premature hydration, the GCL installer shall notify the ENGINEER for a site specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design-dependent upon the degree of damage.

3.5 COVER PLACEMENT

A. The CONTRACTOR shall not leave any tools or equipment on the GCL.

B. The CONTRACTOR shall take all necessary precautions to ensure that the GCL is not damaged during its installation or during other construction activities. Installation on rough surfaces shall be performed carefully.

C. The ENGINEER shall provide monitoring of the placement and spreading of soil materials over the GCL. Equipment shall not be driven directly on the GCL. Unless otherwise specified by the COMPANY, all equipment operating on materials overlying the GCL shall comply with the following:

Table 02274-2
Maximum Allowable Pressure for Respective Soil Thicknesses

Maximum Allowable Equipment Ground Pressure (psi)	**Thickness of Soil Above GCL (in)**
> 5	12
< 10	18
< 20	24
> 20	36

D. **Maximum Allowable Pressure:** The maximum allowable equipment ground pressure shall be 65 psi. The acceptability of equipment operating at ground pressures greater than 65 psi will be evaluated by the COMPANY at the CONTRACTOR'S expense.

E. **Installation Exceptions:** Installation of the overlying geosynthetic component can be accomplished through the use of *lightweight*, rubber-tired equipment such as a 4-wheel

all-terrain vehicle (ATV). This vehicle can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.

F. Cover soils shall be free of angular stones or other foreign matter that could damage the GCL. Cover soils should be approved by the project Engineer with respect to particle size, uniformity and chemical compatibility. Cover soils with high concentrations of calcium (e.g. limestone, dolomite) are not acceptable.

G. Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. Cover soils shall be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.

3.6 PROTECTION OF THE WORK

A. The CONTRACTOR shall use all means necessary to protect all materials and partially completed and completed work.

B. In the event of damage, the CONTRACTOR shall make repairs and replacements necessary to the approval of the COMPANY and at no additional cost to the COMPANY.

C. The ENGINEER shall issue an approval of the GCL liner installation to the COMPANY in accordance with the CQA Plan prior to placement of any material over the GCL.

- END OF SECTION -

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SECTION 02800 – PERMANENT ACCESS CONTROLS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

The CONTRACTOR shall furnish and construct permanent access controls including boulder barriers, jack-leg fencing, and access control gates as shown on the Drawings in accordance with the Contract Documents.

Chain link fencing, gates, accessories, fittings, and fastenings shall be installed according to Section 2831 – Chain Link Fencing and Gates.

1.2 CONTRACTOR SUBMITTALS

A. Shop Drawings and product data submittals shall be made in accordance with Section 01300 - Contractor Submittals.

1. Shop Drawings shall be submitted for access control gates.

PART 2 -- PRODUCTS

2.1 JACK-LEG FENCING

Wood jack legs shall be 5-inch minimum diameter, minimum 52" long, peeled, and butt treated per AWPA standards. Treatment shall extend the entire length of the post.

Wood rails for brace panels shall be peeled with a 3½ inch minimum diameter tip and 5 inch maximum butt and shall be 12 feet long.

Fasteners shall be 7" TimberLok® heavy duty wood screws or approved equal. Two screws are required per jack connection and one screw is required at each rail connection.

2.2 BOULDER BARRIER

Boulder shall be of sufficient size and mass to prevent vehicle access and may be obtained from on-site sources or imported.

A. Boulders shall consist of dense, natural rock. Boulders shall be resistant to weathering and to water action; free from overburden, spoil, shale, and organic material. Shale and shale seams are not acceptable.

2.3 ACCESS CONTROL GATES

Access control gates shall be lockable, swing-arm type steel pipe gates, with a nominal opening width of 18-feet.

All pipe shall be ASTM A53 Grade B steel pipe with a shop applied steel coating system.

Minimum pipe diameter shall be 3-inches.

Gates posts shall be set in concrete.

PART 3 -- EXECUTION

3.1 INSPECTION

Prior to commencing installation, the CONTRACTOR shall inspect all areas and conditions within which WORK of this Section will be performed. Dimensions and clearances shall be verified. Final grading shall be completed and all earth, brush, or other obstructions which interfere with the proper alignment and construction of perimeter controls shall be removed.

3.2 BOULDER BARRIERS

Boulder barrier shall be constructed at the location shown on the Drawings, on slopes of 3H:1V or flatter.

Boulders shall be placed such that they are not subject to rolling or overturning. Shallow sockets shall be excavated as needed to ensure stable placement.

Boulders shall be placed with a nominal edge-to-edge spacing of 4 feet, +/- 0.5 feet. .

3.3 JACK-LEG FENCE

Jack-Leg shall be constructed at the location shown on the Drawings, on slopes steeper than 3H:1V.

Jackleg shall be set in place perpendicular to the ground.

Rails shall be coped and attached to the posts. If coping is done in the field, coped area shall be painted with a wood preservative that meets AWPA standards

1. Jacklegs shall be spaced 10 feet apart and rail lengths shall be 12 feet.
2. When completed, the fence shall be solid.
3. Rails shall be fastened to the jacklegs alternating one above the other. Back rail also shall be fastened alternating one above the other.
4. Starting panels, ending panels, and every 10th panel, shall be braced diagonally.

3.4 ACCESS CONTROL GATES

Gates shall be constructed at the locations shown on the Drawings.

Gate posts shall be set in concrete, and shall be plumb. Gate shall be level.

- END OF SECTION -

SECTION 02831 – CHAIN LINK FENCING AND GATES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

The CONTRACTOR shall design, furbish, and install chain link fencing, gates and appurtenances as indicated on the Drawings in accordance with the Contract Documents.

Chain link fencing, gates, accessories, fittings, and fastenings shall be products of a single manufacturer.

1.2 CONTRACTOR SUBMITTALS

General: Furnish submittals in accordance with Section 01300 - Contractor Submittals.

Shop Drawings

Manufacturer's technical data, product specifications, standard details, certified product test results, installation instructions and general recommendations.

Scale layout of fencing, gates, and accessories. Drawings shall show fence height, post layout, including sizes and sections; post setting and bracing configuration, details of gates and corner construction, barbed wire support arms; and other accessories which may be necessary.

PART 2 -- PRODUCTS

2.1 FENCE CONFIGURATIONS

Existing Site Perimeter Security Fence

New fence segments, replacement fence segments, and new gates shall match the height and configuration of the existing fence and gates.

New gates installed at access road and haul road locations shall provide an equivalent level of security from unauthorized vehicle and personnel access as the existing perimeter fence. Gate configurations shall be determined by the CONTRACTOR and approved by the ENGINEER.

CSZ Fencing

New fence installed for the CSZ shall have a height of 6 feet. Gates shall be chain-link, lockable, swing-gates conforming to the requirement of this section.

Barbed wire top is not required for new CSZ fencing.

Interim Fencing and Water Management Pond Fencing

Perimeter fencing for water management ponds shall have a height of 8 feet. Gates shall be chain-link, lockable, swing-gates, conforming to the requirements of this section.

Barbed wire top is not required for water management pond fencing.

2.2 GENERAL

Dimensions indicated herein for roll-formed pipe and H-sections are outside dimensions, excluding coatings.

Fence fabric height shall be the same as existing chain link fence on the site.

Fencing materials shall be hot-dip galvanized after fabrication.

Fencing shall be topped with 3 lines of barbed wire on single supporting arms, sloped outward at a 45-degree angle.

2.3 STEEL FABRIC

Fence fabric shall be No. 9 gauge steel wire, 2-inch mesh, with top selvages knuckled and bottom selvages twisted and barbed.

Fabric shall be galvanized in conformance with ASTM A 392 - Zinc-Coated Steel Chain Link Fence Fabric, Class II, with not less than 2.0 ounces zinc per square foot of coated surface.

2.4 FRAMING AND ACCESSORIES

Steel Framework, General: Unless otherwise indicated, framework components shall be fabricated of galvanized steel conforming to ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless, or ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, with not less than 1.8 ounces zinc per square foot of coated surface.

Fittings and accessories shall be galvanized in accordance with ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware, with zinc weights per Table I of that standard, except that no coating shall be less than 1.8-ounce zinc per square foot of coated surface.

End, Corner and Pull Posts: Posts shall be one-piece without circumferential welds, 3-inch schedule 40 pipe, 5.79 pounds per linear foot.

Line Posts: Line posts shall be spaced no more than 10-feet on center and shall be 2-1/4 inch “H” column section, 4.1-pounds per linear foot, or schedule 40, 2-1/2 inch pipe, 3.65-pounds per linear foot.

Gate Posts: Gate post dimensions shall be according to manufacturer recommendations or 4-inch schedule 40 pipe, 9.1-pounds per linear foot, whichever is greater.

Top Rail: Top railing shall be provided in manufacturer’s longest lengths, with expansion type couplings, approximately 6-inches long, for each joint. Fence design shall provide positive, secure attachment of top rail to each gate post, corner post, pull post and end post. Top rail and braces shall be 1-5/8 inch schedule 40 pipe, 2.27-pounds per linear foot, or 1-1/2 inch “H” column section, 2.00-pounds per linear foot.

Tension Wire: Tension wire shall be located at the bottom of the fabric and shall consist of No. 7 gauge coated coil spring wire of metal and finish to match fabric. Tension wire

shall be interlaced with the fabric or attached to the fabric along the extreme bottom of the fence. Tension wire attachment shall be with fabric tie wires at a spacing of no more than 24-inches apart.

Fabric Tie Wires: Fabric tie wires shall be No. 9 gauge galvanized steel wire of the same finish as the fabric. Aluminum ties shall not be used. Ties shall be spaced 14-inches apart on posts and 24-inches apart on rails.

Post Brace Assembly: Post brace assembly shall be manufacturer's standard adjustable brace assembly provided at each end post, gate post and at both sides of each corner post and intermediate brace post. Material used for brace shall be same as top rail. Truss bracing between line posts shall be achieved with 0.375-inch diameter rod and adjustable tensioner.

Post Tops: Post tops shall be weather-tight closure caps, designed for containment of top rail and positive permanent attachment to post. One cap shall be provided for each post.

Stretcher Bars: Stretcher bars shall be one-piece lengths equal to the full height of the fabric, with minimum cross-section of 3/16-inch by 3-1/2 inch. One stretcher bar shall be provided for each gate and end post, and 2 for each corner and intermediate brace post.

Stretcher Bar Bands: Stretcher bar bands shall be one-piece fabrications designed to secure stretcher bars to end, corner, intermediate brace, and gate posts. Bands shall have a minimum cross-section of 1/8-inch by 3/4-inch. Stretcher bar bands shall be spaced no more than 15-inches on center.

Barbed Wire Supporting Arms: Supporting arms shall be manufacturer's standard fabrication, of metal and finish to match fence framework, with provision for anchorage to each post and attachment of three rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap. Supporting arm shall be single 45-degree arm type and shall be capable of withstanding 250 pounds of downward pull at outermost end.

Barbed Wire: Barbed wire shall be 2-strand, No. 12-1/2 gauge zinc-coated steel or iron wire with four-point, 14-gauge barbs spaced no more than 5-inches apart.

2.5 GATES

Fabrication: Perimeter frames of gates shall be fabricated from same metal and finish as fence framework. Gate frames shall be assembled by welding or with fittings and rivets for rigid, secure connections. Welds shall be ground smooth. Gate frames and any ungalvanized hardware, shall be hot-dip galvanized after fabrication. Horizontal and vertical members shall be provided to ensure proper gate operation and attachment of fabric, hardware and shall be hot-dip galvanized after fabrication.

Fabric for gates shall match fence fabric, unless otherwise indicated. Fabric shall be installed with stretcher bars at all perimeter edges. Stretcher bars shall be attached to gate frame with stretcher bar bands spaced no more than 15-inches on center.

Each gate shall be diagonally cross-braced with a 3/8-inch diameter adjustable length truss rod to ensure frame rigidity without sag or twist.

Where barbed wire is indicated above gates, vertical members shall be extended and fabricated as required to receive barbed wire supporting arms.

Swing Gates: Perimeter frames of swing gates shall be constructed of the same pipe or "H" column members as the top rails and shall be fabricated by welding. Welds shall be ground smooth prior to hot-dip galvanizing.

Hardware and accessories shall be provided for each gate, galvanized in conformance with ASTM A 153, and in accordance with the following:

Hinges: Hinges shall be of size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Three hinges shall be provided for each leaf 6-feet or more in height.

Latch: Latch shall be forked type or plunger-bar type, permitting operation from either side of the gate, with padlock eye as an integral part of the latch.

Keeper: Keeper shall be provided which automatically engages the gate leaf and holds it in the open position until it is manually released.

Double Gates: Gate stops shall be provided for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Locking device and padlock eyes shall be provided as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.

2.6 RELATED ITEMS

Concrete: Concrete shall be provided according to Section 03300 - Cast-In-Place Concrete.

Nuts, bolts and screws shall be steel, minimum size 3/8-inch diameter, hot-dip galvanized after fabrication.

2.7 MANUFACTURERS

Manufacturer's Qualifications: Chain link fencing and gates shall be products of a single manufacturer which has been successfully engaged in the production of such items for a period of at least 5 years.

Installer's Qualifications: Installation of the chain link fence shall be by the manufacturer or by a firm accepted and licensed by the manufacturer.

Manufacturers, or equal

American Fence Corp.

Anchor Fence, Inc.

United States Steel

PART 3 -- EXECUTION

3.1 INSPECTION

Prior to commencing installation, the CONTRACTOR shall inspect all areas and conditions within which WORK of this Section will be performed. Dimensions and clearances shall be verified. Final grading shall be completed and all earth, brush, or other obstructions which interfere with the proper alignment and construction of fencing shall be removed.

3.2 INSTALLATION

General: Unless otherwise indicated, all posts shall be set in concrete. Gate and related posts, corner posts, and other critical elements shall be provided with concrete foundations which are designed to safely accommodate the loads to which they will be subjected.

Excavation: Holes for posts shall be drilled or hand excavated to the diameters and spacings indicated, in firm, undisturbed or compacted soil. Post foundations shall comply with the following:

Holes shall be excavated to a diameter not less than 12-inches or not less than 5 times the largest dimension of the item being anchored, whichever is larger.

Excavated depth for holes shall be a minimum of 4-inches lower than the post bottom, with bottom of posts set not less than 36-inches below finish grade surface.

Setting Posts: Line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts, parallel to the ground slope. Posts shall be set plumb and shall be centered in holes, 4-inches above the bottom of the excavation, with posts extending not less than 36-inches below finish grade surface.

Corner posts shall be installed where changes in the fence lines equal or exceed 15 degrees, as measured in a horizontal plane.

Each post shall be properly aligned vertically and its top aligned parallel to the ground slope. Posts shall be maintained in proper position during placement and finishing operations.

Concrete

Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing concrete, the earth around the hole shall be thoroughly moistened.

Encasement concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating.

Concrete footings shall have a neat appearance and shall be extended 2-inches above grade and troweled to a crown to shed water.

A minimum of 7 days shall elapse after placing the concrete footings before the fence fabric or barbed wire is fastened to the posts.

Bracing: Bracing shall be provided at all ends, corners, gates, and intermediate brace posts. Corner posts and intermediate brace posts shall be braced in both directions. Horizontal brace rails shall be set midway between the top rail and the ground, running from the corner, end, intermediate brace or gate post to the first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

Braces shall be so installed that posts remain plumb when diagonal rod is under proper tension.

Intermediate Brace Posts: Where straight runs of fencing exceed 500-feet, intermediate brace posts shall be installed, spaced equally between ends or corners; with additional posts provided as required, such that the spacing between intermediate brace posts does not exceed 500-feet. Intermediate brace posts shall be equivalent in size to corner posts and shall be braced with horizontal brace rails and diagonal tension members in both directions.

Top Rails: Top rails shall be run continuously through post caps, bending to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.

Tension Wire: Continuous bottom tension wire shall be stretched tight with turnbuckles at end, gate, intermediate, and corner posts. Tension wire shall be installed on a straight grade between posts, with approximately 2-inches of space between finish grade and bottom selvage, unless otherwise indicated. Tension wire shall be tied to each post with not less than 6 gauge galvanized wire.

Fabric

Chain-link fabric shall be fastened on the secured side of the posts.

Fabric shall be stretched and securely fastened to posts. Between posts, top and bottom edges of the fabric shall be fastened to the top rail and bottom tension wire, respectively.

Fabric shall be stretched and anchored in such a manner that it remains in tension after the pulling force is released.

Tie Wires: Tie wire shall be bent to conform to the diameter of the pipe to which it is attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Ends of wire shall be bent back to minimize hazard to persons or clothing.

Fabric shall be tied to line posts with tie wires spaced at 12-inches on center.

Fabric shall be tied to rails and braces with tie wires spaced at 24-inches on center.

Fabric shall be tied to tension wires, with hog rings spaced 24-inches on center.

Stretcher Bars: Fabric shall be fastened to end, corner, intermediate brace, and gate posts with stretcher bars. Bars shall be threaded through or clamped to fabric at 4-inches on center and secured to posts with stretcher bar bands spaced no more than 14-inches on center.

Fasteners: Nuts for tension bands and hardware bolts shall be installed on the side of fence opposite the fabric side. Ends of bolts shall be peened or the threads scored to prevent removal of nuts.

Galvanized coating damaged during construction of the fencing shall be repaired by application of **Galvo-Weld**; **Galvinox**; or equal.

3.3 GROUNDING

Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150-feet on each side of the crossing.

Fences, gates and appurtenances enclosing electrical equipment areas, gas yards, or other hazardous areas shall be electrically continuous and grounded.

Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4-inch by 10-foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6-inches below grade.

Where driving is impracticable, electrodes shall be buried a minimum of 12-inches deep and radically from the fence. Top of electrode shall be not less than 2-feet or more than 8-feet from the fence.

Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation, the total resistance of fence to ground shall not be greater than 25 ohms.

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SECTION 02970 - REVEGETATION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

The CONTRACTOR shall provide temporary vegetative erosion protection and final stabilization of finished slopes including seeding, plantings, and mulching for all disturbed areas that are not to be otherwise treated.

For purposes of revegetation of disturbed areas, the terrain at the site was divided into the following four categories, as shown on the Drawings:

Flat-lying Waste Containment Capped Areas where a soil cover will be underlain by an impermeable geomembrane.

Other flat-lying disturbed areas which are sloped at 3:1 horizontal to vertical (h:v) or flatter.

Other steeper disturbed areas.

Downstream drainage areas**.**

1.2 REFERENCE PLANS OF OPERATION

The work under this section shall be conducted in substantial compliance with the following plans of operation included as part of the Contract Documents:

Revegetation Plan included as Appendix G to the Remedial Action Work Plan

Remedial Action Work Plan

1.3 CONTRACTOR SUBMITTALS

Furnish submittals in accordance with Section 01300 - Contractor Submittals for approval.

Submit written certification that all equipment used for revegetation has been pressure washed off-site for control of noxious weeds.

Materials List: A list of all materials to be used in the revegetation operations together with the source of those materials. The list shall include mulches, soil amendments, seed mixtures, sod species, and erosion control blanketing. Manufacturer's literature showing physical characteristics, applications, and installation instrumentation shall be included.

Reports

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

Reports for the following materials shall be included.

Seed: For mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed content, date tested and state certification.

Certificates: Certificates of compliance that materials meet the indicated requirements prior to the delivery of materials.

1.4 MAINTENANCE OF PLANTING PRIOR TO ACCEPTANCE OF WORK

General: The CONTRACTOR shall be responsible for protecting, watering, and maintaining seeded areas and plantings until final acceptance of the WORK.

Protection: The CONTRACTOR shall provide adequate protection to all newly seeded planted areas including the installation of approved temporary fences to prevent trespassing and damage.

PART 2 -- PRODUCTS

2.1 GENERAL

Materials shall be first-grade, commercial quality and shall have certificates indicating the source of material, analysis, quantity, or weight attached to each sack or container or furnished with each delivery.

Delivery certificates shall be given to the ENGINEER as each shipment of material is delivered. A list of the materials used, together with typical certificates of each material, shall be submitted to the ENGINEER prior to final acceptance.

2.2 FERTILIZER AND ADDITIVES

Fertilizer shall not be used.

2.3 MULCH

Wood Cellulose Fiber: Mulch shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to aid visual monitoring during application. Composition on air-dry weight basis: 9 to 15 percent moisture and pH range from 4.5 to 6.0.

2.4 SEED MIXTURES

All seed shall conform to the requirements of the approved Revegetation Plan.

The CONTRACTOR shall furnish the seed supplier's guaranteed germination of each variety listed in the seed mixture.

Seed which has become wet, moldy, or otherwise damaged prior to use will not be accepted.

Seed shall be fresh, clean, and new-crop seed composed of the following varieties mixed in the proportions by weight as indicated. Seed shall be tested for compliance with the minimum percentage of purity and germination requirements. All rates specified shall be pure live seed (PLS).

Seed shall be delivered in original unopened packages bearing an analysis of the contents.

Seed mixture contains no more than 0.01% other seed, whether identified or not.

Any deviation of the indicated seed mixture composition shall be approved by the ENGINEER prior to delivery to the Site.

The CONTRACTOR is warned that this seed mixture is composed of native grass and grass-like species, but some lead time may be necessary to locate a distributor and have the seed mix prepared.

2.5 SHRUBS

Shrubs shall be myccorrhizal inoculated seedlings grown from seed or cuttings.

Containerized stock shall be 6 to 12 months old.

Planting stock received within two weeks of planting shall be kept out of direct sunlight and watered to protect from desiccation.

Planting stock held longer than two weeks prior to planting shall be kept out of direct sunlight, containers shall be covered with mulch, and kept moist until planting.

2.6 EROSION CONTROL MATERIAL

Erosion control materials shall conform to the requirements of Section 02160 – Sediment and Erosion Control.

2.7 PESTICIDE

Pesticides shall not be used.

PART 3 -- EXECUTION

3.1 GENERAL

Delivery of seed and plantings shall only begin after approval by the ENGINEER.

Seeding and planting shall not be performed at any time when it may be impaired by climatic conditions.

Seeding and planting shall be conducted after October 15 and prior to November 30.

3.2 NOXIOUS WEED CONTROL

To prevent the spread of non-native and noxious plant species the CONTRACTOR shall clean all equipment used in revegetation work by thoroughly pressure washing at an off-site location. Certify to the ENGINEER that cleaning has been done and allow for inspection at an off-site location in accordance with Part 1.3 of this section.

3.3 SURFACE PREPARATION

Cover soils or other final grade surface soils shall be placed in accordance with Section 02200 – Earthwork.

The seeding shall not begin until the CONTRACTOR has repaired all areas of settlement, erosion, rutting, etc. and the soils have been placed, compacted (if required), and contoured to finish grade. The ENGINEER shall be notified of areas that prevent the planting work from being executed.

The seeding subgrade shall be scarified to a depth of not less than 6-inches and not greater than 12-inches, and all surface irregularities removed.

Surface soils shall be disked to a depth of 6-inches as a final surface preparation immediately prior to seeding and planting.

Any unusual subsoil condition that will require special treatment shall be reported to the ENGINEER.

No seeding shall be done when wind velocity exceeds 4 mph, within 4 hours after rain, or if the surface has been compacted without first loosing the ground.

3.4 BROADCAST SEEDING

Broadcast seeding shall be performed where indicated or as directed in the field by the ENGINEER.

The soil shall be prepared per soil preparation instructions. The ENGINEER will inspect and approve the soil preparation prior to commencing with seeding. The CONTRACTOR shall prepare only enough ground that can be planted within 24 hours thereafter.

Sow seed at the application rates indicated in the approved Revegetation Plan. Equal quantities of seed shall be sown in two directions at right angles to each other to produce an even distribution of seed over the entire area.

Mechanical application (hydroseeding) is acceptable. The CONTRACTOR shall notify the ENGINEER of proposed method, mulch, and type of equipment to be used and shall receive approval before beginning this operation.

3.5 HYDROSEEDING

Equipment: Mixing shall be performed in a tank. The tank shall have a built-in continuous agitation and circulation system, of sufficient operating capacity to produce a homogenous slurry of mulch, stabilizer, seed, fertilizer and water in the designated unit proportions for a minimum coverage of one-half acre. The tank shall have a discharge system which will permit attachment of at least 500-feet of hose extensions, a change of elevation of 150-feet in height from tank to discharge nozzle, and still retain enough pressure to apply the slurry to the areas at a continuous and uniform rate.

Proportions: Proportions of mulch, seed, stabilizer and water per acre shall be as indicated in the approved Revegetation Plan, or as otherwise approved by the ENGINEER.

Application

With agitation system operating at part speed, water shall be added to the tank and good recirculation shall be established. Materials shall be added in such a manner that they are uniformly blended into the mixture.

Slurry distribution shall begin immediately. Application of slurry shall be done only when rain is not anticipated for at least three days after slurry application.

The entire tank of each batch of slurry shall be emptied and the slurry evenly applied to areas to be hydroseeded within a 2 hour period following the mixing of each slurry batch. Slurry batches not applied during this time will be rejected.

3.6 SEEDING COMPLETION

Harrowing shall be conducted upon completion of seeding.

Cellulose wood fiber mulch shall be applied after harrowing. Mulch application rates shall be in as indicated in the approved Revegetation Plan

3.7 SHRUBS

Loose organic material shall be brushed aside from the planting spot to expose mineral soil.

A slit shall be made in the ground using a planting bar or similar tool. In order to avoid damage to the underlying geomembrane, excavations and planting bar insertions shall be limited to depths of 18 inches or less in the Waste Containment Area.

If the roots are too long for the planting equipment, pruning of small end roots shall be not more than 25 percent of the total root length.

After planting in the slit, the bar shall be re-inserted several inches away, rocked away from the plant to kick in the soil at the bottom of the roots, and then rocked toward the plant to compress the soil around the base of the plant.

The soil around the plant shall be packed with foot pressure.

Shrubs shall not be planted when the soil is frozen.

Shrubs shall be planted in a vertical position with the root collars approximately level with or slightly below (0.5 inch or less) the existing ground line.

Seedling protection tubes shall be used for all transplants to protect seedlings.

3.8 EROSION CONTROL INSTALLATION

Erosion control material shall be installed in accordance with Section 02160 - Sediment and Erosion Control.

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DIVISION 03 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall provide cast-in-place concrete, joints in concrete, reinforcement steel, formwork, and appurtenant work in accordance with the Drawings and these Specifications.

B. The following types of concrete are covered in this Section:

1. **Structural Concrete**: Concrete to be used for roof, floor slabs, columns, walls, pavements, drainage channel cut-off walls, and other concrete items not indicated otherwise in the Contract Documents.

2. **Sitework Concrete**: Concrete to be used for anchor posts, curbs, gutters, catch basins, sidewalks, fence and guard post embedment, underground duct bank encasement, and other concrete appurtenant to electrical facilities, unless otherwise indicated.

3. **Fiber Reinforced Concrete:** Concrete to be used as indicated on the Drawings.

1.2 APPLICABLE CODES AND STANDARDS

A. The following standards are referenced in this Section:

1. American Concrete Institute (ACI):

ACI 117	Standard Specifications for Tolerances for Concrete Construction and Materials
ACI 211.1	Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.5R	Guide for Submittal of Concrete Proportions
ACI 301	Specifications for Structural Concrete
ACI 304R	Guide for Measuring, Mixing, transporting, and Placing Concrete
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318/318R	Building Code Requirements for Structural Concrete and Commentary
ACI 347R	Guide to Formwork for Concrete

ACI 546.2R	Guide to Underwater Repair of Concrete

2. American Society for Testing and Materials (ASTM):

ASTM A 615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 29	Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 172	Practice for Sampling Freshly Mixed Concrete
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 311	Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 721	Test Method for Average Particle Size of Alumina and Silica Powders by Air Permeability

ASTM C 989	Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1240	Specification for Silica Fume Used in Cementitious Mixtures
ASTM C 1260	Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM D 695	Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D 2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1611	Test Method for Slump Flow of Self-Consolidating Concrete

3. Concrete Reinforcing Steel Institute (CRSI):

Manual of Standard Practice

1.3 DEFINITIONS

A. "Cementitious material" as used herein shall include all Portland cement, pozzolan, ground granulated blast furnace slag, silica fume, and fly ash.

B. "Defective Concrete": Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. “Design strength” (f’c) is the specified compressive strength of concrete to meet structural design criteria.

1.4 CONTRACTOR SUBMITTALS

A. All submittals shall be made at least 30 Days in advance of initiation of work unless expressly indicated below. Any changes or revisions to previously approved submittals shall be submitted immediately. The CONTRACTOR shall submit the following for ENGINEER review and approval:

1. Shop Drawings

a. Shop bending diagrams, placing lists, and drawings of reinforcing steel prior to fabrication.

b. Details of reinforcing steel for fabrication and erection shall conform to ACI 315 and the requirements herein. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. Include bar placement diagrams which clearly indicate the dimensions of each bar splice. Placement diagrams shall show all embedded metals or pipes and all temporary blockouts shown or necessary to complete the WORK.

c. Where mechanical couplers are permitted to be used to splice reinforcing steel, submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and Shop Drawings that show the location of each coupler with details of how they are to be installed in the formwork.

d. Manufacturer's information demonstrating compliance with requirements of the following:

1) Mill tests for reinforcing steel

2) Mill tests for cement

3) Admixture certification. Chloride ion content shall be included.

4) Aggregate gradation test results and certification

5) Grout materials

2. Mix Designs: Prior to beginning the Work, submit concrete materials and mix designs in accordance with the guidelines of ACI 211.5R. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

3. Concrete Placement Plan: If requested by the ENGINEER, the CONTRACTOR shall submit a Concrete Placement Plan detailing means and methods that the CONTRACTOR will use in placing concrete. Adequate numbers of personnel, equipment and supplies shall be on Site and dedicated to the concrete placement. The plan shall provide and discuss, but not be limited to, the following items, which shall be considered mandatory:

a. Detail equipment to be used, including backup equipment.

b. Detail how concrete requirements for slump, temperature, time of placement from time of batching, etc. will be monitored and how decisions will be made to enable field adjustments to the batching process to be made and how communication with the batch plant will be made.

c. Detail contingency plans to be used in the event of breakdowns or other untimely events.

d. Each lift described shall be identified with a unique identification number that is included in the construction CPM schedule (Section 01311).

e. Estimated volume of concrete included in each lift.

4. Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall furnish certified delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring, and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate, added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each certificate shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the time when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.

1.5 QUALITY ASSURANCE

A. Testing of Materials

1. Tests on component materials and for compressive strength of concrete will be performed as indicated herein. Tests for determining slump will be in accordance with the requirements of ASTM C 143. Unless otherwise noted herein, test samples for compliance shall be taken at the point of placement.

2. Tests for determining the air content of concrete shall be in accordance with ASTM C 231.

3. Testing for aggregate shall include reactivity, organic impurities, abrasion resistance, and soundness in accordance with ASTM C 33 and sand equivalent value in accordance with ASTM D 2419. Testing of the cement-pozzolan-aggregate combination of materials proposed for the work shall be in accordance with ASTM C 1567.

4. The cost of laboratory tests on cement, aggregates and admixtures shall be arranged for and paid by the CONTRACTOR. The cost of laboratory tests on concrete as delivered to the Site will be arranged for and paid by the COMPANY. However, the CONTRACTOR shall pay the cost of any additional tests and investigations on Work that does not meet the Specifications. The laboratory will meet or exceed the requirements of ASTM C 1077.

5. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the COMPANY, and the CONTRACTOR shall assist in providing access, obtaining samples, and disposal and cleanup of excess material.

B. Field Compression Tests

1. Compression test specimen sets will be taken during construction from the first placement of each class of concrete herein and for every 50 cubic yards thereafter to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.

2. Compression test specimens for concrete will be made in accordance with ASTM C 31. Specimens will be 6-inches diameter by 12-inches high cylinders.

3. Compression tests will be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 Days and 2 at 28 Days. The remaining cylinder will be held to verify test results, if needed. The 7-Day cylinder will be used as an indication of normal strength gain and will not have associated acceptance criteria.

C. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 301 and as indicated herein.

2. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for subsequent batches of the type of concrete affected.

3. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement at no additional cost to the COMPANY.

D. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so that the concrete is within the tolerances herein. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117.

1. The variation from required lines or grades shall not exceed 1/4-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to ACI 301 and Section 01600 - Products, Materials, Equipment and Substitutions for job site storage of materials. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

PART 2 -- PRODUCTS

2.1 FORM MATERIALS

A. Except as otherwise expressly accepted by the ENGINEER, lumber brought on the Site for use as forms and bracing shall be new material.

B. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers.

2.2 REINFORCEMENT STEEL

A. General: Reinforcement steel for cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement and anchor bars shall conform to the requirements of ASTM A 615, Grade 60.

B. Accessories

1. Accessories shall include all necessary chairs, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Bar supports shall meet the requirements of the CRSI Manual of Standard Practice.

2. Concrete blocks (dobies) used to support and position reinforcement steel shall have the same or higher compressive strength than required for the concrete in which they are located. Where concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

2.3 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where approved by the ENGINEER. Couplers shall be in accordance with ACI 318 and shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcing bars being spliced at each splice.

2.4 CONCRETE MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the sequence of receipt of shipments.

B. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand portland cement conforming to ASTM C 150, Type I/II low alkali or Type V low-alkali. A single brand of cement shall be used throughout the Work, to the extent possible, and prior to its use, the brand shall be accepted by the ENGINEER. If, over the course of the Project, the cement becomes unavailable or is proposed to be substituted with a new cement, the CONTRACTOR shall provide submittals and certifications for the new cement in accordance with these Specifications. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the ENGINEER, if requested, regarding compliance with these Specifications.

2. Pozzolan shall conform to ASTM C 618, Class N or F, except that the maximum allowable loss on ignition shall be 6 percent. The minimum pozzolan content shall be at least 15 percent of the total cementitious material by mass. In lieu of adding pozzolan independently the cement type indicated 1 subparagraph 1 above may be substituted with cement Type IP conforming to ASTM C 595, which shall contain 15 percent pozzolan by mass. Testing of the cement and aggregate combination is required per ASTM C 1567.

3. Silica fume, if used, shall conform to ASTM C 1240 with a maximum loss of ignition of 6 percent. The material may be supplied in dry or slurry form. The water content in the slurry shall be included in the water-cement ratio. Silica fume shall not exceed 12 percent by weight of cement.

4. Ground Granulated Blast Furnace Slag (GGBFS) shall conform to ASTM C 989 Grade 100 or 120. GGBFS shall not exceed 50 percent by weight of cementitious materials

5. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities, and shall meet the requirements of ASTM C 1602. The water shall be considered potable, for the

purposes of this Section only, if it meets the requirements of the local governmental agencies.

6. Aggregates shall be obtained from a single source pit or quarry acceptable to the ENGINEER and shall conform to the requirements of ASTM C 33.

   a. Coarse aggregates shall be graded to comply with ASTM C 33 and consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof. The coarse aggregates shall consist of Size Number 67 (3/4 in. to No. 4) unless otherwise approved by the ENGINEER or specified.

   b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that is hard and durable and shall meet the requirements of ASTM C 33. When tested in accordance with ASTM D 2419, the sand equivalent value shall not be less than 75 for an average of 3 samples, nor less than 70 for an individual test.

   c. Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics.

   d. Aggregates shall not contain any substance that may be deleteriously reactive with the alkalis in the cement unless effective mitigating measures are taken to control reactivity.

   e. Aggregates shall show expansions less than 0.10 percent at sixteen (16) Days when tested in accordance with ASTM C 1260 using a cement with an alkali content above 0.8 percent (expressed as sodium oxide), and shall not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with ASTM C 295.

   f. If mitigating measures are required to control reactivity, submit satisfactory test results from ASTM C 1567 to determine if the combination of cementitious materials is adequate to mitigate deleterious reactivity.

7. All admixtures, if used, shall be compatible. Admixtures shall be used in accordance with manufacturers' recommendations. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 Days.

   a. Air-entraining agent meeting the requirements of ASTM C 260 - Air-Entraining Admixtures for Concrete shall be used. Sufficient air-entraining agent shall be used to provide the specified air content in the concrete, as placed in the Work, when tested in accordance with ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method. The ENGINEER reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. AIR ENTRAINING ADMIXTURE SHALL NOT BE USD FOR UNDERWATER PLACED CONCRETE

   b. Water reducing and set retarding admixture (WRA) shall conform to ASTM C 494, Types A, E or F. Water reducing and set retarding admixture shall be used in all concrete at the rate recommended by the admixture manufacturer based on the time from batching to delivery on Site.

   c. High Range Water Reducer (HRWRA - Superplasticizers) shall conform to ASTM C494 Types F or G, or ASTM C1017 Types 1 or 2.

d. Accelerating admixtures shall conform to ASTM C 494, Type C.

e. Retarding admixtures shall conform to ASTM C494, Types B, D, or G.

f. Anti-washout / Rheoplastic Admixture (AWA) shall be specially formulated and so indicated to be an anti-washout admixture to increase cohesion and to resist cement washout and concrete segregation and bleeding. AWA shall be compatible with other admixtures and so confirmed by the admixture manufacturers.

1) Rheoplastic concrete is concrete with a plasticity (slump) in the range of 8 to 11 inches, is non-segregating and exhibits little or no bleeding.

2) Use rheoplastic admixtures of the second or third generation type that control slump loss to within 3 inches for at least one and one half hours after batching for concrete temperatures up to 100 degrees F.

3) Second generation rheoplastic admixtures control the rise in concrete temperature for a minimum of one and one half hours from the time of batching.

4) Third generation rheoplastic admixtures will not, when compared to a reference concrete of equal slump, significantly retard the set of concrete throughout their recommended dosage range and at varying concrete temperatures.

5) Add rheoplastic admixtures at the batch plant unless specifically recommended by the manufacturer.

8. Ready-mix concrete shall conform to the requirements of ASTM C 94 - Ready-Mixed Concrete.

2.5 CURING COMPOUND

A. Curing compound shall conform to ASTM C 309, Type 1, Class B.

2.6 EPOXY GROUT

A. Grout for grouting anchor bars shall be specifically formulated for such application, for the moisture condition, application temperature and orientation of the hole to be filled. Epoxy grout shall be Epcon A7 Acrylic Adhesive as manufactured by ITW Ramset/Read Head, Power-Fast Epoxy Injection Gel as manufactured by Powers Fasteners, Five Star RS Anchor Gel manufactured by Five Star Industries, Pro-Poxy 400 manufactured by Unitex, or ENGINEER-approved equal.

2.7 NON-SHRINK GROUTS

A. General

1. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.

2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.

3. Grout shall not contain chlorides or additives that may contribute to corrosion.

4. Grout shall be formulated to be used at any consistency from fluid to plastic.

5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:

   a. Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

   b. Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

   c. Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

   d. Grout shall be certified for use in freeze/thaw environments.

B. Non-Shrink Grout – Class I

1. Unless otherwise indicated, Non-Shrink Grout – Class I shall be provided as listed below whether indicated on the Drawings or not:

   a. Filling blockout spaces for embedded items such as railing posts, gate frame guides, etc. Where placement time exceeds 20 minutes use Non-Shrink Grout – Class II.

   b. Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas.

   c. Storage tanks and other non-motorized equipment and machinery under 30 horsepower.

   d. Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill materials.

   e. Any application not listed in this Section, where grout is indicated.

2. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5000 psi when mixed at a fluid consistency.

3. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.

4. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Test Method for Early Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

5. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

6. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.

7. Class I Non-Shrink Grout shall be Masterflow 713 Plus by MBT/Degussa Building Systems, Five Star Grout by Five Star Products, Sikagrout 212 by Sika Corporation,

Premier by L&M Construction Chemicals; High-Flow Grout by Euclid Chemical Company, CG 200 PC by Hilti, or ENGINEER-approved equal.

C. Non-Shrink Grout – Class II

1. Unless otherwise indicated, Non-Shrink Grout – Class II shall be provided as listed below whether indicated on the Drawings or not:

   a. Filling blockout spaces for embedded items such as railing posts, gate frame guides, etc. where placement time exceeds 20 minutes.

   b. Under precast concrete elements.

   c. Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials.

2. Class II non-shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-Day compressive strength shall be 7500 psi, when mixed at a fluid consistency.

3. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827.

4. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090.

5. Class II non-shrink grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C 827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C 1107.

6. Class II non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C 939.

7. The grout when tested shall not bleed or segregate at maximum allowed water content.

8. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.

9. Class II non-shrink grout shall be Masterflow 928 by MBT/Degussa Building Systems, Five Star Fluid Grout 100 by Five Star Products, Crystex by L&M Construction Chemicals, or ENGINEER-approved equal.

2.8 CRYSTALLINE WATERPROOFING

A. Crystalline waterproofing shall be Krystol T1 and T2 as manufactured by Kryton International Inc. or equal.

2.9 CONCRETE DESIGN REQUIREMENTS

A. General

1. Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and where deposited in forms, to have good consolidation properties and

maximum smoothness of surface. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the COMPANY. Mix changes shall be subject to review by the ENGINEER.

2. The CONTRACTOR is cautioned that the limiting parameters below are NOT a mix design. Admixtures may be required to achieve workability required by the CONTRACTOR's construction methods and aggregates. The CONTRACTOR is responsible for providing concrete with the required workability.

3. Concrete Properties: The specified compressive strength and other requirements shall be not less than the following tabulations:

   a. Structural Concrete:

Specified 28-Day Compressive Strength, psi	5,000
Max. Size Aggregate, inches	¾
Cement Content per cu. yd., pounds, minimum	600
Max. W/C Ratio (by weight)	0.40
Slump (inches) prior to addition of WRA and HRWRA	4 +/- 1
Air Entrainment (percent)	5 to 7.5

   b. Sitework Concrete:

Specified 28-Day Compressive Strength, psi	4,000
Max. Size Aggregate, inches	1
Cement Content per cu. yd., pounds, minimum	254
Max. W/C Ratio (by weight)	0.45
Slump (inches) prior to addition of WRA and HRWRA	4 +/- 1
Air Entrainment (percent)	5 to 7.5

   c. Fiber Reinforced Concrete: Adjust Structural Concrete mix design to produce Concrete with a 28-Day Compressive Strength of 2,500 psi.

      1. Fiber Reinforcing: Reinforcement shall be synthetic fiber reinforcements, Fibermesh 300, as manufactured by Propex.
      2. Fiber reinforcing shall be batched at a rate of 1.5 pounds per cubic yard of concrete.
      3. Material: 100% virgin homopolymer polypropolene fibrillated fibers, containing no reprocessed olefin materials.
      4. Conformance: ASTM C1116, Type III

5 Fire Classifications: UL Report File No. R8534 11 and Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662 1.

6. Fiber Length: 25 mm.

7. Alkali Resistance: Alkali proof.

8. Absorption: Nil.

9. Specific Gravity: 0.91.

10. Melt Point: 162°C.

4. Aggregate Reactivity: The cement-pozzolan-aggregate combination to be used in the proposed mix shall be tested as indicated herein. Mitigating measures shall be employed for all mixes using aggregates from pits with reactive aggregates.

5. **Cement shall be Type V Portland cement as specified in ASTM C150.**

2.10 CONSISTENCY

A. Consistency of the various classes of concrete in successive batches shall be determined by slump and air-content tests in accordance with ASTM C 143 and ASTM C 231, respectively.

2.11 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the ENGINEER; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.12 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the ENGINEER and capable of measuring the water in variable amounts within a tolerance of one percent.

2.13 READY-MIXED CONCRETE

A. At the CONTRACTOR's option, ready-mixed concrete may be used if it meets the requirements as to materials, batching, mixing, transporting, placing, the supplementary requirements as required herein, and is in accordance with ASTM C 94.

B. Ready-mixed concrete shall be delivered to the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather, or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

C. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. Materials including mixing water shall be in the mixer

drum before actuating the revolution counter for determining the number of revolutions of mixing.

D. Each batch of ready-mixed concrete delivered to the Work shall be accompanied by a delivery ticket furnished to the ENGINEER in accordance with Paragraph 1.4.A.4 entitled "Delivery Tickets."

E. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the ENGINEER.

PART 3 -- EXECUTION

3.1 GENERAL FORMWORK REQUIREMENTS

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at the CONTRACTOR's expense. A sufficient number of forms of each kind shall be available to permit the required rate of progress to be maintained. The design and inspection of concrete forms shall comply with applicable local, state and federal regulations. Design, construction, maintenance, preparation, and removal of forms shall follow the guidelines contained in ACI 347 and the requirements herein.

B. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

3.2 CONSTRUCTION

A. Vertical Surfaces: Vertical surfaces of concrete members shall be formed.

B. Construction Joints: Concrete construction joints will not be permitted at locations other than those indicated, except as may be approved by the ENGINEER.

C. Form Ties

1. Embedded Ties: Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use, after the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast

neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink or regular cement grout. Exposed faces of walls shall have at least the outer 2-inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.3 REUSE OF FORMS

A. Forms may be reused only if in good condition and only if acceptable to the ENGINEER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view.

3.4 REMOVAL OF FORMS

A. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. Forms for vertical surfaces shall remain in place at least 48 hours after the concrete has been placed. Forms for parts of the Work not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347.

3.5 REINFORCEMENT FABRICATION

A. General

1. Reinforcement steel shall be accurately formed to the dimensions and shapes indicated, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings.

2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the CONTRACTOR.

3. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will damage the reinforcing bar. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold unless otherwise permitted by the ENGINEER. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the ENGINEER.

3.6 REINFORCEMENT PLACING

A. Reinforcement steel shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. Reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the existing concrete, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks.

B. Tie wires shall be bent away from the forms and surfaces of concrete in order to provide the required concrete cover.

C. Bars additional to those indicated, which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position, shall be provided by the CONTRACTOR at his own expense.

D. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits specified in ACI 117.

E. The minimum spacing requirements of ACI 318 shall be followed for reinforcing steel.

3.7 REINFORCEMENT SPLICING

A. General: Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where indicated, the character of the splice shall be reviewed and accepted by the ENGINEER. Full lap splices will be allowed across construction joints (CJs) considering “top bar” and “other reinforcement” development length modification factors per ACI 318.

B. Splices of Reinforcement: The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318 for a Class B splice.

3.8 REINFORCEMENT CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcing shall be reinspected and, if necessary recleaned.

3.9 CONCRETE BATCHING, MIXING AND DELIVERY

A. Batching, mixing, and delivery of concrete shall conform to requirements of ASTM C 94, as specified otherwise herein, or as otherwise approved by the ENGINEER.

B. Retempering: Retempering of concrete, which has partially hardened, shall not be permitted.

3.10 PREPARATION OF SURFACES FOR CONCRETING

A. Moisture Conditioning: At least 24 hours prior to placement of concrete, existing concrete surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, debris and other matter that would be detrimental to bond at the time of placing concrete.

B. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. Existing concrete against which concrete is to be placed shall be thoroughly cleaned of sediment, loose concrete

and aggregates, and other materials that would affect bonding of the concrete to the existing substrate. Initial preparation shall be by one of the following methods:

1. High-Pressure Water Jetting: A stream of water under a pressure of not less than 6,000 psi.

2. Mechanical Methods: Mechanical methods, such as using “whirl-away” equipment or bush hammering.

C. Rock surfaces upon which concrete is to be placed shall be clean, free from drummy rock, debris, and loose, semidetached, unsound fragments and as specified in Section 02200 - Earthwork. Immediately before the concrete is placed, all rock surfaces shall be cleaned thoroughly by the use of water jets.

D. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent Work; provided that construction joints shall be made only where acceptable to the ENGINEER.

E. Embedded Items

1. No concrete shall be placed until all formwork, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the ENGINEER at least 4-hours before placement of concrete. Surfaces of forms that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.

2. Reinforcement and anchor bars shall be set and secured in the forms at locations indicated on the Drawings or by Shop Drawings and shall be acceptable to the ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

F. No concrete shall be placed until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will damage the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of the ENGINEER.

3.11 HANDLING, TRANSPORTING, AND PLACING OF CONCRETE

A. General: Placing of concrete shall conform to the applicable requirements of ACI 301, the CONTRACTOR’s Concrete Placement Plan, and the requirements of this Section. Concrete will not be allowed to be placed until the CONTRACTOR’s Placement Plan has be reviewed and accepted by the ENGINEER. No aluminum materials shall be used in conveying any concrete.

B. Non-Conforming Work or Materials: Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced.

C. Unauthorized Placement: No concrete shall be placed except in the presence of the ENGINEER. The CONTRACTOR shall notify the ENGINEER in writing at least 24-hours in advance of placement of any concrete.

D. Conveyor Belts and Chutes: Ends of chutes, hopper gates, and other points of concrete discharge throughout the CONTRACTOR's conveying, hoisting, and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the ENGINEER. Chutes longer than 50-feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the required consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. Conveyor belts and chutes shall be covered.

E. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the required minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water, using ice, or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall not be entitled to additional compensation on account of the foregoing requirements.

F. Cold Weather Placement

1. Placement of concrete shall conform to ACI 301 and the following.

a. Foundations shall be free from snow, frost or ice when concrete is placed upon or against them.

b. Maintain the concrete temperature above 50 degrees F for at least 72-hours after placement.

3.12 PUMPING OF CONCRETE

A. General

1. If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

2. Pumping Equipment

a. The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the Site during pumping.

b. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R - Placing Concrete by Pumping Methods.

c. Pumping equipment and hoses conduits that are not functioning properly shall be replaced.

d. Aluminum conduits for conveying the concrete shall not be permitted.

3.13 CONCRETE CONSOLIDATION

A. As concrete is placed, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be high-speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit.

3.14 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Unformed Surfaces: After proper and adequate vibration and tamping, unformed top surfaces of slabs shall be brought to a uniform surface with suitable tools. After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch.

3.15 CURING OF CONCRETE

A. General: Concrete shall be cured for not less than 14 Days after placing. The surface shall be either (1) be covered with burlap mats, which shall be kept wet with water for the duration of the curing period or (2) have a liquid membrane-forming curing compound applied at the coverage rate specified by the manufacturer and shall not be used on surfaces to receive additional concrete or cementitious finishing materials.

B. The CONTRACTOR may submit alternate methods of curing which maintain the concrete in a continuously wet condition for acceptance by the ENGINEER.

3.16 PROTECTION OF CONCRETE

A. The CONTRACTOR shall protect concrete against injury until final acceptance.

B. Fresh concrete shall be protected from damage due to water immersion, dripping water or any other cause. The CONTRACTOR shall provide such protection until the concrete receives its initial set.

3.17 CARE AND REPAIR OF CONCRETE

A. The CONTRACTOR shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final

acceptance of the completed Work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR's expense.

3.18 GROUTING

A. General

1. Grout shall be stored in accordance with manufacturer's recommendations.

2. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the ENGINEER.

3. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.

4. Surface preparation, curing, and protection of cement grout shall be in accordance with the manufacturers' recommendations. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.

5. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.

6. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.

B. Grouting Procedures

1. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.

2. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout or other thickness if indicated.

3. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by the ENGINEER, alternate grouting methods shall be submitted for acceptance by the ENGINEER.

4. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4 inches from the edge of the pad.

C. Grouting of Anchor Bars and Bolts

1. Prepackaged Grouts: Surface preparation, mixing, handling, placing, consolidation, curing, and other means of execution for epoxy grout shall be done according to the instructions and recommendations of the manufacturer.

2. Holes for anchor bars shall be drilled with percussion equipment and shall be of the diameter as indicated on the Drawings or to the hole diameter specifically recommended in writing by the manufacturer of the grout.

3. Holes shall be thoroughly cleaned with bursts of air and water and all water shall be removed from the holes after cleaning.

4. Grout shall be placed in such a manner and at the consistency necessary to assure that the space to be grouted is completely filled.

5. Insert, rotate and vibrate the anchor bars as required to obtain full coating of the bar with grout to aid in corrosion protection and bonding.

6. Do not disturb the anchor bars for 5 Days or until such a time as recommended in writing by the manufacturer of the grout.

D. Consolidation

1. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.19 ENGINEER NOTIFICATION

A. The ENGINEER will inspect the placement area during preparatory phases of the Work, during concrete placements and during subsequent work. CONTRACTOR shall notify the ENGINEER 24 hours in advance of each concrete placement.

3.21 APPLICATION OF CRYSTALLINE WATERPROOFING

A. Crystalline waterproofing shall be applied to the exterior walls of all precast vaults and manholes and to cast-in-place concrete walls as indicated on the Drawings. Application of the two part system indicated in Paragraph 2.8 shall include two coats of the initial coating and a single coat of the outer coating, both mixed and applied in accordance with the manufacturer's written recommendations.

3.22 CLEANUP

A. Concrete trucks will be washed/cleaned only in area(s) so designated by the ENGINEER. The ENGINEER shall provide lighting at the cleanup area if so requested one week in advance of such need. Such solidified concrete shall be removed from the site at completion of the Work.

B. Upon completion of the Work each area shall be thoroughly cleaned of debris and foreign material, as acceptable to the ENGINEER, and such material shall be removed from the Site.

- END OF SECTION –

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SECTION 03361 – SHOTCRETE

PART 1 -- GENERAL

1.1 GENERAL

A. Provide shotcrete as indicated in the Contract Documents or as directed by the ENGINEER.

B. This section provides the requirements for testing, installing, and field-testing shotcrete.

1.2 Reference Specifications, Codes and Standards

A. The following standards are referenced in this section:

1. American Concrete Institute (ACI):

ACI 506R	Guide to Shotcrete
ACI 506.2	Specification for Materials, Proportioning, and Application of Shotcrete
ACI 506.3R	Guide to Certification of Shotcrete Nozzlemen
ACI 544.1R	State-of-the-Art Report on Fiber Reinforced Concrete

2. ASTM International (ASTM):

ASTM A 185	ASTM C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
ASTM C 266	Standard Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles.
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
ASTM C 1140	Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels.
ASTM C 1240	Standard Specification for Silica Fume Used in Cementitious Mixtures.

1.3 Submittals

A. The following items shall be submitted per Section 01300 – Contractor Submittals:

1. Mix proportions and supporting data including strength results for the proposed shotcrete mixture.

2. A resume of the on-site foreman and nozzlemen that will perform the shotcrete work, outlining previous experience in shotcrete applications. Certification of each nozzleman in accordance with ACI 506.3R.

3. Application equipment and procedures.

4. Manufacturer's data sheets, certificates of compliance, mill test reports and sources for cement, pozzolan, aggregates, admixtures, fibers, and silica fume.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. General: All materials used in shotcrete shall comply with the applicable requirements of Section 03300 - Cast-In-Place Concrete, except as hereinafter specified. Testing standards shall be as defined in Section 03300, except as specified otherwise herein.

B. Admixtures: A quick-setting, noncorrosive and noncaustic admixture, Meyco SA 540, as manufactured by Degussa Construction Chemicals, or equivalent, may be added to the mix. Silica fume (microsilica), if used, shall conform to ASTM C 1240.

C. Fiber Reinforcement: The fiber reinforcement for shotcrete shall be synthetic reinforcing fibers 1/2-inch to 3/4-inch in length, polypropylene, collated, fibrillated fibers manufactured specifically for use in concrete conforming to Fibermesh Co.; Forta Corp.; or equal. Fibers shall conform to ASTM C 1116, Type III Shotcrete.

D. Weep Holes or Drains: PVC pipe drains installed during application of shotcrete or drilled holes after shotcrete application at locations as show on the Drawings or specified by the ENGINEER.

2.2 MIXTURE PROPORTIONS

A. Shotcrete may be by the wet or dry process but shall conform to ACI 506.2 except as specified otherwise herein.

B. Shotcrete shall consist of cement, pozzolan, synthetic fiber, aggregates, and water, and may include a quick setting additive.

C. Shotcrete shall contain no less than 1.5 pounds of synthetic fiber per cubic yard and not less than 15 percent pozzolan by weight of total cementitious material.

D. Silica fume, if used, shall not exceed 5 percent to the total cementitious material (cement plus pozzolan) by weight.

E. The aggregate used in the mix shall have one of the following gradations when tested in accordance with ASTM C 136:

Percent Passing by Weight

Std. Sieve Size	Grading A	Grading B
1/2-inch	100	100
3/8-inch	100	90 to 100
No. 4	95 to 100	70 to 85
No. 8	80 to 100	50 to 70
No. 16	50 to 85	35 to 55
No. 30	25 to 60	20 to 35
No. 50	10 to 30	8 to 20
No. 100	2 to 10	2 to 10

F. Mix proportions shall be selected by the CONTRACTOR to produce the properties as follows:

1. Compressive strength of 4,000 psi at 28 days, for a mixture without quick setting additive, when tested in accordance with ASTM C 1140.

2. Compressive strength of 2,000 psi at 72 hours and 3,500 psi at 28 days for a mixture with quick setting additive, when tested in accordance with ASTM C 1140. The quantity of quick setting additive shall be as recommended by the manufacturer based on the quantity of cement plus pozzolan in the mixture but shall meet the following requirements:

   a. Setting times by ASTM C 266 using 0.40 water/cementitious materials (cement plus pozzolan) ratio by weight:

      1) Initial set of not more than three minutes.

      2) Final set of not more than twelve minutes.

   b. Compressive strength determined by ASTM C 109 using 0.40 water/cementitious materials (cement plus pozzolan) ratio by weight, shall not be less than 600 psi at eight hours.

B. The consistency of shotcrete, as applied to surfaces to receive shotcrete, shall be such that the shotcrete does not slough or sag.

C. Construction testing of shotcrete shall conform to the requirements in ACI 506.2.

PART 3 –- EXECUTION

3.1 INSTALLATION

A. General: Batching, mixing, and delivery of either wet mix or dry mix shotcrete shall conform to ASTM C 94 or as otherwise approved by the ENGINEER. Shotcrete work shall be performed in accordance with the guidelines in ACI 506R. Shotcrete shall not be placed at temperatures less than 40°F or during periods of rain or high wind. Subgrade surface shall be cleaned of loose rock and soil prior to application of shotcrete to the satisfaction of the ENGINEER. At the time of shotcrete application, the subgrade surface shall be clean and moist but not wet. The high velocity impact shall be developed pneumatically by injecting compressed air at the nozzle. Shotcrete shall be applied in a manner that ensures a uniformly placed and compacted material.

B. Crew Qualifications: The CONTRACTOR shall have experienced and qualified crew to perform the Work. One test panel each shot in a vertical position for each mix shall be the minimum qualification test for a nozzleman before he is permitted to apply shotcrete in permanent works. Test panels will be witnessed by the ENGINEER and evaluated in accordance with ACI 506.3R.

C. Shotcrete shall be applied in a steady, uninterrupted flow. Should the flow of shotcrete become intermittent for any reason, the nozzleman shall direct the nozzle away from the work until it again becomes constant, or shall shut off the flow of materials.

D. The nozzle shall be held at approximately right angles to the surface and shall be kept at the same distance from the surface as dictated by standards of good practice for the type of application, type of nozzle and air pressure employed. The nozzle shall be moved at a uniform rate and in such a manner that ensures an adequate overlapping of passes and a uniform finish.

E. Layering of Shotcrete:

1. Shotcrete shall be built up in layers as needed to prevent sagging or sloughing. Each layer shall be built up by making several passes of the nozzle over the area but shall not exceed three inches in one application.

2. Adequate metal pins, pegs, or other approved devices shall be used where necessary to establish the thickness of the application.

3. The number of layers required to place the full thickness shall be minimized to the extent possible. If the total thickness requires more than one layer of shotcrete, sufficient time shall be allowed for each layer of shotcrete to set up so that it may take the next layer without sagging. Loose or uneven material shall be removed prior to placing each layer.

4. Rebound or previously expended material shall not be salvaged for reuse in the shotcrete mix.

5. Gun finish will be acceptable unless otherwise specified on the Drawings.

F. Shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids or sand pockets, or is drummy when sounded by a hammer, shall be removed and replaced as directed by the ENGINEER.

G. Materials that have been mixed for more than 90 minutes and not incorporated in the work shall not be used.

3.2 CURING

A. Shotcrete shall be cured in accordance with Section 03300 – Cast-In-Place Concrete, except that the curing period shall be three Days. Membrane curing may be used, except in watercourses. Natural curing may be permitted, when approved, if atmospheric conditions surrounding the shotcrete are satisfactory; such as when the humidity is relatively constant at or above 85 percent.

- END OF SECTION -

SECTION 03495 - PRECAST CONCRETE MANHOLES, DROP INLETS, AND VAULTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide precast concrete manholes and vaults, complete and in place, in accordance with the Contract Documents.

1.2 SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

CI 318/318R	Building Code Requirements for Structural Concrete and Commentary
ASTM A 48	Gray Iron Castings
ASTM C 150	Portland Cement
ASTM C 443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	Precast Reinforced Concrete Manhole Sections
ASTM C 890	Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C 913	Standard Specification for Precast Concrete Water and Wastewater Structures
ASTM C 923	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

1.3 CONTRACTOR SUBMITTALS

A. **General:** Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. **Shop Drawings**

1. Show dimensions, locations, lifting inserts, reinforcement, and joints.

2. Structural design calculations for vaults, signed by a registered professional engineer in the State of Washington.

C. Manufacturer's Certification for Vaults: Written certification that the vault complies with the requirements of this Section.

1.4 QUALITY ASSURANCE

A. **Inspection:** After installation, the CONTRACTOR shall demonstrate that manholes and vaults have been properly installed, level, with watertight joints, at the correct elevations and orientations, and that the backfilling has been carried out in accordance with the Contract Documents.

PART 2 -- PRODUCTS

2.1 MANHOLES (IF NEEDED)

A. The CONTRACTOR shall provide precast manhole sections and conical sections conforming to ASTM C 478 and the requirements of this Section. Adjusting rings shall be standard items from the manufacturer of the manhole sections. Minimum wall thickness of rings shall be 4-inches if steel reinforced and 6-inches if not reinforced.

B. Cement shall be Type V portland cement as specified in ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. All reinforcing steel shall be embedded in the concrete with a minimum clear cover as recommended by ACI 318.

C. Axial length of sections shall be selected to provide the correct total height with the fewest joints.

D. Conical sections shall be designed to support cast iron frames and covers under an H-20 loading, unless indicated otherwise.

E. Where the manhole barrel diameter is greater than 48-inches, a flat slab-transition, either concentric or eccentric, shall be used to transition to 48-inch diameter riser sections. Underside of the transition shall be at least 7-feet above the top of the bench.

F. **Design Criteria:** Manhole walls, transitions, conical sections, and base shall be designed per ASTM C 478 for the depths indicated and the following:

1. AASHTO H-20 loading applied to the cover.

2. Unit weight of soil of 130 pcf located above all portions of the manhole.

3. Lateral soil pressure based on saturated soil producing 126 pcf acting on an empty manhole.

4. Internal fluid pressure based on unit weight of 63 pcf with manhole filled from invert to cover with no balancing external soil pressure.

5. Dead load of manhole sections fully supported by the base and transition.

6. Additional reinforcing steel in walls to transfer stresses at openings.

7. The minimum clear distance between the edges of any 2 wall penetrations shall be 12-inches or one-half of the diameter of the smaller penetration, whichever is greater.

G. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101, or equal**, conforming to ASTM C 990-91 – Standard Specification for Joints in Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

H. Concrete for base and channel formation shall be 4000 psi concrete conforming to Section 03300 - Cast-In-Place Concrete. Cement shall be Type V portland cement as specified in ASTM C 150.

I. Barrel section to pipe connections shall be sealed with resilient connectors, **Z-Lok connector by A-Lok Products, Inc., Kor-N-Seal I by Trelleborg (npc), or equal**, complying with ASTM C 923 – Standard Specification for Resilient Connectors Between

Reinforced Concrete Manhole Structures, Pipes and Laterals. Mechanical devices shall be stainless steel.

J. Manhole steps shall be comprised of ½-inch grade 60 steel reinforcement rod encased in polypropylene copolymer plastic. Steps shall have tread width of 14-inches with a minimum 6-inch projection from the wall. Furnish test results demonstrating step capability to resist a pull out force of 400 pounds. Provide **PS2-PF Manhole Step by M.A. Industries**, or equal.

K. Manufacturers, or Equal

1. **Oldcastle Precast**
2. **Panhandle Concrete Products, Post Falls, ID**
3. **Wilbert Precast, Inc., Yakima, WA**

2.2 FRAMES AND COVERS

A. **Castings:** Castings for manhole frames and covers shall be non-rocking and shall conform to the requirements of ASTM A 48, Class 30. Unless otherwise indicated, cast iron covers and frames shall be heavy traffic type, 30-inches in diameter. Frame and cover shall be designed for H-20 traffic loading.

B. Castings Manufacturers, or Equal

1. **Neenah Foundry Co.**
2. **East Jordan Iron Works**
3. **D & L Supply**

2.3 DROP INLETS

A. Drop inlets shall be Type 2 Grate Inlet, as defined by W.S.D.O.T Standard Specification, Standard Plan B-35.40-00 and shall conform to WSDOT Specification 9-05.50(4) – Pre-Cast Concrete Inlets.

2.4 VAULTS

A. The CONTRACTOR shall provide precast vaults designed for the indicated applications and of the sizes indicated.

B. The minimum structural member thickness for vaults shall be 5-inches. Cement shall be Type V portland cement as specified in ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. All reinforcing steel shall be embedded in the concrete with a minimum clear cover as recommended by ACI 318.

C. Design Loading: Vaults in areas subject to vehicular traffic shall be designed for H-20 traffic loading. Vaults in other areas shall be designed for a vertical live load of 300 psf. Lateral loads on vaults in all areas shall be calculated from:

$L = 90\ h$, plus surcharge of 240 psf in areas of vehicular traffic

Where L = loading in psf

and h = depth of fill in feet

D. Where joints are designed in pre-cast concrete vaults, such joints shall be interlocking to secure proper alignment between members and prevent migration of soil through the joint. Structural sections at joints shall be sized sufficiently to reinforce the section against localized distress during transportation and handling and against excess contact bearing pressures through the joint.

E. Where openings for access to the vault are required, the full clear space opening indicated shall be provided, without obstructions from brackets or supports. For large openings where brackets or supports are designed to protrude into the opening for support of required covers, such brackets or supports shall be designed to be easily removed and replaced with a minimum of effort and without cutting or welding.

F. Covers for access openings shall be provided. Frames for covers shall be fabricated from steel, galvanized after fabrication, and shall be integrally cast into the vault concrete sections. All covers shall be tight fitting to prevent the entrance of dirt and debris. Where edge seams are permitted, no gaps greater than 1/16-inch between edges will be accepted. All covers, except round, heavy-weight, cast iron manhole covers, shall have securing mechanisms to hold the covers firmly in place against the effects of repetitious live loads such as pedestrian or vehicle traffic.

G. Where penetration of the pre-cast concrete vault are required for piping, conduit, or ducts, such penetrations shall be accommodated through pre-cast openings or thin-wall knock-out sections. All openings for penetrations shall be smooth and free of surface irregularities and without exposed steel reinforcing. Vaults need not be designed to resist thrust from piping passing through the vault.

H. Warning Signs

1. The entrance to every manhole and vault shall be fitted with a permanently affixed, plastic warning sign, located above and centered on the top step. Each sign shall be in accordance with the design drawings.

2. Sign Manufacturer, or Equal

a. **W. H. Brady Company**

b. **Seton Nameplate Corporation**

2.5 CRYSTALLINE WATERPROOFING

A. Crystalline waterproofing shall be as indicated in Section 03300 – Cast-In-Place Concrete.

PART 3 -- EXECUTION

3.1 GENERAL

A. Pre-cast concrete sections shall be transported and handled with care in accordance with the manufacturer's written recommendations. Where lifting devices are provided in pre-cast sections, such lifting devices shall be used as intended. Where no lifting devices are provided, the CONTRACTOR shall follow the manufacturer's recommendations for lifting procedures to provide proper support during lifting.

B. Buried pre-cast concrete vaults and manholes shall have a crystalline waterproofing applied to their exterior surfaces in accordance with Section 03300 – Cast-In-Place Concrete and the manufacturer's application instructions.

C. Buried pre-cast concrete vaults shall be assembled and placed in excavations on properly compacted soil foundations as indicated. Pre-cast concrete vaults shall be set to grade and oriented to provide the required dimensions and clearances from pipes and other structures.

D. Prior to backfilling, all cracks and voids in pre-cast concrete vaults shall be filled with non-shrink grout or polyurethane sealant, or both.

E. Unless otherwise indicated, around pipe and conduit penetrations, openings shall be sealed with polyurethane sealant. With the authorization of the ENGINEER, grout or a closed-cell flexible insulation may be used as filler material prior to placing a final bed of polyurethane sealant.

F. Steps shall be driven into tapered holes formed in the concrete by inserts from the step manufacturer or 1-inch holes drilled 3-3/4-inches deep into the manhole wall in the field. No more than 6-1/8 inches of plastic arm, measured on the inside of the step, shall be exposed outside the concrete.

G. Steps shall be installed 12-inches on centers vertically, not more than 1/2 inch out of plumb. The top step shall be no more then 12-inches below the manhole cover.

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DIVISION 05 - METALS

SECTION 05500 - MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide miscellaneous metalwork and appurtenances, complete and in place, as indicated in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3)	(Ships) Aluminum Planks. (6063-T6)
MIL-PRF-907F	Antiseize Thread Compound, High Temperature

B. Codes

OSHA 1927.10	Fixed Ladders

C. Commercial Standards

AA-M32C22A41	Aluminum Assn.
AASHTO HS-20	Truck Loading
AISC	Manual of Steel Construction
AISI	Design of Light Gauge, Cold-Formed Steel Structural Members
ASTM A 36	Carbon Structural Steel
ASTM A 48	Gray Iron Castings
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ANSI/AWS D1.1	Structural Welding Code - Steel
ANSI/AWS D1.2	Structural Welding Code - Aluminum
ANSI/AWS QC1	Qualification and Certification of Welding Inspectors

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01300 – Contractor Submittals.

B. Shop Drawings

1. Shop Drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the WORK.

2. Shop Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

3. Grating

a. Submit layout drawings for grating, showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners.

b. Submit load and deflection tables for each style and depth of grating used.

4. Anchors

a. Submit an ICBO report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor.

b. Submit manufacturer's recommended installation instructions and procedures for adhesive anchors.

c. Upon review by the ENGINEER, these instructions shall be followed specifically.

d. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICBO report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.4 QUALITY ASSURANCE

A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.

B. Welding shall be inspected by a CONTRACTOR-furnished inspector qualified in accordance with AWS requirements and approved by the ENGINEER.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Steel

Wide Flange Shapes	ASTM A 992
Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless indicated otherwise
HSS	ASTM A 500 Grade B

B. Corrosion Protection

1. Unless otherwise indicated, fabricated steel metalwork which will be used in a corrosive environment and/or will be submerged in water or wastewater shall be coated in accordance with the requirements of Section 09800 – Protective Coating, and shall not be galvanized prior to coating.

2. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.

C. Stainless Steel

1. Unless otherwise indicated, stainless steel metalwork and bolts shall be fabricated from Type 316 stainless steel.

D. Aluminum

1. Unless otherwise indicated, aluminum metalwork shall be fabricated from Alloy 6061-T6.

2. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with the requirements of Section 09800 – Protective Coating.

E. Cast Iron

1. Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B, or better.

2.2 ALUMINUM RAILINGS

A. General

1. Aluminum handrails and railings shall be component systems, complete with anchors, attachments, balusters, brackets, caps, fasteners, gates (swing with self-latching hardware or be removable), posts, sleeves, trim, and any other related items as required or necessary for a complete installation.

2. Gates and removable rail sections shall be complete with hardware such as self-closing hinges, self-latching latches, hasps, and the like.

3. Railings shall conform to Building Code and OSHA requirements, General Industry Occupational Safety and Health Standards (29CFR1910).

B. Materials shall conform to the following requirements:

1. Aluminum

a. Aluminum shall be U.S. Alloy 6063 T-5 or T-6.

b. Aluminum pipe rail shall not be less than 1-1/2-inch diameter Schedule 40 pipe.

2. Electrolysis protective material shall be in accordance with the requirements of Section 09800 – Protective Coating.

3. Sleeves shall be of galvanized steel or PVC.

4. Grout for handrail posts shall consist of an inorganic, non-shrink, non-metallic premixed grout in accordance with the requirements of Section 03315 – Grout, with a minimum 28-Day compressive strength of 4,000 psi.

5. Fasteners, screws, and bolts shall be concealed and shall be fabricated from stainless steel or aluminum.

6. Aluminum welding rods shall be of a type recommended by the aluminum manufacturer for anodized finished products.

7. Kickplates shall be provided on railings and not set in curbs.

C. Pipe railing systems, including handrails, railings, tube caps, and other miscellaneous parts of the rails, shall be provided with a clear anodized finish, AA-M32C22A41.

D. Manufacturers or Equal

1. C-V Pipe Rail by Crane Veyor Corp.

2. Connectorail by Julius Blum and Co.

2.3 METAL STAIRS

A. Metal Stairs

1. Metal stairs shall be composed of steel or aluminum stringers and supports, shall be fabricated in accordance with the standard practice of the National Association of Ornamental Metal Manufacturers, and shall be as indicated.

2. Steel stair members shall be hot-dip galvanized after fabrication.

2.4 GRATING STAIR TREADS

A. Grating stair treads shall be designed to support a live load of 100 psf or a concentrated load at mid-span of 300 pounds, whichever creates the higher stress.

B. The maximum deflection due to the uniform live load shall be as required for metal grating, below.

C. Grating stair treads shall be provided with an integral non-slip nosing.

2.5 SAFETY STAIR NOSINGS

A. Safety stair nosing shall be provided on concrete stairs and other locations as indicated.

B. The nosing shall be 3 inches wide and fabricated from extruded aluminum with cast-in abrasive strips and integral extruded anchors.

C. The color of the cast abrasive shall be as selected by the ENGINEER from among the manufacturer's standard colors.

D. The nosing shall be Amstep Products Style 231-A, Grating Pacific XRS-3, Robertson Grating Products Type 9511, or equal.

2.6 LADDERS

A. Materials

1. Ladders which may be partially or wholly submerged or which are located inside a hydraulic structure shall be fabricated entirely of Type 316 stainless steel.

2. Other ladders shall be fabricated from aluminum materials as indicated.

B. Pop-Up Extension

1. Every ladder that does not have an exterior handhold shall be equipped with a pop-up extension.

2. The pop-up extension device shall be manufactured of the same material and finish as the ladder, and shall be provided with a telescoping tubular section that locks automatically when fully extended.

3. Upward and downward improvement shall be controlled by stainless steel spring balancing mechanisms.

4. The units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer’s instructions.

2.7 METAL GRATING

A. General

1. Metal grating shall be of the indicated design, size, and type.

2. Grating shall be supported around an opening by support members.

3. Where grating is supported on concrete, unless otherwise indicated provide embedded support angles that match the grating material and are mitered and welded at their corners.

4. Banding

    a. The grating shall be completely banded at edges and cutouts.

    b. The banding material and cross-section shall be equivalent to the bearing bars.

    c. The banding shall be welded to each cut bearing bar.

5. The grating pieces shall be fastened to each support in 2 locations.

6. Where grating forms the landing at the top of a stairway, the edge of the grating that forms the top riser shall have an integral non-slip nosing with a width equal to that of the stairway.

7. Where the grating depth is not indicated, provide grating within allowable stress levels and which shall not exceed a deflection of 1/4 inch or the span divided by 180, whichever is less.

8. Design Loading

    a. For standard duty plank and safety grating, the loading to be used for determining stresses and deflections shall be the uniform live load of the adjacent floor or 100 psf, whichever is greater, or a concentrated load of 1000 pounds.

    b. For heavy-duty grating, the loading used for determining stresses and deflections shall be in accordance with AASHTO HS-20.

B. Material

1. Except where indicated otherwise, bar grating shall be fabricated entirely of:

    a. aluminum

        1) Bearing and Banding Bars: Alloy 6061-T6

        2) Cross Bars: Alloy 6063-T5

2. Grating that may be partially or wholly submerged shall be fabricated entirely of Type 316 stainless steel.

C. Standard-Duty Grating

1. No single piece of grating shall weigh more than 80 pounds, unless indicated otherwise.

2. Standard duty grating shall be composed of serrated bar grating.

3. Cross bars shall be welded or mechanically locked tightly into position such that there is no movement between the bearing and cross bars.

D. Safety Grating

1. Safety grating shall be fabricated from sheet metal punched into an open serrated diamond pattern and be formed into plank sections.

2. The open diamond shapes shall be approximately 1-7/8 inches by 11/16-inch in size.

3. Safety grating shall be Grip Strut by Metal Products Division, United States Gypsum Company, Deck Span by IKG Industries, or equal.

E. Heavy-Duty Grating

1. Heavy-duty grating shall be fabricated from welded steel, galvanized after fabrication.

2.8 METAL DECKING

A. Metal decking shall be of the indicated size and gauge, and shall meet the requirements of the AISI specification for the "Design of Light Gauge, Cold-formed Steel Structural Members."

B. The steel shall be hot-dip galvanized after fabrication.

2.9 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application)

1. Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be fabricated from steel as indicated.

2. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.

3. Except as otherwise indicated, steel for bolt material, anchor bolts, and cap screws shall be in accordance with the following requirements:

a. Structural Connections: ASTM A 307, Grade A or B, hot-dip galvanized

b. Anchor Bolts: ASTM A 307, Grade A or B, or ASTM A 36, hot-dip galvanized

c. High-Strength Bolts, where indicated: ASTM A 325

d. Pipe and Equipment Flange Bolts: ASTM A 193, Grade B-7

B. Corrosive Service

1. Bolts, nuts, and washers in the locations listed below shall be fabricated from stainless steel as indicated.

a. all water management pond applications

b. buried locations

c. submerged locations

d. locations subject to seasonal or occasional flooding

e. inside hydraulic structures below the top of the structure

f. inside buried vaults, manholes, and structures chemical handling areas

g. inside trenches, containment walls, and curbed areas

h. locations indicated or designated by the ENGINEER to be provided with stainless steel bolts

C. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be fabricated from Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.

D. Buried pipe flange bolts and nuts on pipe of Class 275 and greater shall be in accordance with ASTM A193/A194, Grade B7.

E. Coating

1. Threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, meeting government specification MIL-A-907E.

2. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

3. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

4. Antiseize lubricant shall be "PURE WHITE" by **Anti-Seize Technology,** Franklin Park, IL, 60131, **AS-470** by **Dixon Ticonderoga Company,** Lakehurst, NJ, 08733, or equal.

F. Bolt Requirements

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts.

3. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.

4. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

5. Bolts and nuts shall be installed with washers fabricated from material matching the base material of bolts, except that hardened washers for high-strength bolts shall conform to the requirements of the AISC Specification.

6. Lock washers fabricated from material matching the bolts shall be installed where indicated.

7. The length of each bolt shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

G. Adhesive Anchors

1. General

   a. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors.

   b. No substitutions will be considered unless accompanied with an ICBO report verifying strength and material equivalency.

2. Epoxy Anchors

   a. Epoxy adhesive anchors are required for drilled anchors for outdoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars.

   b. Epoxy shall be in accordance with the requirements of Section 03315 – Grout.

   c. Threaded rod shall be galvanized for general purpose applications and fabricated from Type 316 stainless steel for use in corrosive applications.

   d. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100 degrees F or higher than the limiting temperature recommended by the manufacturer, whichever is lower.

   e. Epoxy anchors shall not be used where anchors are subject to vibration or fire.

   f. Embedment depth shall be as the manufacturer recommends for the load to be supported.

3. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above, and shall be **Hilti HVA**, **Cobra Anchors**, or equal.

4. Threaded rod shall be fabricated from galvanized steel.

H. Expanding-Type Anchors

1. Expanding-type anchors, if indicated or permitted, shall be fabricated from galvanized steel, shall be of the expansion type, and shall be **ITW Ramset/Redhead Trubolt** anchors, **Hilti Kwik-Bolt TZ,** or equal.

2. Lead caulking anchors will not be permitted.

3. Size shall be as indicated.

4. Embedment depth shall be as the manufacturer recommends for the load to be supported.

5. Expansion-type anchors that are to be embedded in grout may be fabricated from steel.

6. Non-embedded buried or submerged anchors shall be fabricated from stainless steel.

I. Non-Shrink Grouted Anchors

1. Anchors, if indicated or permitted, shall be grouted with a non-shrink cementitious grout in accordance with the manufacturer's recommendations.

2. Embedment depth shall be as the manufacturer recommends for the load to be supported.

3. Non-shrink grout material shall be Class B or C in accordance with Section 03315 – Grout.

2.10 POWDER-DRIVEN PINS

A. Powder-driven pins for installation in concrete or steel shall be fabricated from heat-treated steel alloy.

B. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they will be exposed, they shall be protected in an acceptable manner.

C. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support.

D. Pins that are connected to steel shall be provided with longitudinal serrations around the circumference of the shank.

2.11 IMPACT ANCHOR

A. Impact anchors shall be an expansion-type anchor in which a nail-type pin is driven to produce the expansive force.

B. The pin shall be provided with a zinc sleeve with a mushroom-style head and stainless steel nail pin.

C. Anchors shall be Metal Hit Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company, or equal.

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. Fabrication and Erection

1. Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. Aluminum Railings

1. Aluminum railing fabrication and installation shall be performed by craftsmen experienced in the fabrication of architectural metalwork.

2. Exposed surfaces shall be free from defects or other surface blemishes.

3. Dimensions and conditions shall be verified in the field.

4. Joints, junctions, miters, and butting sections shall be precision fitted with no gaps occurring between sections, and with surfaces flush and aligned.

5. Electrolysis protection of materials shall be provided.

C. Unless otherwise indicated, provide a 1/2-inch drain line to the nearest floor drain for floor hatches.

D. Powder-Driven Pins

1. Powder-driven pins shall be installed by a craftsperson certified by the manufacturer as being qualified to install the manufacturer's pins.

2. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration.

3. Driven pins shall conform to the following requirements where "D" is equal to the pin shank diameter:

Material Penetrated by Pin	Material Minimum Thickness	Pin Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	See DRAWINGS

3.2 WELDING

A. Method

1. Welding shall be performed by the metal-arc method or gas-shielded arc method as described in the American Welding Society "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. The qualification of the welders shall be in accordance with the AWS Standards.

B. Quality

1. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained in order to minimize distortion and for control of dimensions.

2. Weld reinforcement shall be as indicated by the AWS Code.

3. Upon completion of welding, remove weld splatter, flux, slag, and burrs left by attachments.

4. Welds shall be repaired in order to produce a workmanlike appearance, with uniform weld contours and dimensions.

5. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32 inch on the flat.

3.3 GALVANIZING

A. Structural steel plates shapes, bars, and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123.

B. Any galvanized part that becomes warped during the galvanizing operation shall be straightened.

C. Bolts, anchor bolts, nuts, and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153.

D. Field Repairs

1. Field repairs to damaged galvanizing shall be performed by preparing the surface and applying a coating.

2. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.

3. The coating shall be applied to at least 3 mils dry film thickness, and shall be **Zinc-Clad XI** by **Sherwin-Williams**, **Galvax** by **Alvin Products**, **Galvite** by **ZRC Worldwide**, or equal.

3.4 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions.

B. Holes shall be roughened with a brush on a power drill, and then cleaned and dried.

C. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength.

D. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- END OF SECTION -

DIVISION 11 - EQUIPMENT

SECTION 11000 - EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide equipment and appurtenant WORK, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to equipment throughout the Contract except where otherwise indicated.

C. **Equipment Arrangement:** Unless specifically indicated otherwise, the arrangement of equipment indicated is based upon information available at the time of design and is not intended to show exact dimensions particular to a specific manufacturer. Some aspects of the Drawings are diagrammatic and some features of the illustrated equipment arrangement may require revision to meet the actual equipment requirements. Structural supports, foundations, piping and valve connections, and electrical and instrumentation connections indicated may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations. Substantiating calculations and drawings shall be submitted prior to beginning the installation of equipment.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:

1. American Society for Testing and Materials (ASTM).

2. American National Standards Institute (ANSI).

3. American Society of Mechanical Engineers (ASME).

4. American Water Works Association (AWWA).

5. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).

6. American Welding Society (AWS).

7. National Fire Protection Association (NFPA).

8. Federal Specifications (FS).

9. National Electrical Manufacturers Association (NEMA).

10. Manufacturer's published recommendations and specifications.

11. General Industry Safety Orders (OSHA).

B. The following standards are referenced in this Section:

ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800

ASME B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and other Special Alloys
ASME B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ASME B1.20.1	General Purpose Pipe Threads (Inch)
ASME B31.1	Power Piping
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)
AWWA D100	Welded Steel Tanks for Water Storage
ASTM A 48	Gray Iron Castings
ASTM A 108	Steel Bars, Carbon, Cold-Finished, Standard Quality

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 - Contractor Submittals.

B. **Shop Drawings:** Furnish complete drawings and technical information for equipment, piping, valves, and controls. Where indicated or required by the ENGINEER, Shop Drawings shall include clear, concise calculations showing equipment anchorage forces and the capacities of the anchorage elements proposed by the CONTRACTOR.

C. **Spare Parts List:** The CONTRACTOR shall obtain from the manufacturer and submit at the same time as Shop Drawings a list of suggested spare parts for each piece of equipment. CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment.

1.4 QUALITY ASSURANCE

A. **Costs:** Responsibility shall be the CONTRACTOR'S for performing and paying the costs of inspection, startup, testing, adjustment, and instruction services performed by factory representatives. The COMPANY will pay for costs of power and water. If available, the COMPANY'S operating personnel will provide assistance in the field testing.

B. **Inspection:** The CONTRACTOR shall inform the local authorities, such as building and plumbing inspectors, fire marshal, OSHA inspectors, and others, to witness required tests for piping and plumbing, and related items to obtain required permits and certificates, and shall pay inspection fees.

C. **Quality and Tolerances:** Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.

1. Machine WORK shall be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30-feet or less in length, and not greater than 1/8-inch for members over 30-feet in length.

2. Castings shall be homogeneous and free from non-metallic inclusions and defects. Surfaces of castings which are not machined shall be cleaned to remove foundry irregularities. Casting defects not exceeding 12.5 percent of the total thickness and where defects will not affect the strength and serviceability of the casting may be repaired by approved welding procedures. The ENGINEER shall be notified of larger defects. No repair welding of such defects shall be carried out without the ENGINEER'S written approval. If the removal of metal for repair reduces the stress resisting cross-section of the casting by more than 25 percent or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then the casting may be rejected. Costs of casting new material shall be the CONTRACTOR'S responsibility as part of the WORK.

3. Materials shall meet the physical and mechanical properties in accordance with the reference standards.

D. **Machine Finish:** The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:

1. Surface roughness not greater than 63 micro-inches shall be required for surfaces in sliding contact.

2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.

3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.

4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.

E. **Manufacturer's Experience:** Equipment manufacturer shall have a record of at least 5 years of successful, trouble-free operation in similar applications and size equal or larger than the equipment in this Contract.

PART 2 -- PRODUCTS

A. **Drive Trains and Service Factors:** Service factors shall be applied in the selection or design of mechanical power transmission components. Components of drive train assemblies between the prime mover and the driven equipment shall be designed and rated to deliver the maximum peak or starting torque, speed, and horsepower. All of the applicable service factors shall be considered, such as mechanical (type of prime mover), load class, start frequency, ventilation, ambient temperature, and fan factors. Drive train components include couplings, shafts, gears and gear drives, drive chains, sprockets, and V-belt drives. Unless otherwise indicated, the following load classifications shall apply in determining service factors:

Type of Equipment	Service Factor	Load Classification
Pumps centrifugal or rotary	1.0	Uniform

B. Mechanical Service Factors

	Mechanical Service Factors	
	Electric Motor	**Internal Combustion Engine**
Uniform	1.25	1.50
Moderate Shock	1.50	1.75
Heavy Shock	2.00	2.25

C. For thermal rating adjustments such as start frequency, ambient temperature, and hourly duty cycle factor, ventilation factor, and fan factor, refer to gear manufacturer sizing information.

D. For service factors of electric motors, see Section 16460 - Electric Motors.

E. Where load classifications are not indicated, service factors shall be for standard load classifications and for flexible couplings.

F. **Welding:** Unless otherwise indicated, welding shall conform to the following:

1. Latest revision of AWWA D100.

2. Latest revision of AWWA C206.

3. Composite fabricated steel assemblies that are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

4. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners of material that are to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

G. **Protective Coating:** Stainless steel and thermoplastic surfaces shall not be coated. Ferrous surfaces shall be coated with the manufacturer’s standard premium coating system. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

H. **Potable water contact**: Materials immersed in or exposed to potable water shall be listed as compliant with NSF Standard 61.

I. **Protection of Equipment:** Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings. In addition, motor space heaters shall be energized and shafts shall be rotated. Equipment delivered to the Site with rust or corroded parts shall be rejected. If equipment develops defects during storage, it shall be disassembled, cleaned, and recoated to restore it to original condition.

J. Identification of Equipment Items

1. At the time of shipping, each item of equipment shall have a legible identifying mark corresponding to the equipment number in the Contract Documents for the particular item.

2. After installation, each item of equipment shall be given permanent identification.

a. Pumps, compressors, and blowers of 150 horsepower or less shall receive acrylic plastic nametags in accordance with Section 10400 – Identifying Devices.

K. **Shop Fabrication:** Shop fabrication shall be performed in accordance with the Contract Documents and the Shop Drawings.

L. **Controls:** Equipment and system controls shall be in accordance with Division 17 - Instrumentation.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. **Equipment Supports:** Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10 percent of gravity. Submitted design calculations for equipment supports shall bear the signature and seal of an engineer registered in the State wherein the project is to be built, unless otherwise indicated. Calculations shall account for forces and distribution of forces on supporting structures resulting from normal operation, normal operation plus seismic loadings, and normal operation plus wind loadings.

1. Wall-mounted equipment weighing more than 250 pounds or which is within 18-inches above the floor shall be provided with fabricated steel supports. Pedestals shall be of welded steel. If the supported equipment is a panel or cabinet or is enclosed with removable sides, the pedestal shall match the supported equipment in appearance and dimensions.

2. Seismic requirements: Freestanding and wall-hung equipment shall be anchored in place by methods that satisfy the building code. Calculations shall be performed and signed and stamped for equipment weighing more than 400 pounds. Calculations shall analyze lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. Calculations shall include the distribution of

forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces.

B. Wind requirements: Exterior freestanding equipment shall be anchored in place by methods that satisfy the building code.

C. **Anchors:** Anchor bolts shall be in accordance with Section 05500 - Miscellaneous Metalwork. CONTRACTOR shall determine the size, type, capacity, location, and other placement requirements of anchorage elements. Anchoring methods and leveling criteria in the manufacturer's literature shall be followed. Submit methods and criteria with the Shop Drawings.

2.3 SHAFTING

A. **General:** Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. **Design Criteria**: Shafts shall be designed to carry the steady state and transient loads suitable for unlimited number of load applications, in accordance with ASME B106.1M - Design of Transmission Shafting. Where shafts are subjected to fatigue stresses, such as frequent start and stop cycles, the mean stress shall be determined by using the modified Goodman Diagram. The maximum torsional stress shall not exceed the endurance limit of the shaft after application of the factor of safety of 2 in the endurance limit and the stress concentration factor of the fillets in the shaft and keyway. Stress concentration factor shall be in accordance with ASME Standard B17.1 - Keys and Keyseats.

C. **Materials:** Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.

1. Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.

2.4 BEARINGS

A. **General:** Bearings shall conform to the standards of the American Bearing Manufacturers Association, Inc. (ABMA).

B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and lubrication shall be considered in bearing selection.

C. Re-lubricatable type bearings shall be equipped with hydraulic grease fittings in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. Lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.

E. **Anti-Friction Type Bearing Life:** Except where otherwise indicated, bearings shall have a minimum L-10 life expectancy of 5 years or 20,000 hours, whichever occurs first.

Where so indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of Service	Design Life, years	L-10 Design Life, hours
	(whichever comes first)	
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

F. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

G. **Sleeve Type Bearings**: Sleeve-type bearings shall have a cast iron or ductile iron housing and Babbitt or bronze liner. Bearing housing shall be bolted and doweled to the lower casing half. These housings shall be provided with cast iron caps bolted in place and the bearing end caps shall be bored to receive the bearing shells. Sleeve bearings shall be designed on the basis of the maximum allowable load permitted by the bearing manufacturer. If the sleeve bearing is connected to an equipment shaft with a coupling, the coupling transmitted thrust will be assumed to be the maximum motor or equipment thrust. Lubricant, lubrication system, and cooling system shall be as recommended by the bearing manufacturer.

H. **Plate Thrust Bearings**: Thrust bearings shall be the **Kingsbury** Type, designed and manufactured to maintain the shaft in the fixed axial position without undue heating or the necessity of adjustment or attention. Bearings shall be oil lubricated to suit the manufacturer's standard method of lubrication for the specific bearing. If bearing cooling is required, manufacturer shall provide necessary piping, filters, and valves.

2.5 PIPING CONNECTIONS

A. **Pipe Hangers, Supports, and Guides:** Pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment.

B. **Flanges and Pipe Threads:** Flanges on equipment and appurtenances shall conform to ASME B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated. Pipe threads shall be in accordance with ASME B1.20.1 and Section 15000 - Piping, General.

2.6 GASKETS AND PACKINGS

A. Gaskets shall be in accordance with Section 15000.

B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be **Garlock No. 432, John Crane Everseal,** or equal.

C. Packing around rotating shafts (other than valve stems) shall be "O" rings, stuffing boxes, or mechanical seals, suitable for the fluid as recommended by the manufacturer and approved by the ENGINEER, in accordance with Section 11100 - Pumps, General.

2.7 NAMEPLATES

A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.8 TOOLS AND SPARE PARTS

A. **Tools:** The CONTRACTOR shall furnish one complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. Tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. Tools shall be suitable for professional work and manufactured by **Snap On, Crescent, Stanley,** or equal. The set of tools shall be neatly mounted in a labeled toolbox of suitable design provided with a hinged cover.

B. Spare parts shall be furnished as indicated in the individual equipment sections. Spare parts shall be suitably packaged in a metal box and labeled with equipment numbers by means of stainless steel or solid plastic nametags attached to the box.

2.9 EQUIPMENT LUBRICANTS

A. The CONTRACTOR shall provide lubricants for equipment during shipping, storage, and prior to testing, in accordance with the manufacturer’s recommendations. Lubricants that could come in contact with potable water shall be food grade lubricants. After successful initial testing, final testing, and satisfactory completion startup testing per Section 01660 - Equipment Testing and Plant Startup, the CONTRACTOR shall conduct one complete lubricant change on all equipment. In addition, the CONTRACTOR shall be responsible for the proper disposal of used lubricants. The COMPANY will then be responsible for subsequent lubricant changes

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment**: Where required by individual sections, an authorized, experienced, and competent service representative of the manufacturer shall visit the Site for the number of Days indicated in those sections to witness or perform the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

1. Installation of equipment

2. Inspection, checking, and adjusting the equipment and approving its installation

3. Startup and field testing for proper operation, efficiency, and capacity

4. Performing field adjustments during the test period to ensure that the equipment installation and operation comply with requirements

B. Instruction of the COMPANY’S Personnel

1. Where required by the individual equipment sections, an authorized training representative of the manufacturer shall visit the Site for the number of Days indicated in those sections to instruct the COMPANY'S personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.

2. The representative shall have at least 2 years of experience in training. A resume of the representative shall be submitted.

3. Training shall be scheduled 3 weeks in advance of the scheduled session.

4. Proposed training material and a detailed outline of each lesson shall be submitted for review. Review comments from the ENGINEER shall be incorporated into the material.

5. The training materials shall remain with the trainees after the session.

6. The COMPANY may videotape the training for later use by the COMPANY'S personnel.

3.2 INSTALLATION

A. **General:** Equipment shall be installed in accordance with the manufacturer's written recommendations.

B. **Alignment**: Equipment shall be field tested to verify proper alignment.

3.3 PACKAGED EQUIPMENT

A. When any system is furnished as pre-packaged equipment, the CONTRACTOR shall coordinate space and structural requirements, clearances, utility connections, signals, and outputs with Subcontractors to avoid later change orders.

B. If the packaged system has any additional features (as safety interlocks, etc.) other than required by the Contract Documents, the CONTRACTOR shall coordinate such features with the ENGINEER and provide material and labor necessary for a complete installation as required by the manufacturer.

3.4 FIELD ASSEMBLY

A. Studs, cap screws, bolt and nuts used in field assembly shall be coated with **Never Seize** compound or equal.

3.5 WELDING

A. Welds shall be cleaned of weld-slag, splatter, etc. to provide a smooth surface.

3.6 FIELD TESTS

A. Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or overheating of bearings or motor.

B. The following field testing shall be conducted:

1. Start equipment, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable standards.

2. Obtain concurrent readings of motor voltage, amperage, capacity, vibration, and bearing temperatures.

3. Operate equipment indicated in Section 01660.

C. The ENGINEER shall witness field-testing. The CONTRACTOR shall notify the ENGINEER of the test schedule 3 Days in advance.

D. In the event that any equipment fails to meet the test requirements, the equipment shall be modified and retested until it satisfies the requirement.

- END OF SECTION -

SECTION 11100 - PUMPS, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide pumps and pumping appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section shall apply to pumps and pumping equipment throughout the Contract Documents, except where otherwise indicated.

C. Unit Responsibility

1. The pump manufacturer shall be made responsible for furnishing the WORK and for the coordination of design, assembly, testing, and installation of the WORK of each specific pump Section.

2. The CONTRACTOR shall be responsible to the COMPANY for compliance with the requirements of each specific pump Section.

D. Single Manufacturer

1. Where 2 or more pump systems of the same type or size are required, provide pumps produced by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01300 – Contractor Submittals.

B. Shop Drawings

1. Submit pump name, identification number, and specification Section number.

2. Performance Information

a. Submit performance data curves showing head, capacity, horsepower demand, NPSH required, and pump efficiency over the entire operating range of the pump.

b. Require the equipment manufacturer to indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions.

c. Submit performance curves at intervals of 100 RPM from minimum speed to maximum speed for each centrifugal pump equipped with a variable speed drive.

3. Operating Range

a. Require the manufacturer to indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration.

b. Provide a stable operating range as wide as possible, based on actual hydraulic and mechanical tests.

4. Submit assembly and installation drawings. including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

5. Submit data, in accordance with the requirements of Section 16460 – Electric Motors, for the electric motor proposed for each pump.

6. Submit an elevation of the proposed local control panel, showing panel-mounted devices, details of enclosure type, a single-line diagram of power distribution, current draw of the panel, and a list of all terminals required to receive inputs or to transmit outputs from the local control panel.

7. Submit a wiring diagram of field connections, with identification of terminations between local control panels, junction terminal boxes, and equipment items.

8. Submit a complete electrical schematic diagram.

C. Technical Manual

1. Submit a Technical Manual containing the required information indicated in Section 01300 – Contractor Submittals and each specific pump Section.

D. Spare Parts List

1. Submit a spare parts list containing the required information indicated in Section 01300 – Contractor Submittals and each specific pump Section.

E. Factory Test Data

1. Submit signed, dated, and certified factory test data for each pump system which requires factory testing.

2. Submit these data before shipment of equipment.

F. Certifications

1. Submit the manufacturer's certification of proper installation.

2. Submit the CONTRACTOR's certification of satisfactory field testing.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Compliance with the requirements of the specific pump Sections may necessitate modifications to the manufacturer's standard equipment.

B. Performance Curves

1. Provide centrifugal pumps with a continuously rising curve or with the system operating range not crossing the pump curve at 2 different capacities or “dip region.”

2. Unless otherwise indicated, the required shaft horsepower for the entire pump assembly at any point on the performance curve shall not exceed the rated horsepower of the motor or engine or encroach on the service factor.

C. Compatibility

1. Provide entirely compatible components of each pump system provided under the specific pump Section.

2. In each unit of pumping equipment, incorporate basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings, and appurtenances.

2.2 MATERIALS

A. Provide materials suitable for the intended application.

B. For materials not indicated, provide high-grade, standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and conforming to the following requirements:

1. Provide cast iron pump casings and bowls constructed of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal.

2. Provide bronze pump impellers conforming to ASTM B 62 - Composition Bronze or Ounce Metal Castings, or B 584 - Copper Alloy Sand Castings for General Applications, where dezincification does not occur.

3. Provide pump shafts constructed of Type 416 or 316 stainless steel.

4. Miscellaneous stainless steel parts shall be of Type 316.

5. Provide anchor bolts, washers, and nuts in standard service (non-corrosive application) of galvanized steel in accordance with the requirements of Section 05500 – Miscellaneous Metalwork.

6. Provide anchor bolts, washers, and nuts in corrosive service as defined in Section 05500 – Miscellaneous Metalwork, of stainless steel in accordance with Section 05500 – Miscellaneous Metalwork.

C. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

2.3 PUMP COMPONENTS - GENERAL

A. Flanges and Bolts

B. Provide suction and discharge flanges conforming to ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 or ASME B16.5 - Pipe Flanges and Flanged Fittings dimensions.

C. Provide bolts shall be in accordance with the requirements of Section 05500 – Miscellaneous Metalwork.

D. Lubrication

1. Vertical pump shafts of clean water pumps shall be product water-lubricated, unless otherwise indicated.

2. Provide deep-well pumps and pumps with dry barrels with water- or oil-lubricated bearings and seals, and enclosed line shafts.

3. Pumps for sewage, sludge, and other process fluids shall be lubricated as indicated.

E. Hand holes

1. Provide hand holes on pump casings shaped to follow the contours of the casing in order to avoid any obstructions in the water passage.

F. Drains

1. Pipe gland seals, air valves, cooling water drains, and drains from variable speed drive equipment to the nearest floor sink or drain, using galvanized steel pipe or copper tube that is properly supported with brackets.

G. Grease Lubrication

1. For vertical propeller, mixed-flow, and turbine pumps, other than deep well pumps, of bowl sizes 10-inch and larger, provide a stainless steel tube attached to the column for grease lubrication of the bottom bearing.

H. Stuffing Boxes

1. Where stuffing boxes are indicated for the pump seal, provide stuffing boxes of the best quality, using the manufacturer's suggested materials best suited for the specific application.

2. For sewage, sludge, drainage, and liquids containing sediments, provide fresh-water-flushed seals, using lantern rings.

3. If fresh water is not available, the seal shall be flushed with product water cleaned by a solids separator as manufactured by **John Crane Co., Lakos (Claude Laval Corp.),** or equal.

4. Conventional Packing Gland Type Seal

   a. Unless otherwise indicated, provide packing material of Teflon braiding, containing 50 percent ultrafine graphite impregnation in order to satisfy the requirements listed in the table below.

   b. Acceptable ring materials are asbestos-free die-molded packing rings of braided graphite material free of PTFE, **Chesterton 1400R** or equal, for non-potable water service, and braided PTFE material, **Chesterton 1725** or equal, that is listed under NSF Standard 61 for potable water service.

c. Seal Requirements

Shaft speeds	up to 2500 fpm
Temperature	up to 500 deg F
pH range	0 - 14

5. Mechanical Seals (Conventional Non-Split-Type)

   a. Provide mechanical seals of the fresh water-flushed-type, unless otherwise indicated in which case use product water cleaned by a solids separator as indicated above.

   b. Provide mechanical seals as manufactured by the following, or equal:

Sewage, Sludge, or Wastewater Pumps	Double seals	John Crane Type 5620P, Flowserve Type ISCPP, Chesterton Type GDS or 255
Abrasives, Grit, or Lime Slurry Pumps	Double seals	John Crane Type 5620P (hard faces), Flowserve Type ISCPP or SLC (check with pump manufacturer), Chesterton Type GDS or 255
Chemicals or Corrosive Liquid Pumps	Single seals	John Crane Type 8-1 or 9, Flowserve Type ISCPX, or Chesterton Type UV, GSS, or 155
Water Pumps (hot and cold)	Single seals	John Crane Type 5610Q, Flowserve Type ISCPX, Chesterton Type UV, GSS, or 155

6. Where indicated, circulate a buffer fluid at a minimum 20 psi above discharge pressure, or as required by the manufacturer, in order to maintain reliable seal performance.

7. Equip mechanical seals with nonclogging, flexible–mounted seats with elastomer secondary seals.

8. Provide wetted metal parts constructed of Type 316 stainless steel, Alloy 20, or Hastelloy B or C, whichever has the best corrosion resistance to the pumped fluid.

9. Provide double-balanced dual cartridge seals in order to allow for seal integrity in case of flush water pressure reversal.

10. Provide springs in single and double seals, in the non-wetted end of the seal.

11. Deliver fresh water to the seals through appropriate size piping with plug valves, strainers, pressure regulators, electrically operated solenoid valves, and rotameters.

12. Wiring shall comply with the requirements of Division 16 – Electrical, and solenoid control shall comply with the requirements of Division 17 – Instrumentation and Control.

2.4 PUMP APPURTENANCES

A. Nameplates

1. Equip each pump with a stainless steel nameplate indicating serial number(s), rated head and flow, impeller size, pump speed, and manufacturer's name and model number.

B. Solenoid Valves

1. Require the pump manufacturer to provide solenoid valves on the water or oil lubrication lines and on cooling water lines.

2. Provide solenoid valve electrical ratings compatible with the motor control voltage.

C. Gauges

1. Equip pumps with pressure gauges installed at the pump discharge lines.

2. Located gauges in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.

3. Where subject to shock or vibrations, wall-mount the gauges or attach the gauges to galvanized channel floor stands and connect by means of flexible connectors.

4. Construction

   a. Diameter: 4-1/2 inches

   b. bottom connected

   c. white laminated dials and black graduations

   d. Windows: acrylic

5. Provide the gauges with a blowout disc, and encase in phenolic, steel, or cast iron.

6. The measuring element shall be a stainless steel bourdon tube with welded, stress-relieved joints.

7. Provide the socket with wrench flats.

8. Provide a rotary- geared movement and construct of stainless steel.

9. Provide the gauges with a pulsation snubber constructed of Type 316 stainless steel, and an isolation valve.

10. Calibrate the gauges to read in applicable units.

11. Provide an accuracy of plus and minus 1/2-percent range to 150 percent of the working pressure or vacuum of the pipe or vessel to which the gauge is connected.

12. Pressure Gauges Manufacturer, or Equal

    a. Ashcroft 1279

    b. Ametek Solfrunt Series 1900

2.5 FACTORY TESTING

A. Conduct the following tests on each indicated pump system:

1. Motors

    a. Test electric motors in accordance with the requirements of Section 16460 – Electric Motors.

    b. Furnish test results to the pump manufacturer prior to the pump test.

2. Factory Non-witnessed Test

    a. Test centrifugal pump systems with drives 10 hp up to and including 125 hp at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) acceptance Level "1U" or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and published by the Hydraulic Institute.

    b. For sump pumps and sample pumps, acceptance shall be in accordance with Level "2" of ANSI/HI 1.6, unless otherwise indicated.

    c. Perform tests using the complete pump system to be furnished, including the Project motor and variable speed drive if equipped with variable speed drive.

    d. For pumps with motors smaller than 100 hp, the manufacturer's certified test motor will be accepted.

    e. Testing of prototype models will not be accepted.

    f. Conduct the following minimum tests and submit the test results:

        1) hydrostatic test;

        2) Performance Test:

            a) Conduct performance testing at maximum speed, obtain a minimum of 5 hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, and record on data sheets as defined by the Hydraulic Institute standards;

            b) For variable speed driven pumps, test each pump between maximum and minimum speed at 100-RPM increments;

            c) Submit pump curves showing head, flow, bhp, and efficiency results;

        3) mechanical test;

        4) NPSH

a) Perform a net positive suction head required test (NPSHr3), if required by the specific pump Section.

b) If not required by the specific pump Section, submit the published manufacturer-calculated NPSHr3 curve.

g. Submit certification signed by a senior official of the pump manufacturer that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.

h. Submit test results to the ENGINEER for review prior to delivery to the Site.

3. Acceptance

a. In the event of failure of any pump to meet any of the requirements, make necessary modifications, repairs, or replacements in order to conform to the requirements of the Contract Documents, and re-test the pump until found satisfactory.

PART 3 -- EXECUTION

3.1 MANUFACTURER'S SERVICES

A. Inspection, Startup, and Field Adjustment

1. Where required by the specific pump Section, furnish an authorized service representative of the manufacturer at the Site continuously to supervise the following items and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation:

a. installation of the equipment;

b. inspection, checking, and adjusting the equipment;

c. startup and field testing for proper operation; and

d. performance of field adjustments to ensure that the equipment installation and operation comply with the indicated requirements.

B. Instruction of COMPANY's Personnel

1. Where required by the individual pump Section, furnish an authorized training representative of the manufacturer at the Site for the number of Days indicated in the specific pump Section, to instruct the COMPANY's personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment.

2. Furnish instruction specific to the model of equipment provided.

3. Qualifications

a. Furnish a representative with at least 2 years of experience in training.

b. Submit a resume for the representative.

4. Schedule the training a minimum of 3 weeks in advance of the first session.

5. Lesson Plan Review

   a. Submit the proposed training material and a detailed outline of each lesson for review.

   b. Incorporate review comments into the material.

6. The trainees will keep the training materials.

7. The COMPANY may videotape the training for later use with the COMPANY's personnel.

3.2 INSTALLATION

A. General

1. Install pumping equipment in accordance with the manufacturer's written recommendations.

B. Alignment

1. Field-test the equipment in order to verify proper alignment and freedom from binding, scraping, shaft runout, or other defects.

2. Measure the pump drive shafts just prior to assembly in order to ensure correct alignment without forcing.

3. Ensure that the equipment is secure in position and neat in appearance.

C. Lubricants

1. Provide the necessary oil and grease for initial operation.

3.3 PROTECTIVE COATING

A. Coat materials and equipment in accordance with the requirements of Section 09800 – Protective Coating.

3.4 FIELD TESTS

A. Field-test each pump system after installation in order to demonstrate:

1. satisfactory operation without excessive noise and vibration;

2. no material loss caused by cavitation;

3. no overheating of bearings; and,

4. indicated head, flow, and efficiency at the design point.

B. Conduct the following field testing:

1. Startup, check, and operate the pump system over its entire speed range.

2. If the pump is driven by a variable speed drive, test the pump and motor at 100-RPM increments.

3. If the pump is driven at constant speed, test the pump and motor at the maximum RPM.

4. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute standards at a minimum of 4 pumping conditions defined by the ENGINEER.

5. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge head for at least 4 pumping conditions at each pump rotational speed, at 100-RPM increments if equipped with a variable speed drive or at maximum RPM if equipped with a constant speed drive.

6. Check each power lead to the motor for proper current balance.

7. Bearing Temperatures

   a. Determine bearing temperatures by a contact-type thermometer.

   b. Precede this test with a run time sufficient to stabilize bearing temperatures, unless an insufficient liquid volume is available to furnish such a run time.

8. Ensure that electrical and instrumentation tests conform to the requirements of the Section under which that equipment is specified.

C. Witnessing

1. Field testing will be witnessed by the ENGINEER.

2. Furnish 3 Days advance notice of field testing.

D. If the pumping system fails to meet the indicated requirements, modify or replace the pump and re-test as indicated above until it satisfies the indicated requirements.

E. Certification

1. After each pumping system has satisfied the requirements, certify in writing that it has been satisfactorily tested and that final adjustments have been performed.

2. Certification shall include the date of the field tests, a listing of persons present during the tests, and the test data.

F. The CONTRACTOR shall be responsible for costs of field tests, including related services of the manufacturer's representative, except for power and water, which the COMPANY will bear.

G. If available, the COMPANY'S operating personnel will provide assistance in field testing.

- END OF SECTION -

SECTION 11155 - DEWATERING PUMPS

PART 1 -- GENERAL

1.1 GENERAL DESCRIPTION

A. Identification:

Pump Name	Equipment Number
Pit 3 Waste Rock Dewatering	P-0031
Pit 3 Underdrain	P-0035
Pit 4 Waste Rock Dewatering	P-0041
Pit 4 Underdrain	P-0045
Central Drainage Alluvial	TP-0060
Western Drainage Alluvial	TP-0070
Far East Drainage Alluvial	TP-0080
Alluvial Ground Water Controls Wet Well	TP-0090
Seepage Collector Dewatering Wet Well	P-0101
South Pond East Cell	TP-0131
South Pond West Cell	TP-0132
West Pond	TP-0105

B. **Operating Conditions:** The WORK of this Section shall be suitable for long term operation under the following conditions:

Duty	Constant
Drive	Full Voltage Non-Reversing
Ambient environment	Submerged /Outdoors
Ambient temperature, °F	0 to 100
Ambient relative humidity, percent	Submerged
Fluid service	Water
Fluid temperature, °F	Ambient
Fluid pH range	4.0-8.0
Fluid specific gravity	1.0
Project site elevation, msl	2350 to 3275
Maximum size spheres to pass	Sand
Pump removal method	Well casing/Pond riser
Pump Control	Water Level

C. Performance Requirements:

Equipment Number	Design flow capacity, gpm	Design flow TDH, feet	Design flow minimum hydraulic efficiency, percent	Minimum motor size, hp	Power
P-0031	228	450	60	50	480 VAC, 3 Ø, 60 Hz
P-0035	366	500	75	60	480 VAC, 3 Ø, 60 Hz
P-0041	68	250	56	7.5	480 VAC, 3 Ø, 60 Hz
P-0045	128	315	75	15	480 VAC, 3 Ø, 60 Hz
TP-0060	15	37	-	0.5	230 VAC, 3 Ø, 60 Hz
TP-0070	15	51	-	0.5	230 VAC, 3 Ø, 60 Hz
TP-0080	15	42	-	0.5	230 VAC, 3 Ø, 60 Hz
TP-0090	45	205	60	5	230 VAC, 3 Ø, 60 Hz
P-0101	10	250	50	1	230 VAC, 3 Ø, 60 Hz
TP-0131	250	75	75	7.5	480 VAC, 3 Ø, 60 Hz
TP-0132	250	75	75	7.5	480 VAC, 3 Ø, 60 Hz
TP-0105	500	55	78	15	480 VAC, 3 Ø, 60 Hz

1.2 PUMP REQUIREMENTS

A. General

1. Each pump shall be capable of pumping mine tailing water. See mine water chemistry elsewhere in these specifications.

2. Each pump shall be capable of continuous operation at full load, without cavitation or overheating of the motor.

3. Each pump, with its cable and appurtenances, shall be able to withstand continuous maximum submergence, whether running or off, without leakage.

4. Each pump shall be supplied with a built-in check valve to prevent flow back through the pump.

B. Each pump shall be controlled by means of a level transducer or floats. The transducer shall be set to activate the pump at a maximum level and deactivate the pump at a minimum level above the invert of the pond sump invert. The floats shall have a high and a low level to deactivate and activate the pump, respectively. The float system shall also have a high, high level to indicate an alarm condition.

C. Pump Construction: Construction of submersible pumps shall conform to the following requirements:

Bowls	Type 316 stainless steel
Impeller (multi-stage vertical turbine)	Stainless steel, Type 316
Impeller seal ring	Stainless steel
Impeller shaft method of connection	Type 316 stainless steel impeller lock collet
Wear rings	Stainless steel, hard-faced, replaceable
Bowl shaft	Stainless steel, Type 410, 416, or 316
Suction case and strainer	Type 316 stainless steel
Motor Adaptor	Type 316 stainless steel
Suction case bearing	Stainless steel
Bowl bearing	Rubber with stainless steel
Pump to motor coupling	Stainless steel

D. Drive

1. Motor Design

a. Provide a squirrel cage induction motor designed for continuous underwater operation in conformance with NEMA standards.

b. Provide a bearing rated for a minimum of 130 percent of the maximum pump downthrust load.

c. Do not use oils or grease lubrication.

d. The shaft seal shall be a Nitrite rubber lip seal or a Nitrite, carbon, carbide or ceramic face seal.

e. A mercury-type shaft seal will not be accepted.

f. Provide exterior material construction of Type 316 or 316L stainless steel

g. The nameplate horsepower shall not be exceeded at any point on the pump curve.

h. See Specification 16460 for additional requirements.

2. Electrical Cable

a. Provide necessary cables for power connection, control wires, and overload protection, sheathed, coded, and suitable for submersible pumps, and of sufficient length for direct and continuous connection from the motor to the control panels located above ground.

b. Provide the surface plate with a power cable splice box that meets the requirements of the National Electrical Code.

c. If indicated, provide a junction box that meets the requirements of the National Electrical Manufacturer's Association (NEMA).

d. Connect cables to the pumps and test at the factory.

e. If the cables are not assembled in the factory, the field connection of the cable to the motor shall be supervised and certified by the pump manufacturer's representative.

f. Splicing of cable between the motor and the terminal box will not be accepted.

g. The size and type of cable shall be determined by the pump manufacturer, suitable for the application.

h. Fully contain the motor lead-to-electrical cable within the water-tight motor housing and conform to IEEE and NEC standards.

i. Provide an electrical wire of annealed, bare, 19-stranded copper conductors insulated with PVC.

j. Jacket the power conductors plus a ground conductor in a flat heavy-duty PVC jacketing.

k. Provide UL-listed cable in accordance with UL83 Type TW Construction A, as Deep Well Submersible Cable.

l. Size power conductors to allow no more than 5 percent voltage loss in the entire length.

m. Size the grounding conductor in accordance with Table 24.3 of UL83.

n. Strap the electrical cable to the discharge column with stainless steel bands.

3. Motor Rating

   a. Provide motors with a service factor of 1.10 or greater.

4. Provide the motor with a junction box capable of being sealed completely from the stator casing in order to prevent leakage through the junction box into the stator housing should a motor cable be damaged, or provide some other means to prevent leakage into the junction box under any condition.

5. Cable Entry

   a. Design the cable entry water seal such that it precludes specific torque requirements in order to ensure a watertight and submersible seal.

   b. It shall permit no entry of water into any high voltage area even if the cable is severed below the water level.

6. Motor Protection

a. Provide integral thermal sensors in the motors, one for each phase, to monitor stator temperatures.

b. Utilize these sensors in conjunction with and supplemented by external motor over-current protection located at the control panel.

c. Provide integral leak detection in the motors.

1.3 FACTORY TESTING AND SHIPMENT

A. In addition to the factory tests in Section 11100, perform the following procedures with the factory test prior to shipment:

1. Hydrostatically test the hydraulic end of pump assembled to the motor not less than 150 percent of the shutoff head of the pump.

2. Leak-Test

a. Leak-test the motor not less than 150 percent the maximum submergence at Site conditions.

b. If the motor is to be installed inside an artesian well, leak-test the motor at a test of pressure equal to at least 150 percent of the static pressure above the centerline of the motor.

3. Acceptance criteria for hydrostatic and leak test shall be zero leak.

4. Verify the pump characteristic curves by testing at shutoff head, 25, 50, 75, 100, and 125 percent of the indicated design flow, and at maximum "run-out" flow, and recording the measured head and motor current for each flow.

5. Verify cavitation-free service and absence of motor overheating during conditions simulating the actual operating conditions after installation.

6. Design the motor seals for complete water tightness at 150 percent of the actual maximum submergence at the Site for 30 minutes, and submit data on factory testing and quality control with the Shop Drawings.

7. Properly lubricate and protect parts such that no damage or deterioration will occur even during a prolonged delay from the time of shipment until installation is completed and the pumps are ready for operation.

8. Properly protect unpainted finished ferrous surfaces in order to prevent rust and corrosion.

9. Protect the finished surfaces of exposed flanges by strong wooden blind flanges.

10. Properly crate each pump to protect against damage during shipment.

1.4 PUMP CONTROLS

A. Equipment manufacturer shall be responsible for coordination of controls and control strategies with the ENGINEER.

1.5 SPARE PARTS

A. **General:** The pumps shall be backed by supplies of spare parts from stock, and after-sales service from a factory trained and authorized maintenance facility.

B. Parts to be Furnished

1. bearings, radial

2. valve seat

3. neck rings

4. seal ring

5. upthrust ring.

1.6 MANUFACTURERS, OR EQUAL

A. Grundfos

PART 2 -- PRODUCTS

2.1 THE REQUIREMENT

A. The CONTRACTOR shall provide dewatering pumps and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 11000 - Equipment General Provisions apply to this Section.

C. The Supplier shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump which will best satisfy the indicated requirements.

D. This section covers submersible non-clog pumping units. Each pumping unit shall be complete with a closed-coupled, submersible, electric motor and all other appurtenances specified or otherwise required for proper operation.

2.2 SUBMITTALS

A. General. Submittals shall be prepared and transmitted in accordance with Section 01300 – Contract Submittals.

B. Shop Drawings. The following information shall be furnished with the Shop Drawings:

1. Fabrication, assembly, and installation drawings showing dimensions and materials of construction of the equipment components.

2. Equipment mounting drawings showing the weight and base dimensions.

3. Structural calculations, where required, for seismic analysis and/or equipment design.

4. Location and orientation of piping interconnections.

5. Pump performance information as specified in Section 11100 – Pumps, General

6. Provide complete electrical motor data in accordance with Section 16460– Electric Motors.

7. Wiring diagram of field connections with identification of terminations between equipment devices, instrumentation items, junction terminal boxes, local control panels, vender control panels, etc.

8. Instructions for delivery, handling, storage, and installation of the equipment.

9. List of spare parts to be furnished.

10. Describe any exceptions or deviations taken to the Contract Documents.

C. Technical Manuals. Operation and Maintenance Information and Equipment Maintenance Sheets as specified in Section 01300 – Contract Submittals.

D. Manufacturer's Certificate. A Manufacturer's Certificate of satisfactory installation is required for the equipment specified herein. The Manufacturer's Certificate shall be prepared and submitted as specified in Section 01300 – Contractor Submittals.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Contractor shall provide fittings/reducers/increasers and pipe spools needed to connect pump discharge to field transmission pipeline

B. In addition to the requirements of Section 11100, the CONTRACTOR shall ensure that anchor bolts are set only after the discharge piping has been properly installed, to ensure exact fit with embedded piping components.

C. Each discharge base shall be leveled, plumbed, aligned, and wedged into position to fit connecting piping.

D. Field Startup and Testing: After installation, each pump and motor shall be tested with the process service fluid. Record the following each minute for one hour per pump:

1. Flow, discharge pressure, wet well level, amp draw, speed and winding temperatures.

2. Check instruments attached to the pump and motor and record conditions. Each instrument shall read normal readings. If any instrument indicates abnormal conditions, notify the ENGINEER, and have the manufacturer quickly resolve the problem.

3.2 SERVICES OF MANUFACTURER

A. **Inspection, Startup, and Field Adjustment:** The service representative of the manufacturer shall be present continuously at the Site to furnish the services required by Section 11100.

B. **Instruction of OWNER'S Personnel:** The training representative of the manufacturer shall be present at the Site for 1 Day to furnish the services required by Section 11100.

C. For the purposes of this paragraph, a Day is defined as an 8 hour period at the Site, excluding travel time.

D. The ENGINEER may require that the inspection, startup, and field adjustment services above be furnished in 2 separate trips.

- END OF SECTION -

DIVISION 15 - MECHANICAL

SECTION 15000 - PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to piping sections in Divisions 2 and 15.

C. The Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type.

D. The Drawings are not pipe construction or fabrication drawings.

E. Where pipe supports and spacing are indicated on the Drawings and are referenced to a Standard Detail, the CONTRACTOR shall use that detail.

F. Where pipe supports are not indicated on the Drawings, it is the CONTRACTOR's responsibility to develop the details necessary to design and construct mechanical piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

G. The CONTRACTOR shall provide plumbing specialties in accordance with manufacturer's printed instructions.

H. Screwed joints shall be made with joint compound and be tight and leakproof. A sufficient number of brass to ferrous metal seat unions shall be placed in lines so that any pipe, valve, or piece of equipment may be easily disconnected.

I. Drainage and sanitary lines shall be properly run, trapped, and vented to conform to Code requirements. Changes in direction shall be made with "Y" branch fittings and shall be of the same size as the pipe. Changes in pipe size shall be made with reducing fittings. Minimum depth of cover shall be 4-feet.

J. Horizontal soil, drain, and waste pipes shall be given a slope of at least 1/4-inch per foot unless indicated otherwise.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 – Contractor Submittals.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Drawings: Layout drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, and material lists. Fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.

2. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

3. Modular Seals for Pipe: Manufacturer's catalog sheet showing materials and installation procedures.

C. Samples: Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.

D. Certifications

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.

2. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator's or a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the manufacture of any pipe.

1.3 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact.

B. Defective or damaged materials shall be replaced with new materials.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Extent of Work: Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable Sections of Divisions 2 and 15 and as indicated.

B. Pipe Supports: Pipes shall be adequately supported, restrained, and anchored in accordance with manufacturer's recommendations.

C. Pressure Rating: Piping systems shall be designed for the maximum expected pressure as defined on the Piping Schedule.

D. Inspection

1. Pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture, the ENGINEER shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

E. Tests

1. Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards.

2. Welds shall be tested as indicated.

3. The CONTRACTOR shall be responsible for performing material tests.

F. Welding Requirements

1. Welding procedures shall be submitted for the ENGINEER's review.

G. Welder Qualifications

1. Welding shall be performed by skilled welders and welding operators who have adequate experience in the methods and materials to be used.

2. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.

3. Qualification testing of welders and materials used during testing is part of the WORK.

2.2 PIPE FLANGES

A. General

B. Flanges shall be provided with flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated.

C. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207.

D. Flanges fabricated from steel plate shall meet the requirements of ASTM A 516, Grade 70. Forgings shall meet the requirements of ASTM A 105. Castings shall meet the requirements of ASTM A 216 WCB.

E. Flange faces shall be perpendicular to the axis of the adjoining pipe.

F. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes.

G. Flanges and pipe stub for HDPE pipe shall be machined from a single block of material that can be butt fused to pipe. Steel backer flanges shall be used at connections.

H. Pressure Ratings

1. 150 psig or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb. class.

2. Selection Based on Test Pressure

a. Do not expose AWWA flanges to test pressures greater than 125 percent of rated capacity.

b. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

I. Blind Flanges

1. Provide blind flanges in accordance with AWWA C207, or as indicated for miscellaneous small pipes.

J. Flange Coating: Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

K. Flange Bolts

1. Bolts and nuts shall be Type 316 stainless steel Class 2, grade B8M conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.

2. Use all-thread studs on valve flange connections where space restrictions preclude the use of regular bolts.

L. Insulating Flanges: Insulated flanges shall be provided with bolt holes 1/4-inch diameter greater than the bolt diameter.

M. Flange Gaskets

1. Gaskets for flanged joints used in general shall be full-faced type, with material and thickness in accordance with AWWA C207, suitable for temperatures to 700 degrees F, a pH of one to 11, and pressures to 1000 psig.

2. Blind flanges shall be provided with gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.

3. Ring gaskets will not be accepted unless otherwise indicated.

4. Flange gaskets shall be: **John Crane, Style 2160; Garlock, Style 3000; or equal**.

5. Gaskets for flanged joints used in chemicals, air, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature.

2.3 THREADED INSULATING CONNECTIONS

A. General

1. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials

1. Threaded insulated connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and proprieties to suit the service and loading conditions.

2.4 EXPANSION JOINTS

A. Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures, accomplished with expansion loops.

B. Dual-wall pipe has the potential for unique expansion between the outer and inner walls of the pipe. Details on any above-grade dual-wall pipe expansion considerations shall be submitted.

C. Submit detailed calculations and manufacturer's Shop Drawings of proposed expansion loops, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.

2.5 PIPE THREADS

A. Pipe threads shall be in conformance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

2.6 MODULAR MECHANICAL SEALS FOR PIPING PENETRATIONS

A. Where indicated and where required in order to prevent flow of water or air, the passages of piping through wall sleeves and cored openings shall be sealed with modular interlocking link mechanical closures.

B. Individual links shall be constructed of EPDM rubber, be suitable for temperatures between minus 40 and plus 250 degrees F, and be shaped to fill the annular space between the outside of the pipe and the inside of the wall sleeve or cored opening.

C. Assemble the links using Type 316 stainless steel bolts and nuts to form a continuous rubber belt around the pipe.

D. Pressure plates under each bolt and nut shall be fabricated of a corrosion-resistant composite material.

E. After the seal assembly is positioned in the sleeve, tighten the bolts against the pressure plates to expand the rubber links and form the watertight seal.

F. Sizing and installation of sleeves and assemblies shall be in accordance with the manufacturer's recommendations.

G. Modular Mechanical Seals Manufacturer, or Equal: Thunderline Corporation, Link-Seal.

PART 3 -- EXECUTION

3.1 GENERAL

A. Install piping, fittings, and appurtenances in accordance with the requirements of applicable Sections of Division 2 and Division 15.

B. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.

C. Care shall be taken to insure that piping flanges, , flexible connectors, and expansion joints are properly installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection.

2. Each gasket shall be centered properly on the contact surfaces.

3. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected.

4. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

5. Flange Bolts

   a. Flange bolts shall be initially hand-tightened with the piping connections properly aligned.

   b. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC-recommended torque for the bolt material.

6. Harness, Thrust Restraint, and Tie Rod Bolts

   a. Harness, thrust restraint, and tie rod bolts used for sleeve couplings, flange coupling adapters, or flexible joints shall be tightened gradually and equally at diametrically opposite sides until snug, in order to prevent misalignment and to insure that all studs carry equal loads.

   b. In order to prevent induced stress or misalignment, do not over-torque connections to adjoining pump or equipment.

7. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.

8. After installation, joints shall meet the indicated leakage rate.

9. Flanges shall not be deformed nor cracked.

D. Core Drilling: Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction in order to avoid damage to embedded raceways and reinforcing bars.

E. Cleanup

1. After completion of the WORK, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site.

2. The entire piping system shall be handed over in a clean and functional condition.

- END OF SECTION -

SECTION 15200 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The requirements of Section 11000 – Equipment General Provisions, apply to the WORK of this Section.

C. Apply the provisions of this Section to all valves and valve actuators except where otherwise indicated.

D. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.

E. Support

1. Where a valve is to be supported by means other than the piping to which it is attached, obtain from the valve manufacturer a design for its support and foundation that satisfies the criteria in Section 11000 – Equipment General Provisions.

2. Submit the support design, including drawings and calculations sealed by an engineer, with the Shop Drawings.

3. Provide the support after the design has been approved.

F. Unit Responsibility

1. Make a single manufacturer responsible for the coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the COMPANY for compliance with the requirements of each valve Section.

2. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.

G. Single Manufacturer

1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01300 – Contractor Submittals.

B. Furnish the following information on Shop Drawings:

1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;

2. complete information on the valve actuator, including size, manufacturer, model number, limit switches, and mounting;

3. cavitation limits for control valves;

4. assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels, position indicators, limit switches, integral control systems, needle valves, and control systems;

5. data in accordance with Section 16460 – Electric Motors, for electric motor-actuated valves;

6. complete wiring diagrams and control system schematics; and,

7. A valve-labeling schedule, listing the valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.

C. Furnish a technical manual containing the required information for each valve, as indicated.

D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.

E. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.

2. Furnish a certification of quality and test results for factory-applied coatings.

PART 2 -- PRODUCTS

2.1 PRODUCTS

A. General

1. Provide valves and gates of new and current manufacture.

2. Provide shut-off valves 6-inch and larger with actuators with position indicators.

3. Provide gate valves 18-inch and larger, or where chain wheel is required, with spur gear and hand wheel.

4. Provide buried valves with valve boxes and covers containing position indicators and valve extensions.

5. Provide manual shut-off valves mounted higher than 7 feet above the working level with chain actuators.

B. Valve Actuators

1. Unless otherwise indicated, provide valve actuators in accordance with Section 15201 – Valve and Gate Actuators.

C. Protective Coating

1. Coat the exterior surfaces and the wet interior surfaces of ferrous valves of sizes 4-inch and larger with epoxy in accordance with the requirements of Section 09800 – Protective Coating.

2. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with the indicated requirements.

3. Do not epoxy-coat the flange faces of valves.

D. Valve Labeling

1. Except when such requirement is waived by the ENGINEER in writing, provide a label on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves.

2. Furnish a label composed of 1/16-inch thick acrylic, a minimum of 1-inch by 3-inches in size, as indicated in Section 10400 – Signage, and permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER. Label shall include valve tag number and function.

E. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves 3 inches in diameter and smaller in accordance with the manufacturer's standard procedure.

2. Factory-test valves 4 inches in diameter and larger as follows:

a. Hydrostatic Testing

1) Subject valve bodies to an internal hydrostatic pressure equivalent to twice the water-rated pressure of the valve.

2) Metallic valves rating pressures shall be at 100 degrees F.

3) Plastic valves rating pressures shall be at 73 degrees F, or at a higher temperature according to material type.

4) During the hydrostatic test, there shall be no leakage through the valve body, end joints, or shaft seals, nor shall parts of the valve be permanently deformed.

5) Allow a test duration of at least 10 minutes, in order to allow visual examination for leakage.

b. Seat Testing

1) Test the valves for leaks in the closed position, with the pressure differential across the seat equal to the water rated pressure of the valve.

2) Provide a test duration of at least 10 minutes, in order to allow visual examination for leakage.

3) The leakage rate shall be the more stringent of the following:

a) As recommended by the reference standard for that type of valve; or,

b) Leakage past the closed valve not to exceed one fluid ounce per hour per inch diameter for metal seated valves, and drop-tight for resilient seated valves.

c. Performance Testing

1) Shop-operate the valves from the fully-closed to the fully-open position, and reverse under no-flow conditions in order to demonstrate that the valve assembly operates properly.

F. Certification

1. Prior to shipment of valves over 12-inches in size, submit certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

G. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General

1. Provide materials suitable for the intended application.

2. Provide materials in contact with potable water listed as compliant with NSF Standard 61.

3. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

4. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:

a. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings

b. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures

c. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

d. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications

e. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel

f. PVC: Polyvinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454

2.3 VALVE CONSTRUCTION

A. Bodies

1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.

2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.

3. Perform welds on welded bodies by certified welders and ground welds smooth.

4. Provide valve ends as indicated, and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.

2. Provide valves 3 inches in diameter and larger with flanged end connections.

C. Bonnets

1. Connect valve bonnets to the body by clamping, screwing, or flanging.

2. Provide bonnets of the same material, temperature, and pressure rating as the body.

3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

D. Stems

1. Provide valve stems of the materials indicated, or, if not indicated, of the best commercial material for the specific service, with adjustable stem packing, O-rings, chevron V-type packing, or other suitable seal.

E. Stem Guides

1. Provide stem guides spaced 10 feet on centers, unless the manufacturer can demonstrate by calculation that a different spacing is acceptable.

2. Construct submerged stem guides from Type 316 stainless steel or other best-suited material based on the acidity of the liquid.

F. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.

2. Where not indicated, construct valve trim from Type 316 stainless steel or other best-suited material.

G. Nuts and Bolts

1. Provide nuts and bolts on valve flanges and supports in accordance with the requirements of Section 05500 – Miscellaneous Metalwork.

2.4 VALVE ACCESSORIES

A. Provide valves complete with the accessories required to provide a functional system.

2.5 SPARE PARTS

A. Furnish the required spare parts, suitably packaged and labeled with the valve name, location, and identification number.

B. Furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve.

C. Spare parts are intended for use by the COMPANY, after expiration of the correction of defects period.

2.6 MANUFACTURERS

A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION

A. General

1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.

2. Firmly support valves in order to avoid undue stresses on the pipe.

B. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

C. Valve Accessories

1. Where combinations of valves, sensors, switches, and controls are indicated, properly assemble and install such items such that systems are compatible and operating properly.

2. Clearly note the relationship between interrelated items on Shop Drawing submittals.

- END OF SECTION -

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SECTION 15201 - VALVE ACTUATORS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide valve actuators and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section apply to valves except where otherwise indicated in the Contract Documents.

C. Unit Responsibility

1. Make the valve manufacturer responsible for the coordination of design, assembly, testing, and installation of actuators on the valves; however, the CONTRACTOR shall be responsible to the OWNER for compliance of the valves and actuators with the Contract Documents.

D. Where 2 or more valve actuators of the same type or size are required, the actuators shall be produced by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01300 – Contractor Submittals and Section 15200 – Valves, General.

B. Submit Shop Drawing information for actuators with the valve submittals as a complete package.

C. Submit calculations showing dynamic seating and unseating torques versus the output torque of the actuator.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, provide shut-off and throttling valves and externally actuated valves and gates with manual actuators.

B. Provide actuators complete and operable with mounting hardware, gears, hand wheels, levers, chains, and extensions, as applicable.

C. Provide actuators with torque ratings equal to or greater than required for valve seating and dynamic torques, whichever is greater, and capable of holding the valve in any intermediate position between fully-open and fully-closed without creeping or fluttering.

D. Actuator torque ratings for butterfly valves shall be determined in accordance with AWWA C504 - Rubber-Seated Butterfly Valves.

E. Manufacturers

1. Where indicated, certain valves may be provided with actuators manufactured by the valve manufacturer.

2. Where actuators are furnished by different manufacturers, coordinate the selection to result in the fewest number of manufacturers possible.

F. Materials

1. Provide actuators of current models, of the best commercial quality materials, and liberally sized for the required torque.

2. Provide materials suitable for the environment in which the valve is to be installed.

G. Actuator Mounting and Position Indicators

1. Securely mount actuators by means of brackets or hardware specially designed and sized for this purpose and of ample strength.

2. Cast the word "OPEN" on each valve or actuator, with an arrow indicating the direction to open in the counter-clockwise direction.

3. Equip gear and power actuators with position indicators.

4. Where possible, locate manual actuators between 48 and 60 inches above the floor or the permanent working platform.

H. Standards

1. Unless otherwise indicated and where applicable, provide actuators in accordance with AWWA C 540 - Power-Actuating Devices for Valves and Sluice Gates.

I. Provide fasteners in accordance with the requirements of Section 05500 – Miscellaneous Metalwork.

J. Provide coatings in accordance with the requirements of Section 09800 – Protective Coating.

2.2 MANUAL ACTUATORS

A. General

1. Unless otherwise indicated, provide valves with manual actuators.

2. Provide valves in sizes up to and including 4-inches with direct-acting lever or hand wheel actuators of the manufacturer's best standard design.

3. Provide valves larger than 4-inch with gear-assisted manual actuators, with an operating pull of maximum 60 pounds on the rim of the hand wheel.

4. Provide buried and submerged gear-assisted valves for pressures higher than 250 psig, and where indicated, with worm gear actuators, hermetically-sealed water-tight and grease-packed.

5. Valves 6-inch to 24-inch diameter may be provided with traveling-nut actuators, worm gear actuators, spur or bevel gear actuators, as appropriate for each valve.

B. Buried Valves

1. Unless otherwise indicated, provide buried valves with extension stems to grade, with square nuts or floor stands, position indicators, and cast-iron or steel pipe extensions with valve boxes, covers, and operating keys.

2. Where indicated, provide buried valves in cast-iron, concrete, or similar valve boxes with covers of ample size in order to allow operation of the valve actuators.

3. Permanently label the valve box covers as required by the OWNER or the ENGINEER.

4. Provide wrench-nuts in compliance with AWWA C 500 - Metal-Seated Gate Valves for Water Supply Service.

C. Handwheel Operation

1. The maximum torque required on the handwheel under the most adverse conditions shall not exceed 60 lb-ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb.

2. Cast or permanently affix an arrow and either the word "OPEN" or "CLOSE" on the handwheel in order to indicate the appropriate direction to turn the handwheel.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install valve actuators and accessories in accordance with the requirements of Section 15200 – Valves, General.

B. Locate the actuators to be readily accessible for operation and maintenance without obstructing walkways.

C. Do not mount actuators where shock or vibrations will impair their operation.

D. Instruction of OWNER's Personnel

1. The authorized service representative shall visit the Site for not less than 1/2 Day in order to instruct the OWNER'S personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting procedures.

- END OF SECTION –

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SECTION 15202 - BUTTERFLY VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide butterfly valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 11000 – Equipment General Provisions apply to this Section.

C. The requirements of Section 15200 - Valves, General apply to this Section.

D. The requirements of Section 15201 - Valve Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 15200.

B. Shop Drawings

1. Complete Shop Drawings of butterfly valves and actuators.

2. Drawings showing valve port diameter complete with dimensions, part numbers, and materials of construction.

3. Dynamic seating and unseating torque for motor actuated valves.

4. Certified statement of proof-of-design tests from the valve manufacturer. Valve manufacturer shall state that the valves proposed for this project will be manufactured with identical basic type of seat design and materials of construction to the prototype evaluated under the proof of design testing.

1.3 QUALITY ASSURANCE

A. Valves shall be subjected to performance, leakage, and hydrostatic tests in accordance with procedures and acceptance criteria established by AWWA C504.

PART 2 -- PRODUCTS

2.1 PVC BUTTERFLY VALVES FOR WATER SERVICE

A. **General:** Butterfly valves for steady-state water working pressures and steady-state differential pressure up to 150 psi and for water service having a pH range from 2 to 11 and temperature range from 33 to 85 degrees F shall conform to AWWA C504 and be as indicated. Thermoplastic butterfly valve bodies shall be constructed from PVC Type I, cell class 12454, (one-piece molded) with type 316/316L wetted metallic parts. Valve seals and O-rings shall be EPDM. Valve stems shall be type 316 stainless steel. Bolt pattern shall conform to ANSI/ASME B 16.5 Class 150 standards. Disc shall be constructed of PP (one-piece molded with stainless steel reinforcement). Gear operator shall include a position indicator. Valves shall be pressure rated at 150 psi, non-shock water at 73° F (10" and smaller) and 100 psi, non-shock water at 73° F (12").

B. Manufacturers, or Equal

1. Colonial Valve

2. Asahi/America

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator. Installation shall be in accordance with Section 15200.

- END OF SECTION -

SECTION 15203 - CHECK VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide check valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 15200 - Valves, General apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 15200.

B. Submit documentation from the valve supplier indicating that the proposed materials used for valves construction are suitable for the intended fluid service, i.e. pH of 2.5.

PART 2 -- PRODUCTS

2.1 PLASTIC SWING OR WYE-CHECK VALVES

A. **General**: Plastic swing or wye-check valves for corrosive fluids, in sizes up to 8-inches or as available, may be used for horizontal or vertical up-flow conditions.

B. **Construction**: The valve bodies and discs or piston shall be of PVC, PP, or PVDF construction as best suited for each individual service condition. They shall have flanged ends conforming to ASME B16.5 Class 150, and flanged top access covers and shall shut positively at no-flow conditions. The seats and seals shall be of EPDM, Teflon, or Viton. The PVC valves shall be rated for a maximum non-shock working pressure of 150 psi at 73 degrees F for sizes 3-inches and smaller. For larger sizes and other materials and temperatures the pressure rating may be lower.

C. Manufacturers, or Equal

1. ASAHI-AMERICA

2. George Fischer, Inc.

3. **Spears Mfg. Co.** (Plastic Swing Check only)

PART 3 -- EXECUTION

3.1 GENERAL

A. Valves shall be installed in accordance with provisions of Section 15200 - Valves, General.

- END OF SECTION -

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SECTION 15230 - MISCELLANEOUS VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide miscellaneous valves and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The requirements of Section 15200 - Valves, General, apply to this Section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 15200.

PART 2 -- PRODUCTS

2.1 AIR-VACUUM AND AIR-RELEASE VALVES

A. Air and Vacuum Valves: Air and vacuum valves shall be capable of venting large quantities of air while pipelines are being filled, and allowing air to re-enter while pipelines are being drained. They shall be of the size indicated, with flanged or screwed ends to match piping. Bodies shall be of high-strength cast iron. The float, seat, and moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150 psi water-working pressure, unless otherwise indicated.

B. Air-Release Valves: Air-release valves shall vent accumulating air while system is in service under pressure and be of the size indicated. Valves shall meet the same general requirements as indicated for air and vacuum valves except that the vacuum feature will not be required. Valves shall be designed for a minimum water-working pressure of 150 psi, unless otherwise indicated.

C. Combination Air Valves: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. Valves shall have the same general requirements as indicated for air and vacuum valves.

D. Manufacturers, or Equal

1. **APCO (Valve and Primer Corporation)**

2. **Crispin - Multiplex Manufacturing Company**

3. **GA Industries**

4. **Val-Matic (Valve and Manufacturing Corporation)**

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Valves shall be installed in accordance with the manufacturer's printed recommendations, and with Section 15200.

- END OF SECTION -

DIVISION 16 - ELECTRICAL

SECTION 16000 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. It is the intent of this part of the Contract Documents to cover the work and materials necessary for erecting a complete electrical system, tested and ready for continuous use. The system shall be constructed in accordance with the Contract Documents, and Federal, State, and Local codes and regulations.

1.2 RELATED SECTIONS

A. The Contractor shall coordinate the work with other trades, and furnish and install the equipment in accordance with the manufacturers' requirements.

B. The Related Work can be found in other Divisions of these specifications, such as, but not limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract
Division 1	General Requirements
Division 2	Sitework
Division 3	Concrete
Division 9	Finishes
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 17	Instrumentation

1.3 GENERAL PROVISIONS

A. Minimum sizes of equipment, and electrical devices, are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.

B. Work indicated on the Plans is approximately to scale, but actual dimensions and detailed Plans should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is governed by field conditions. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination.

C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the Engineer for clarification, prior to purchasing and installing equipment.

D. The alignment of equipment and conduit shall be adjusted to accommodate architectural changes, or to avoid work of other trades, without extra expense to the COMPANY.

E. The Contractor shall furnish and install the parts and pieces necessary to the installation of equipment, in accordance with the best practice of the trade, and in conformance with the requirements of these Contract Documents.

F. Items not specifically mentioned in these Contract Documents, or noted on the Plans, or indicated on reviewed shop drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.

G. The Contractor shall layout and install electrical work prior to placing floors and walls. Furnish and install sleeves and openings through floors and walls, required for installation of conduits. Sleeves shall be rigidly supported and suitably packed, or sealed, to prevent ingress of wet concrete. Spacers shall be installed in order to prevent conduit movement. Dimensions indicated for electrical equipment and their installation are restrictive dimensions.

H. The Contractor shall furnish and install inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, or other mounting hardware are improperly placed, or installed, the Contractor shall do necessary work, at their own expense, to rectify the errors.

I. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated for the altitude indicated on the Plans. Electrical equipment not rated for operation at that temperature shall be provided with air conditioning to meet the manufacturers' operating temperature.

J. If any contradictions, contrasts, nonhomogeneity, or inconsistency appears, the most strict criteria noted and the collective requirements in any and all of the project documents shall apply.

K. The Contractor shall perform necessary saw cutting, core drilling, excavating, removal, shoring, backfilling, and other work required for the proper installation of conduits, whether inside, or outside of the buildings and structures. The Contractor shall repair and patch where demolition has taken place in a manner to match existing original structure.

1.4 REGULATIONS, CODES, AND STANDARDS

A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations, codes, and standards, of the following:

1. National Electrical Code (NEC)

2. State and local codes

3. Institute of Electrical and Electronic Engineers (IEEE)

4. American National Standards Institute (ANSI)

5. American Society for Testing and Materials (ASTM)

6. Insulated Cable Engineers Association (ICEA)

7. National Electrical Manufacturers Association (NEMA) Standards

8. Federal Occupational Safety and Health Act (OSHA)

9. National Fire Protection Association (NFPA)

B. When applicable, the material used in the performance of the electrical work shall be listed by the Underwriters' Laboratories, Inc. (UL) for the class of service for which they are intended.

1.5 SUBMITTALS

A. It is the obligation of the Contractor to organize their work, so that a complete electrical, instrumentation, and control system for the facility will be provided, and will be supported by accurate shop and record drawings, and O&M manuals.

B. The Contractor shall submit detailed shop drawings and data prepared and organized by the suppliers. The quantity of submittal sets required shall be as specified in the Contract Documents.

C. The submittals shall be neatly grouped and organized by specification section number, and sub-section. Related information shall be highlighted, and the specific product shall be marked. All submittals shall be complete, and presented in one package. Incomplete submittals will be returned without review. If a portion of the project requires a fast track schedule, that portion only may be submitted earlier under a separate cover letter. The following shall be submitted to the Engineer and returned, reviewed to the Contractor before fabrication is started.

1. A complete list of the equipment and materials, including the manufacturer's name, product specification, descriptive data, technical literature, performance charts, catalog cuts, installation instructions, and spare part recommendations for each different item of the equipment specified. The above shall clearly show all the specified requirements as described in the Specifications including but not limited to specific U.L. and NEMA rating, technical capabilities, test result verifications, Seismic Zone rating, and acceptance letters.

2. Drawings containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will operate as intended. Drawings shall also show proposed layout, anchoring, support, and appurtenances of equipment, and equipment relationship to other parts of the work including clearances for maintenance and operations.

3. Any exceptions to these specifications, with the reasons for requesting such exceptions, with calculations and drawings for redesign of related components, including detail drawings showing internal and assembly details, with installation instructions. Proposed layout showing any modifications or exceptions to related work made necessary by this work, with calculations and drawings showing such modifications or exceptions.

4. Prior to project acceptance, The Contractor shall submit “Record Drawings” of the electrical, control, and instrumentation, along with step-by-step procedure manuals for the installation, operation start-up, and maintenance of the equipment. Each set shall include installation, operating, troubleshooting, and maintenance and overhaul instructions in complete detail. It shall also include possible breakdowns and repairs, and troubleshooting guides, as well as simplified wiring and control diagrams of the system installed. This shall provide the COMPANY with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded or other detailed views of all equipment, devices, assemblies, and accessory components shall be included, together with complete parts lists and ordering instructions.

5. Record Drawings:

a. The Contractor shall maintain a marked up set of Contract Document Plans showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (larger than #12 AWG), and all other deviations from the design Plans.

b. Underground conduit and concealed items shall be dimensioned on the Plans from permanent, visible, building features.

c. The Contractor shall provide actual motor size, starter size, and overload heater size, along with all other protective equipment for all 480 V and motor circuits as part of the one-line record drawings.

d. The Contractor shall revise all conductor identification and panel schedules to indicate as-built conditions.

PART 2 -- PRODUCTS

2.1 GENERAL MATERIALS AND METHODS

A. Materials, equipment, and parts comprising any unit, or part thereof, specified or indicated on the Plans, shall be new and unused, of current manufacture, and of highest grade consistent with the state of the art. Damaged or dirty materials, equipment, and parts, are not considered to be new and unused, and will not be accepted.

B. Field verification of scale dimensions on Plans is directed, since actual locations, distances, and levels will be governed by actual field conditions. The Contractor shall also review architectural, structural, yard, mechanical, and other Plans, and the accepted electrical and mechanical shop drawings, and shall adjust their work to conform to the conditions indicated therein.

C. The fabricator of major components, such as distribution panelboards, switchgear, and motor control centers, shall also be the manufacturer of the major devices therein. Were possible, the major components shall be manufactured and supplied by the same fabricator.

D. Refer to various Division sections for individual equipment manufacturers. Indicated manufacturers are subject to strict compliance with the specifications and complete project documents. The reference to a particular manufacturer does not relieve the Contractor from conforming to the specified requirements.

2.2 NAMEPLATES

A. Where indicated elsewhere in these specifications, or on the Plans, the Contractor shall furnish and install nameplates, which shall be white laminate with black letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnecting means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose.

2.3 EQUIPMENT ASSEMBLIES

A. Equipment assemblies, such as Service Entrance Sections, Switchgear, Switchboards, Control and Distribution Panels, and other custom fabricated electrical enclosures shall bear a UL label as a complete assembly. The UL label on the individual components

making up the assembly will not be considered sufficient to meet the present requirement. Whenever a generic UL label does not apply for the assembly, a serialized UL label shall be affixed to the assembly, and the serial number shall be submitted with the assembly record shop drawings.

B. Custom fabricated electrical control panels, and enclosures shall bear a serialized UL label affixed by a local inspector, and the serial number shall be submitted with the assembly record shop drawings.

2.4 SEISMIC RESTRAINT

A. The construction area is classified by the Uniform Building Code (UBC) as Seismic Zone III. The Code requires that not only the structures, but also major electrical components be designed and installed in a manner which will preclude damage during a seismic event. All electrical equipment shall be securely anchored and seismic braced in accordance with regulations contained in the most recent adopted edition of the UBC, and the Sheet Metal and Air Conditioning Contractor’s National Association (SMACNA) "Guidelines for Seismic Restraints of Electrical Systems".

B. Units mounted and secured directly to structure shall be provided with connectors of sufficient strength to meet the restraining criteria.

C. All electrical equipment which is securely anchored (hard mounted) to the building or structure shall have supports designed to withstand lateral and vertical "G" loadings equal to or greater than UBC requirements and SMACNA guidelines.

D. Shop drawings are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, load/deflection data, center of gravity, standard connections, manufacturer's recommendations, and behavior problems (vibration, thermal, expansion, etc.) associated with equipment.

PART 3 -- EXECUTION

3.1 UTILITY SERVICE AND EQUIPMENT

A. The Contractor shall be responsible for contacting and coordinating the electrical utility work with the electrical utility company. The Contractor shall be responsible for furnishing and installing equipment and material required to bring electrical power service to the service location in conformance with the electrical utility requirements. The Contractor may have to provide the following for the electrical utility company's primary (from utility power line to the utility transformer) and secondary (from utility transformer to the service) electrical lines in accordance with the electrical utility company’s specifications and requirements:

1. Conduits and cables (verify quantity and sizes)

2. Trenching, backfill, and compacting (verify trench size(s), backfill material, and compaction percentage requirements)

2. Concrete pad(s) (for pad mounted transformer(s))

3. Cable protection along the vertical drop at the utility company’s pole (if pole mounted transformer(s))

4. Other items required by the power utility company’s specifications

5. The Contractor shall also submit copies of service entrance shop drawings to the utility, per utility submittal requirements, prior to submittal to the Engineer. The Contractor shall obtain written approval from the power utility company that the service entrance equipment is acceptable prior to release the order to the supplier for fabrication. A copy of the approval letter from the utility shall be transmitted to the Engineer along with the submittal.

3.2 INSTALLATION OF ELECTRICAL EQUIPMENT

A. Coordinate the installation of electrical equipment with other trades.

Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, and other openings, as required to allow installation of equipment after structure construction is complete.

B. Verify that equipment will fit support layouts indicated.

C. Equipment Dimensions and Clearances:

1. Do not use equipment that exceeds the indicated dimensions except as approved in writing by the Engineer.

2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

D. Install equipment in accordance with the manufacturer's instructions.

E. Equipment Access:

1. Install equipment so it is readily accessible for operation and maintenance.

2. Equipment shall not be blocked or concealed.

3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

F. Equipment shall be installed plumb, square and true with the building construction, and shall be securely fastened.

G. Outdoor wall-mounted equipment, and indoor equipment mounted on earth, or water bearing walls, shall be provided with corrosion-resistant spacers to maintain ¼-inch separation between the equipment and the wall.

H. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

I. Equipment fabricated from aluminum shall not be imbedded in earth or concrete.

J. Provide all necessary anchoring devices and supports.

1. Use supports as detailed on the Plans and as specified.

2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.

3. Hardware shall be stainless steel.

4. Do not cut, or weld to, building structural members.

5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

K. Contractor shall verify exact rough-in location and dimensions for connection to electrical items furnished by others.

1. Shop drawings shall be obtained from those furnishing the equipment.

2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.

3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.

4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.

a. The Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.

1) Provide additional reinforcing if required.

2) Cutting shall be done neatly using proper tools and methods.

L. Provide concrete foundations or pads required for electrical equipment and control panels as indicated or specified.

1. Floor-mounted or ground-mounted equipment shall be mounted on a 6-inch concrete housekeeping pad unless otherwise noted on the drawings. Pad shall be poured on top of the finished floor or slab or placed on an appropriately compacted base material approved by the ENGINEER. Rebar reinforcements and their spacing shall be approved by the ENGINEER if not specified on the drawings. If the pad is for ground-mounted equipment/control panels, the surrounding earthen material shall be graded to be level with the top of the pad and properly compacted. Contractor shall verify the distance to all equipment from the finished floor meets the current NEC requirements. All modifications shall be made to the electrical equipment as required.

2. All conduits penetrating concrete floors or pads shall have a 3-inch concrete housekeeping pad unless otherwise noted on the drawings. Conduits should be grouped as allowed to limit the number of housekeeping pads required.

3.3 TEMPORARY POWER

A. The Contractor shall furnish, install, and maintain, temporary power and lighting systems needed for construction in accordance with Section 01515 – Temporary Distribution Line. This temporary system shall include weatherproof panel(s) for the Contractor's main breakers and distribution system. Ground fault interrupting equipment shall be

installed. Connections shall be watertight, with wiring done with Type SO portable cable. After construction is completed, the Contractor shall remove temporary power equipment and devices.

3.4 CUTTING AND REPAIRING

A. Where it becomes necessary to cut into existing work for the purpose of making electrical installations, core drills shall be used for making circular holes. Other demolition methods for cutting or removing shall be reviewed by the Engineer prior to starting the work.

B. The Contractor shall repair damage caused by construction, or demolition work, and restore damaged areas to original condition.

3.5 CORROSION PROTECTION

A. Wherever dissimilar metals, except conduit and conduit fittings, come in contact, the Contractor shall isolate these metals, as required, with neoprene washers, 9 mil polyethylene tape, or gaskets. Where fastening conduit, electro plated, or equivalent fasteners and stainless steel bolts shall be used.

B. Factory finishes damaged during shipping, or construction, shall be restored to original new condition. Rust shall be removed, and bare metal surfaces shall be primed and painted to match the original surrounding finish.

C. Electrical panels, switchgear, motor control centers, and other electrical equipment, shall be shipped in sealed dust and moisture proof plastic sheet enclosures, and the seal maintained until units are installed. Said units shall be new and free of any dirt, dust, water, grease, rust, damaged parts or components. Relays, starters, circuit breakers, switches, contacts, insulators, mechanisms, and buses shall be free of dust, dirt, oil, moisture, metal shavings, and other debris before testing and energizing.

D. Equipment shall be protected at all times with plastic sheet covers until the area is free of dirt, dust, paint spray, water, heat, and other trades. Heat shall be provided to eliminate condensation. All repairs due to storage will be the responsibility of the contractor.

3.6 COORDINATION OF THE ELECTRICAL SYSTEM

A. The Contractor shall verify actual equipment, and motor full-load, and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If the Contractor furnishes equipment of different ratings, the Contractor shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a current carrying capacity of not less than 125 percent of the actual full-load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices, up to the equipment, shall not exceed 2 percent, when the equipment is running at full-load and rated voltage.

3.7 TESTING

A. The electrical work shall be free from improper grounds, and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Next, individual circuit continuity checks shall be

made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans, or accepted Drawings, shall be corrected and indicated on the record drawings.

B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record drawings to enable rapid and accurate circuit tracing by maintenance personnel.

3.8 ONE-LINE DIAGRAMS

A. One-line diagrams, as indicated on the Drawings, show circuit voltages, circuit protection rating, and other pertinent data. Where conflicts exist on the Drawings, the one-line diagrams shall take precedence. Grounding conductors are not necessarily indicated. See grounding requirements specified elsewhere herein.

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SECTION 16111 - CONDUITS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. Furnish and install conduits as required, and as shown on the Plans. Materials employed shall be as shown on the Plans.

1.2 SUBMITTALS

A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.

B. If changes from the Plan are proposed, shop drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work.

C. Proposed routing of conduits buried under floor slabs-on-grade and below grade.

D. Identify conduit by tag number of equipment served or by circuit schedule number.

E. Proposed routing and details of construction including conduit and rebar embedded in floor slabs, columns, etc.

F. Proposed location and details of construction for openings in slabs and walls for raceway runs.

G. Refer to Section 16000 General Electrical Requirements for further submittal requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI): C80.1, Rigid Steel Conduit - Zinc-Coated.

B. National Electric Manufacturers Association (NEMA): RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.

C. Underwriters Laboratories Inc. (UL):

1. 1, Flexible Metal Conduit.

2. 6, Rigid Metal Conduit.

3. 360, Liquid-Tight Flexible Steel Conduit.

4. 467, Grounding and Bonding Equipment.

5. 514, Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.

6. 651, Schedule 40 and 80 Rigid PVC Conduit.

7. 870, Wireways, Auxiliary Gutters, and Associated Fittings.

8. 884, Underfloor Raceways and Fittings.

9. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

PART 2 -- PRODUCTS

2.1 RACEWAYS

A. Exposed conduits in an unclassified or hazardous area shall be galvanized rigid steel (GRS) unless specifically indicated otherwise on the Plans. Conduits in corrosive, hazardous, or damp areas shall be PVC coated GRS unless otherwise indicated. Underground and/or concrete encased conduits shall be PVC, unless otherwise indicated. All conduits concealed in block walls or steel framing shall be EMT with compression fittings unless otherwise indicated. Set screw type fittings in EMT conduit will not be accepted. All wiring, except as otherwise noted, shall be in conduit. Conduit size shall not be less than the National Electrical Code (NEC) size required for the conductors therein and shall not be smaller than 3/4-inch. No underground conduit shall be less than one inch.

B. Condulets type fittings shall be Crouse-Hinds, Appleton, or equal with wedge nut covers. All condulets located outdoors, damp or wet locations shall be weather tight.

C. In unclassified areas, flexible conduit shall be grounding type, weatherproof, corrosion resistant, and watertight.

D. Couplings, connectors, and fittings shall be standard types specifically designed and manufactured for the purpose. They shall be installed to provide a firm mechanical assembly and electrical conductivity throughout. Conduit systems shall be water tight.

E. Expansion fittings shall be OZ type AX with jumper for exposed locations and type DX at structural expansion joints, Spring City, or equal. Conduits shall have expansion fittings in accordance with NEC.

F. The conduits and fittings shall be supported per NEC requirements as a minimum.

G. Sealing fittings shall be provided for classified areas per the NEC requirements in hazardous or corrosive areas. Fittings shall be poured after the final walk-thru unless otherwise directed in writing by the Engineer.

2.2 GALVANIZED RIGID STEEL (GRS)

A. Conduits and couplings shall be hot-dipped galvanized with zinc-coated threads and outer coating of zinc bichromate, in accordance with ANSI C80.1 standards, as manufactured by Jones & Laughlin Steel Corporation, Allied Tube & Conduit Corporation, Triangle PWC, or equal.

B. Steel conduit shall not be buried in earth without concrete encasement and additional corrosion protection. A half lapped rapping of 20 mil PVC based corrosion protection tape shall be used.

2.3 PVC COATED GALVANIZED RIGID STEEL (PVC-GRS)

A. PVC coated GRS conduit shall be installed where shown on the Plans or elsewhere specified and shall conform to NEMA RN-1 and ANSI C80.1 standards.

B. The zinc surface of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit throughout the preparation and application processing. A PVC coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040-inch (40 mil).

C. A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 1-1/2 inches, whichever is smaller. The wall thickness of the coating on the coupling and the sleeve shall be a minimum of 0.055-inch (55 mil).

D. A PVC coating shall be bonded to the inner and outer surface of all conduit bodies and fittings and a PVC sleeve shall extend from all hubs. The wall thickness of the coating on conduit bodies and fittings and the sleeve walls shall be identical to those on couplings in length and thickness. The covers on all conduit bodies shall be coated on both sides and shall be designed to be completely interchangeable. The inside of conduit bodies shall remain undisturbed in the processing.

E. Type 304 stainless steel screws shall be furnished and used to attach the cover to the conduit body. All coated material shall be installed and patched according to the manufacturer's recommended installation and patching instructions.

F. Conduit straps shall be PVC coated or stainless steel.

G. PVC coated conduits and fittings shall be as manufactured by Kor Kap Corporation, Occidental Coating Company, Rob-Roy, or equal.

H. PVC coated flexible conduits shall be liquid and vapor-tight and manufactured in accordance with UL 360 standards.

2.4 RIGID NONMETALLIC - PVC

A. Where specifically indicated on the Plans, or elsewhere specified, conduit may be high density Schedule 40, 90 degrees C, heavy-duty PVC. The conduit shall be manufactured from virgin polyvinyl chloride compound which meets ASTM D1784, NEMA TC-2, ANSI C33.91, and UL 651 standards. Smoke emissions shall be limited to less than 6 grams per 100 grams of material tested.

B. Where conduit concrete encasement is indicated on the Plans, conduit supports shall be installed at five-foot intervals. PVC conduit shall be manufactured by Carlon, Triangle Conduit & Cable, or equal.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight flexible metal conduit shall be liquid and vapor-tight, oil and ultraviolet ray resistant and manufactured in accordance with UL 360 standards. Liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, galvanized steel core with an extruded PVC jacket. The PVC jacket shall be rated for high ambient heat applications, 90 degrees Celsius.

B. For corrosive locations, liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, aluminum core with an extruded PVC jacket. The PVC jacket shall be impervious to corrosive liquids and vapors.

C. An external bonding conductor shall be required for flexible conduit connections containing circuits rated at 60 amps or greater and for sizes 1 1/2 " or larger. Flexible conduits and connectors for 1 1/4 " and smaller shall be listed for grounding.

D. Connectors for liquidtight flexible conduit shall be galvanized, furnished with a sealing ring and locknut, and suitable for wet locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conduit runs are schematic only, and shall be modified as required to suit field conditions, subject to review and acceptance by the Engineer.

B. Conduit shall run continuously between outlets and shall be provided with junction boxes where connections are made. Couplings, connectors, and fittings shall be acceptable types designed and manufactured for the purpose, and shall provide a firm mechanical assembly, and electrical conductivity throughout.

C. Conduit runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical. Changes in direction shall be made with long radius bends, or with fittings of the condulet type.

D. Conduit runs in buildings and structures shall be concealed where possible except as specifically noted, or accepted by the Engineer.

E. Conduit runs shall not interfere with the proper and safe operation of equipment, and shall not block or interfere with ingress or egress, including equipment removal hatches.

F. Exposed conduits shall be securely fastened with clamps, or straps, intended for conduit use. All exposed conduit shall be run on the walls and ceiling only and shall be parallel to the planes of the walls or ceiling. No diagonal runs will be permitted. Flexible conduit shall be used only for short lengths required to facilitate connections between rigid conduit to vibrating equipment such as motors, fans, and transformers. The maximum length of flexible conduit shall be 3 feet, unless approved in writing by engineer. Flexible conduit shall not be used for electrician’s convenience where rigid conduit could be used.

G. Conduit runs on water-bearing walls shall be supported one inch away from the wall on an accepted channel. When channel galvanizing, or other coating, is cut or otherwise damaged, it shall be field coated to original condition. No conduit shall be run in water-bearing walls, unless specifically designated otherwise.

H. Conduit shall be thoroughly reamed to remove burrs. IMC or GRS shall be reamed during the threading process, and Rigid Nonmetallic PVC shall be reamed before applying fittings. A zinc-rich cold galvanizing shall be used to restore corrosion protection on field cut threads.

I. Bushings and lock nuts or hubs shall be used at conduit terminations. Conduit, bushings, locknuts, and enclosures shall be fastened to the conduit system prior to pulling wire. Splitting the bushings for installation will not be accepted. Hubs shall be

used in all process areas outside of electrical rooms unless otherwise specified. The total number of bends in any run between pull points shall not exceed 360 degrees. Junction boxes and pull boxes shall be installed at points acceptable to the Engineer. Conduit ends shall be plugged to prevent the entrance of moisture or debris during construction. All spare conduits shall be adequately capped and shall contain a suitable pull string. Splices shall be made in junction boxes only. Splices in conduit bodies will not be accepted.

J. Joints shall be set up tight. Hangers and fastenings shall be secure, and of a type appropriate in design, and dimensions, for the particular application.

K. Conduit runs shall be cleaned and internally sized (obstruction tested) so that no foreign objects, or obstructions remain in the conduit prior to pulling in conductors.

L. After installation of complete conduit runs 2 inches and larger, conduits shall be snaked with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Conduits through which the mandrel will not pass shall not be used. Test results should be submitted to the Engineer.

M. Expansion fittings shall be installed across all expansion joints and at other locations where necessary to compensate for thermal expansion and contraction.

N. Provide trenching, backfill, and compaction for conduits installed underground.

O. Empty or un-used conduits shall contain a pull cord securely fastened on each end.

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SECTION 16123 - 600 VOLT CLASS CABLE

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This section covers the furnishing and installation of 600 Volt Class cables and conductors, terminations and splicing, and pulling lubricants.

B. SO & SJO Conductors are specified elsewhere in these specifications.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.3 REFERENCES

A. Insulated Cable Engineers Association/National Electrical Manufacturers Association (ICEA/NEMA):

1. S-68-516/WC 8, ethylene-propylene rubber-insulated wire and cable for the transmission and distribution of electrical energy.

2. S-61-402/WC 5, thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.

3. S-66-524/WC 7, cross-linked thermosetting-polyethylene-insulated wire and cable for transmission and distribution of electrical energy.

B. Underwriters Laboratory, Inc.

1. 44, rubber insulated wires and cables.

2. 83, thermoplastic-insulated wires and cables.

3. 486A, wire connectors and soldering lugs for use with copper conductors.

4. 486B, wire connectors for use with aluminum conductors.

5. 510, insulating tape.

C. National Electric Code

D. Insulated Cable Engineers Association

PART 2 -- PRODUCTS

2.1 ACCEPTED MANUFACTURERS

A. Conductors and Multi Conductor Cables (MCC), subject to compliance with Contract Documents, the following manufacturers are acceptable: American Insulated Wire Corporation, Cablec Corporation, Okonite Company, Southwire Company, or equal.

2.2 CONDUCTORS

A. Wire sizes shall be American Wire Gauge (AWG) sizes with Class B stranded construction. Number 2 AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape. Conductors #6 AWG or smaller shall be THWN or XHHW. Conductors #2 AWG or smaller shall be XHHW. Conductors #1 AWG or larger shall be XHHW-2. The minimum power or ground conductor size shall be #12 AWG.

B. Individual or multiple conductor cables for power, control, and alarm circuits of 480 volts or less shall be insulated for not less than 600 volts and shall have insulation type as indicated on the Plans. “THHW” shall conform to ICEA S-61-402/NEMA WC 5 and UL 83 and “XHHW” shall conform to ICEA S-66-524/NEMA WC 7 and UL 44. Where wire size is not indicated, they shall be of the size required by the NEC, except that no wire external to panels and motor control centers shall be less than No. 12 AWG, unless specifically noted on the Plans. Panel control wiring shall not be less than No. 14 AWG.

C. Multi-conductor tray cables shall be rated 600 volts, listed by UL as Type TC cable or ITC for instrumentation cable only per Article 340 of the NEC. The individual conductors shall be UL listed as Type XHHW, with a sunlight-resistant overall jacket. Conductor sizes shall be the same as for power and lighting wire and control wire above. Connectors/Terminators shall be water tight and manufactured of the same material as the cabling system referenced elsewhere in Division 16.

D. Multi-conductor tray cables to be installed in classified areas shall be armored, rated 600 volts, listed by UL as Type MC-HL cable per Article 340 of the NEC. The individual conductors shall be UL listed as Type XHHW, with a sunlight-resistant overall jacket. Conductor sizes shall be the same as for power and lighting wire and control wire above. Connectors/terminators shall be rated for classified areas and submitted upon accordingly.

E. All wiring shall be as indicated on the Plans. Wires shall be new and shall be soft drawn copper with not less than 97 percent conductivity. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's name permanently marked on the outer covering at not more than 2-foot intervals. All wires shall conform to the latest Standards of the ASTM, and ICEA, and shall be tested for their full length by these Standards. Insulation thickness shall be not less than that specified by the National Electrical Code.

2.3 TERMINATIONS AND SPLICES

A. Cable shall be rated 600 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splicing shall join conductors mechanically and electrically to provide a complete circuit prior to installation of insulation.

B. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, Type I, Class 1, Grade B, Style G, or Type II, Class 1 of FS W-S-610 and conforming to the applicable requirements of UL 486A.

C. Splices in wires No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, Type II, Class 2 of FS W-S-610, conforming to the applicable requirements of UL 486A and UL 486B. They shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket.

D. Insulated conductor splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

E. Bare conductor splices in wet locations or below grade shall be of the exothermic type.

2.4 PULLING LUBRICANT

A. All cables shall be properly coated with pulling compound (Aqua Gel, Polywater, or equal) before being pulled into conduits so as to prevent mechanical damage to the cables during installation. “Yellow 77” is not acceptable.

B. Other lubricants to be substituted must be accompanied by a statement from the cable manufacturer as to its acceptable use with the cable being installed.

2.5 IDENTIFICATION

A. All conductors shall be numbered with "tube sleeve" type tags with heat impressed letters and numbers.

B. Color code all wiring as follows:

1. Lighting and power wiring:

	120/208 VAC	**480VAC**	**12V DC**	**24V DC**	**120 VAC Control/ Power**
a. Phase 1	Black	Brown	Orange	Blue	Red
b. Phase 2	Red	Orange			
c. Phase 3	Blue	Yellow			
d. Neutrals	White	White	Grey	Blue/White	White

2. Color code ends of feeder phase conductors only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The pulling tension and side-wall pressures, as recommended by the cable manufacturer, shall not be exceeded.

B. As far as practical, all circuits shall be continuous from origin to termination without splices in intermediate pull boxes. Sufficient slack shall be left at the termination to make proper connections. In no case shall a splice be pulled into the conduit. Conductor splicing shall not be permitted without the Engineer's approval. Conductor splices shall not be made in underground junction boxes or manholes unless specifically noted on the plans.

C. Install all cables in conduit. Manufacturer's cables and SO cord may be installed without conduit where approved and noted on the plans.

D. Each feeder and branch circuit shall be installed in its own individual conduit unless combining feeder and branch circuits is permitted as defined in the following:

1. As specifically indicated on the Plans.

2. For lighting, multiple branch circuits may be installed in a conduit as allowed by the NEC and with the wire ampacity de-rated in accordance with the requirements of the NEC. Conduit fill shall not exceed the limits established by the NEC.

3. When field conditions dictate and written permission is obtained from the Engineer.

E. Feeder and branch circuits shall be isolated from each other and from all instrumentation and control circuits.

F. Control circuits shall be isolated from all other feeder, branch and instrumentation circuits, except as noted above.

1. 12 V DC, 24 V DC and 48 V DC control circuits may be combined in common conduit.

2. 120/208/240 V AC control circuits shall be isolated from all DC control circuits.

3. 277/480 V AC circuits shall be isolated from all other voltages.

G. Single conductor cable in cable trays shall be No. 1/0 or larger and shall be of a type listed and marked for use in cable trays. Tray cable smaller than 1/0 shall be multi-conductor with outer jacket.

H. Make splices only at pull or junction boxes.

Crimp or indented-type connectors are not allowed, unless approved by engineer.

- END OF SECTION -

SECTION 16124 - INSTRUMENTATION CLASS CABLE

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This section covers cable use for process signal and controls.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with Contract Documents, the instrumentation cable shall be as manufactured by Belden, Okonite, or equal.

2.2 INSTRUMENTATION CABLE

A. Instrument cable shall be Type TC, and have the number of individually shielded twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 18 AWG minimum. Shielded, grounded instrumentation cable shall be used for all analog and low voltage digital signals.

B. The jacket shall be flame retardant with 90 degrees C temperature rating. The cable shield shall be a minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.

C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

D. Pairs shall be assembled with a nominal 2-inch lay and shall then be group shielded with a minimum of 1.3 mil aluminum or copper tape overlapped to provide 100 percent coverage. All group shields shall be completely isolated from each other.

E. Pairs installed in a cable tray shall have a UV resistant jacket, and shall have a jacket intended for cable tray use.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Feeder and branch circuits shall be isolated from each other, and from instrumentation and control circuits. Instrumentation cables shall be installed in separate raceways from other cables and wiring. This includes portions running through manholes. Instrumentation cable shall be continuous between instruments or between field devices and instrument enclosures. There shall be no intermediate splices or terminal boards, unless otherwise shown on the Plans.

B. Maintain electrical continuity of the shield when splicing twisted shielded pair conductors. Drain wires shall be terminated inside enclosures at grounded terminal blocks. Only one end of each instrument loop cable drain wire shall be grounded. Ground drain wires of shielded conductors at one end only.

C. Terminate instrumentation and control wiring, including spare wires, at control panels and motor control centers on terminal boards mounted inside the equipment.

1. Contractor shall supply terminal boards as required.

2. Do not field wire directly to devices.

- END OF SECTION -

SECTION 16130 - OUTLET, PULL, AND JUNCTION BOXES

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Outlet, pull and junction boxes.

B. Related Sections include but are not necessarily limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract.
Division 1	General Requirements.
Section 16000	General Electrical Requirements.
Section 16111	Conduits.
Section 16141	Wiring Devices.
Section 16170	Grounding.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Refer to Section 16000.

1.3 SUBMITTALS

A. Shop Drawings:

1. See Section 16000.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Section 16000.

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Galvanized steel boxes:

a. Appleton Electric Co.

b. Steel City.

c. Raco.

2. Sheet metal boxes for non-classified areas:

    a. Hoffman Engineering Co.

3. Corrosion-resistant boxes:

    a. Hoffman Engineering Co.

    b. Crouse-Hinds.

4. Hazardous location boxes (Class I, II & III):

    a. Appleton Electric Co.

    b. Crouse-Hinds.

    c. Killark.

    d. O-Z/Gedney.

5. Raintight and watertight boxes:

    a. Appleton Electric Co.

    b. Crouse-Hinds.

6. Terminal boxes:

    a. Hoffman Engineering Co.

7. Boxes in sidewalk:

    a. Appleton Electric Co.

    b. Crouse-Hinds.

    c. O-Z/Gedney.

8. Boxes in earth:

    a. Carlon Electric Products.

9. Exposed switch and receptacle boxes:

    a. Appleton Electric Co.

    b. Crouse-Hinds.

    c. Killark.

10. Concrete Manholes

    a. Dura Crete

    b. Or equal

B. Submit requests for substitution in accordance with Specification requirements.

2.2 MATERIALS

A. Pull and Junction Boxes for Offices and other Dry Architecturally Finished Areas:

1. Material: 14 GA, galvanized steel.

2. Concentric knockouts on all four sides.

3. Flat cover fastened with screws.

4. NEMA 1 classification.

5. UL listed.

B. Pull and Junction Boxes for General Use Unclassified Areas Suitable for NEMA 12 Enclosures:

1. Material: 14 GA galvanized steel with seams continuously welded, ground smooth and no knockouts.

2. Zinc rich coating on all seams.

3. Stainless steel captivated cover screws threaded into sealed wells.

4. Flat door with oil resistant gasket.

5. NEMA 12 classification.

6. UL listed.

C. Pull and Junction Boxes for Wet Areas:

1. Material: 14 GA steel with polyester powder coating inside and out over phosphatized surfaces.

2. Seams continuously welded, ground smooth, no knockouts.

3. Stainless steel clamps on four sides.

4. Flat cover with oil resistant gasket.

5. NEMA 4 classification.

6. UL listed.

D. Pull and Junction Boxes for Corrosive Areas:

1. Material: 14 GA steel with powdered epoxy resin coating inside and out or fiberglass-reinforced polyester material.

2. Steel boxes:

a. Seams continuously welded, ground smooth, no knockouts.

b. Rolled lip around all sides.

c. Hinged door.

d. Captivated stainless steel door screws.

e. Flat door with oil-resistant gasket.

3. Fiberglass-reinforced polyester boxes:

a. Hinged door with latch and lockout.

b. Neoprene door gasket.

c. Grounding bushing(s).

4. NEMA 4X classification.

5. UL listed.

E. Pull and Junction Boxes for Hazardous Areas:

1. Material: Cast gray iron alloy or copper-free cast aluminum.

2. Drilled and tapped openings or tapered threaded hub equipped.

3. Flat bolted-down or threaded cover with neoprene gasket.

4. Stainless steel hex head screws.

5. Explosion proof, UL listed for Class 1 Groups C and D.

F. Pull and Junction Boxes for Sidewalks:

1. Cast-iron box and cover, hot-dip galvanized.

2. Flange for flush mounting.

3. Checkered cover with neoprene gasket, pry bar slots and stainless steel screws.

4. UL listed.

5. Drilled and tapped holes.

6. Watertight NEMA 4 classification.

G. Large Pull and Junction Boxes (100 CU IN and larger):

1. Located in offices and other dry architecturally finished areas where EMT is utilized:

a. NEMA 1 gasketed without knockouts.

2. Located in general use areas:

a. NEMA 12 construction:

1) Welded steel.

2) Furnished with gray enamel inside and out over phosphatized surfaces.

3. Located in wet and corrosive areas:

a. NEMA 4X with stainless steel screws.

b. Type 304 L welded stainless steel:

4. Constructed of 14 GA steel with seams continuously welded, ground smooth, no knockouts.

5. Rolled lip around all sides.

6. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.

7. Split covers when heavier than 25 LBS.

H. Terminal Boxes:

1. Galvanized 16 GA steel box provided with plain blank screw cover, subpanel, and terminal points.

2. Refer to Drawing for dimensions and number of terminals.

3. Terminal blocks shall be screw-post barrier-type, white center marker strip.

4. Rated 20 ampere, minimum 600 V.

I. Fiberglass Cable-Pulling Enclosure:

1. Use: Access points to facilitate pulling of electrical cables in buried conduit runs.

2. Size and quantity: As shown on Drawings.

3. Type: Rectangular fiberglass composite, suitable for direct burial pedestrian traffic on top, -50 Deg F, chemical, sunlight, and weather resistant.

4. Provide matching top with "ELECTRIC" logo.

J. Outlet Boxes:

1. Use: Installation of wiring devices.

2. Boxes for exposed wiring:

a. Cadmium plated, cast, ferrous metal, with threaded hubs.

3. Boxes for concealed wiring:

a. Code gage, hot-dip galvanized steel.

b. Include bar hangers for metal stud partitions.

c. Provide barriers between switches in boxes with 277 V switches on opposite phases.

d. Use extension and plaster rings where required.

e. Provide grounding screw.

K. Concrete Manholes

1. Use: Duct bank pulling location or splitting of duct bank.

2. Size and quality: As shown on Drawings

3. Type: Concrete traffic rated with rebar re-enforcing.

4. Other requirements:

a. 30 inch diameter minimum opening with traffic rated cover. Cover shall contain the legend “Electrical”.

b. 3 inch deep 6 inch wide minimum dimension sump shall be provided in the center of the manhole.

c. Contractor shall install a 20 amp GFCI weatherproof in use receptacle in the manhole. Receptacle shall be located at the highest point on the wall of the manhole.

d. Pulling eyes shall be provided on all four walls.

e. Thin Wall blockouts shall be provided on all four walls.

f. Contractor to seal manhole penetrations to eliminate leaks at the junction between the conduits and the manhole.

g. Train cables around sides of manhole during installation. Keep cables away from sump and receptacle.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Use locknut and bushing for boxes in non-classified areas.

B. Use cast metal boxes with threaded conduit hubs in damp, wet or hazardous areas.

C. Use Type FS and FD boxes in wet areas and where exposed rigid steel conduit is required.

D. Use epoxy resin coated, stainless steel, cast aluminum or fiberglass boxes for corrosive areas.

E. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.

F. Use outlet boxes sized to accommodate quantity of conductors enclosed.

G. Use boxes sized to accommodate conduit tying into box.

H. Install pull boxes or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.

   1. Make covers of boxes accessible.

I. Install pull boxes or junction boxes rated for the area classification.

J. Install rigid conduit squarely into boxes which do not have hubs or are drilled and tapped.

   1. Install with locknut on the outside and bushing on inside.

K. Install conduit into boxes with hubs, or that are tapped, using thread lubricant.

L. Do not use back-to-back boxes on this Project.

M. Seal all points of conduit entry into fiberglass cable-pulling enclosures for a waterproof installation.

N. Support outlet boxes for lighting fixtures and other ceiling-mounted devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.

- END OF SECTION -

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SECTION 16141 - WIRING DEVICES

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Light switches, receptacles, device plates, dimmers, plug-in strips and tele-power poles.

B. Related Sections include but are not necessarily limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract
Division 1	General Requirements
Section 16000	General Electrical Requirements
Section 16130	Outlet, Pull, and Junction Boxes
Section 16170	Grounding

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Refer to Section 16000

1.3 SUBMITTALS

A. Shop Drawings:

1. Refer to Section 16000

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Light switches

a. Not Used

2. Receptacles

a. Hubbell

b. Slater

c. P&S

d. Arrow Hart

e. General Electric

f. Leviton

2.2 MATERIALS

A. Receptacles for Unclassified Areas:

1. Straight blade, grounding type, specification grade

2. Back and side wired with wrap-around bridge

3. Rated 20 A, 125 V AC

4. UL listed

5. Color:

a. For use on normal power: White unless Owner or Engineer specifies otherwise.

b. For use on UPS systems: Red.

c. For use on isolated ground systems: Orange.

d. For special purpose receptacles: Black

6. Wall plate: Type 304 stainless steel

7. Type: As indicated on Drawings

B. Receptacles for Wet Areas:

1. Straight blade, grounding type, specification grade

2. Back and side wired with wrap around bridge

3. Rated 20 A, 125 V AC

4. UL listed

5. Color: Ivory

6. Wall plate: Weatherproof, cast aluminum, UL listed

7. Type: As indicated on Drawings

C. Ground Fault Circuit Interrupter Receptacles:

1. Straight blade, grounding type, specification grade

2. Rated 20 A, 125 V AC

3. UL listed

4. Test and reset buttons

5. Wall plate: Indoor or weatherproof as required

6. Feed-through type

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Mount devices where indicated on the Drawings.

B. Surface mount receptacles and light switches in concrete construction.

C. In masonry and metal stud construction, recess-mount receptacles and light switches unless device precludes recessed mounting or unless otherwise noted on the Drawings.

D. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.

E. Set switches and receptacles plumb and vertical to the floor.

F. Set recess-mounted switches and receptacles flush with face of walls.

G. Do not connect dimmers to loads in excess of 80% of the rating of the dimmer.

H. Provide blank plates for empty outlets.

- END OF SECTION -

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SECTION 16142 - WEATHERPROOF WHILE IN USE OUTLET ENCLOSURES

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. These specifications encompass outlet enclosures used on outlet devices where outlets are required to be weatherproof and/or physically protected while in use or idle.

B. These safety outlet enclosures shall be used in locations where attachment plugs will be connected permanently, or for an indefinite period of time, in potentially wet or weather exposed environments.

C. They are also to be used where outlets are subject to contamination, corrosion, or damage.

1.2 DESCRIPTION

A. The safety outlet enclosure shall consist of a suitable style outlet/receptacle plate with a hinged safety cover.

B. The safety outlet enclosure shall have cord port(s) capable of allowing an appropriate size electrical cord(s) to pass through when safety cover is closed.

C. The safety outlet enclosure shall have a latching mechanism to allow the enclosure to maintain weatherproof integrity. The latch shall be a tamper resistant (locking/security) style in areas where security is needed.

D. The safety outlet enclosure shall be sufficient depth to allow full closure with attachment plug(s) in use.

1.3 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and the Contract Documents, prior to installation.

1.4 MANUFACTURER

A. Manufacturer shall be Taymac Corporation, or equal.

PART 2 -- PRODUCTS

2.1 WEATHERPROOF WHILE IN USE OUTLET ENCLOSURES

A. The enclosures shall be used in locations, where attachment plugs will be connected permanently, or for an indefinite period of time, in potentially wet or weather exposed environments, or as indicated on the Plans.

B. They are also to be used where outlets are subject to contamination, corrosion or damage.

C. The enclosure shall consist of a suitable style outlet/receptacle plate with a hinged safety cover, and shall be of sufficient depth to allow full closure with attachment plugs in use.

D. The enclosure shall have cord ports capable of allowing appropriate size electrical cords to pass through when safety cover is closed.

E. The enclosure shall have a latching mechanism to allow the enclosure to maintain weatherproof integrity. The latch shall be a tamper resistant, and locking style, in areas where security is needed, as shown on the Plans.

F. The enclosure shall be Underwriters Laboratories (UL) listed per UL Standard 514C for non-metallic boxes, flush device boxes and enclosures, and conform to National Electric Code (NEC), Article 410.57 paragraphs a and b, Article 110.3 and Article 110.11, pertaining to damp, wet or possible corrosive installations.

G. Body materials shall be of a flame resistant, self extinguishing, ultraviolet inhibiting, impact resistant, polycarbonate resin such as GE Lexan 943A, or Mobay Makrolon 6457. Material must meet UL Standard 94.

H. Gasket materials shall be of sufficient thickness to form a weatherproof seal under normal mounting conditions. Thicknesses; 3/16” for base plate and 1/8" for covers. Material is to be closed cell neoprene foam by Monarch Rubber A5032, or equivalent, self extinguishing and flame retardant. Material must meet UL Standard 94 HF1.

I. Mounting hardware shall be stainless steel, and of sufficient length to properly secure the device, and ensure seal to mounting surface.

J. The enclosures shall be installed over a weatherproof box and outlet in conformance with the manufacturer's instruction. Cover shall be mounted to insure that access holes for the portable line cords will be located at the lower end of the cover.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed in accordance with the manufacturer’s recommendations.

- END OF SECTION -

SECTION 16143 - TERMINAL BLOCKS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This section covers terminal blocks for control and other wiring.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.3 MANUFACTURERS

A. Terminal blocks shall be Entrelec, Phoenix Contact, Weidmuller, Allen Bradley or equal.

B. Surge protection blocks shall be Telematic, series SD, or equal.

C. Power distribution blocks shall be Ilsco Corporation, or equal.

PART 2 -- PRODUCTS

2.1 TERMINAL BLOCKS

A. Terminal blocks shall mount on standard DIN rail, and be of the size required for conductors therein. A minimum of 25 percent spares shall be provided in each terminal box. No more than 2 conductors shall be allowed per termination. Jumper bar assemblies shall be installed for interconnecting terminal blocks, distributing power and signal commons. Terminal blocks shall be UL rated for 600 Volts, and 30 Amps, minimum.

B. Grounding terminal blocks shall be provided for instrumentation cable shields. The terminal blocks shall have distinctive 2-color bodies yellow and green, and shall be mounted to the DIN rail with metal screw down type clamps, providing a positive ground connection. One grounding terminal block shall be installed for every 2 instrument cables terminated. Grounding terminal blocks shall be UL rated for 600 Volts, and 20 Amps, minimum.

C. Terminal blocks shall be available in a variety of colors, including red, green, blue, gray, black, yellow, and orange.

D. DIN mount fuse holders shall have blown fuse indicators for DC and AC circuits. Fuse holders shall be of the compression clamp type. Fuse holders shall be U.L. listed, and rated for 600 Volts. Fuse sizes shall not exceed the UL current rating for the fuse holders.

E. DIN rail shall be prepunched, zinc bichromate plated steel. Symmetrical DIN rail shall be 35 mm X 7.5 mm, minimum.

F. Terminal blocks for 4 to 20 milliamp signals shall have knife disconnect switches, and accessible test points for testing and measurement of current loop signals, without the need for removing wire terminations.

2.2 SURGE PROTECTION BLOCKS (SPB)

A. Analog inputs and outputs shall be terminated at surge protection blocks (SPB). The SPBs shall be designed for a working voltage of 32 volts, and shall be fused.

B. SPBs shall provide full hybrid line to line protection, and shall have a GDT rating of 10,000 A (8/20μs pulse waveform).

C. SPBs shall be UL94 V-2 listed.

2.3 POWER DISTRIBUTION BLOCKS (PDB)

A. PDBs shall be Electro-tin plated and manufactured from high strength 6061-T6 aluminum alloy.

B. PDBs shall be UL Recognized rated 90º C and CSA Certified.

C. PDBs shall provide flexibility in using the connector as an in line splice or to reduce conductor size.

D. PDBs shall be rated for 600 Volts and dual rated for Copper and Aluminum Conductor.

E. PDBs shall have the sizes and ratings as shown on the Plans.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Each terminal block and fuse holder shall be identified with the circuit number, or conductor number, corresponding to the identification appearing on the shop Drawings for the equipment, or system.

B. Terminal block and fuse holder markers shall be computer printed plastic-type, with permanent markings.

C. End clamps and end sections shall be installed on each terminal block and fuse holder assembly.

D. Terminal blocks shall be gray unless specified otherwise.

- END OF SECTION -

SECTION 16160 – ENCLOSURES

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This specification includes enclosures to house electrical controls, instruments, terminal blocks, and serve a junction boxes where shown on the Plans.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.3 MANUFACTURERS

A. Enclosures shall be manufactured by Hoffman, Rittal, or equal.

PART 2 -- PRODUCTS

2.1 STEEL

A. Enclosures shall be fabricated from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin.

B. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket. All wires entering or leaving the enclosure shall terminate on terminal strips. All wires and terminals shall be clearly identified as specified elsewhere in these specifications.

C. Finish shall be white enamel interior, light gray enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

2.2 NEMA RATING

A. Unless otherwise indicated on the Plans, enclosures shall be NEMA 12 for indoors, NEMA 4X for corrosive areas, and NEMA 4 for outdoor installations. NEMA 4X enclosures shall be stainless steel, unless noted otherwise. NEMA 4X enclosures shall also be used in wet, or wash down areas.

B. All enclosures used in classified areas shall be NEMA 7.

C. In Waste Water facilities all enclosures in process areas shall be NEMA 4X stainless steel. Enclosures in electrical rooms, meeting rooms, offices and shops shall be NEMA 12 unless otherwise specified.

D. Areas not specified in Water Treatment, Wastewater, or other water related facilities shall be approved by the Engineer for NEMA type prior to installation.

2.3 FIBERGLASS

A. Enclosures shall be heavy-duty, compression molded, fiberglass reinforced polyester, high impact, heat resistant, NEMA 4X.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Enclosures shall be installed as indicated on the Plans, and according to manufacturer's instructions.

B. Enclosures shall be properly grounded, and shall include ground straps connected to hinged doors and accessories.

- END OF SECTION -

SECTION 16161 - CONTROL PANELS

PART 1 -- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Control panels.

B. Products shall be submitted for review in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society for Testing and Materials (ASTM):

a. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

2. Joint Industrial Council (JIC):

a. EMP-1, Mass Production Equipment.

3. National Electrical Manufacturers Association (NEMA):

a. ICS 4, Terminal Blocks for Industrial Use.

b. ICS 6, Enclosures for Industrial Controls and Systems.

c. 250, Enclosures for Electrical Equipment (1000 V Maximum).

4. National Fire Protection Association (NFPA):

a. National Electric Code (NEC).

B. Miscellaneous:

1. Prior to placement of conduit feeds, assure approved control panel layouts available.

2. Assure completely matching color tones for any individual color specified.

3. Provide panel with the required NEMA rating per NEMA Publication No. 250 to meet classifications shown on drawings or specifications.

1.3 SUBMITTALS

A. Shop Drawings:

1. Scaled panel face and subpanel face instrument and nameplate layout drawings.

2. Panel and subpanel materials of construction.

3. Panel and subpanel dimensions and weights.

4. Panel access openings.

5. Conduit and wiring access locations.

6. Internal wiring and terminal block drawings.

7. Nameplate text.

8. Scaled layouts of any graphic panels.

9. Seismic restraint requirements.

B. Operation and Maintenance Manuals.

PART 2 -- PRODUCTS

2.1 ENCLOSURES

A. Enclosures shall be sized and rated for the application, and shall be as specified elsewhere.

2.2 ACCESSORIES

A. Furnish electrical equipment, devices, and accessories as required for a complete and operable control panel. Equipment, devices, and accessories shall be as specified elsewhere.

2.3 FABRICATION

A. General:

1. Fabricate panels with devices and instrument arrangements as required by the Plans.

2. Prime control panels with rust inhibitive shop applied primer and paint with two coats of UV resistant white water-based paint.

3. Finish interior of panel with epoxy glass white.

4. Provide control panels which meets the following requirements:

a. Panel depth per JIC EMP-1-1967, E7.1.4.

b. Door opening per JIC EMP-1-1967, E7.1.5.

c. Data pocket per JIC EMP-1-1967, E7.1.6.

d. Rigidity per JIC EMP-1-1967, E7.1.7.

e. Door alignment and reinforcement per JIC EMP-1-1967, E7.1.8.

f. Panel holes and openings per JIC EMP-1-1967, E7.3.2, E7.3.3, and E7.3.4.

g. Doors per JIC EMP-1-1967, E7.5.

h. Clear panel mounting space per JIC EMP-1-1967, E8.2.9.

i. Panel mounted control device location per JIC EMP-1-1967, E8.3.4.

j. Clearances in enclosures per JIC EMP-1-1967, E8.4.

B. Free-Standing Panels:

1. Minimum construction thicknesses:

a. Front panel, subpanel, or front door with cutouts: 0.123”.

b. Top, sides, back, filler plates and side or doors with no cutouts: Minimum thickness per, NEMA ICS 6, Tables 3-8,9.

2. Welded construction.

3. Completely enclosed, self-supporting, and gasketed dust tight.

4. Edges turned back minimum of 2”.

5. Seams and corners welded and ground smooth to touch and smooth in visual appearance.

6. Arrange control panel faces continuous and flush with face of adjacent electrical motor control centers.

7. Provide filler panels where necessary to close gaps between panels or back of panel and wall. Provide full length flush pan doors.

8. Provide full length piano hinges rated for 1.5 times door plus instrument weight.

9. Furnish doors with keyed alike locking handles and three point catch.

10. Provide appropriate conduit, wiring, and instrument openings in accordance with best panel design.

11. After cutouts have been made, finish opening edges to smooth and true surface condition.

12. Provide each panel with lifting eyebolts.

C. Wall Mounted Panels:

1. Minimum construction thicknesses:

a. Front panel, sub-panel or door with cutouts:

1) Width or height not exceeding 42”: 0.093”.

2) Width or height exceeding 42”: 0.123”.

b. Side, top, back and doors without cutouts: minimum thickness per NEMA ICS 6, Tables 3-8, 3-9.

2. Seams continuously welded and ground smooth.

3. Body stiffeners for extra rigidity if either height or width exceeds 28”.

4. Rolled lip around all sides of enclosure door opening.

5. Gasketed dust tight.

6. Three-point latching mechanism operated by oil tight key-locking handle.

7. Furnish doors with keyed alike locking handles and three point catch.

8. Continuous heavy gage hinge pin on doors.

   a. Hinges rated for 1.5 times door plus instrument weight.

9. After cutouts have been made, finish opening edges to smooth and true surface condition.

10. Front full opening door.

11. Brackets for wall mounting.

12. Maximum size shall be 60” tall 40” wide. All larger panels shall be supplied as free standing unless otherwise specified on the plans.

D. Panel Front Construction:

1. Minimum construction thicknesses: per NEMA ICS 6, Tables 3-8, 3-9.

2. Welded construction.

3. Edges turned and ground smooth to touch and visual appearance.

4. At joints where panel face meets side walls, provide dustproof sponge rubber gasket entire height and face.

5. Use full length piano hinges rated for 1.5 times door weight for panel access door.

6. Equip doors with locking devices and handle and three point catches.

7. Finish all instrument cutouts smooth and true.

E. Panel Wiring and Piping:

1. Factory pipe and wire panels to identified terminal blocks equipped with screw type lugs.

2. Install all wiring without splicing in factory in raceways:

   a. Size raceways per the requirements of NEC Article 373.

b. Raceways shall have removable covers.

3. Wire bending space shall be in accordance with Tables 307B, C in NEMA ICS 6.

4. Keep AC power lines separate from low-level DC lines, I/O power supply cables, and all I/O rack interconnect cables.

5. Keep AC signal wires separate from DC signal wires.

6. When I/O wiring must cross AC power wiring, it shall only do so at right angles.

7. Arrange circuits on terminal blocks plus any spare conductors on adjacent terminals.

8. Provide necessary power supplies for control equipment.

9. Equip each panel with a main thermal magnetic circuit breaker. Limit load to maximum of 80 percent of circuit breaker rating.

10. Provide all necessary stabilizing voltage transformers, balancing potentiometers and rectifiers as necessary for specific instrument requirements.

11. Assure each panel mounted device is bonded or otherwise grounded to panel or panel grounding system by means of locknuts or pressure mounting methods.

    a. Equip panel with grounding terminals.

12. Arrange wiring with sufficient clearance for all leads.

13. Wiring to sub-panels or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without disconnecting wiring.

14. Identify all wires with plastic sleeve type wire markers at each end. Markers shall:

    a. Identify circuit numbers.

    b. Identify function and polarity.

15. Provide all wiring according to color code as follows:

COLOR OF INSULATION	120 V, 60 hZ SERVICE	CONTROL WIRING	LOW VOLTAGE DC SERVICE
Black	Phase Conductor		Negative (analog transmission)
Red		120V AC Controls	Positive (analog transmission)
White	Neutral	120V Neutral	
Blue		24V DC Controls	
Blue/White		24V DC Neutral	
Orange		12V DC Controls	
Orange/White		12V DC Neutral	
Green	Ground	Ground	
Yellow		Intrinsically safe circuits	

16. Termination requirements:

    a. Terminal block markings, mechanical characteristics and electrical characteristics shall be in accordance with NEMA ICS 4.

    b. Terminals shall facilitate wire sizes as follows:

        1) 120 V AC applications: Wire size 12 AWG and smaller.

        2) Other: Wire size 14 AWG and smaller.

    c. Provide terminal blocks with continuous marking strip.

    d. Tag each I/O terminal to indicate tag number of the connected device.

    e. Provide terminals for individual termination of each signal shield.

    f. Provide 20 percent excess terminals for future expansion.

17. Pneumatic tubes and appurtenances:

    a. Provide ¼” OD pneumatic control tubing.

    b. Main headers within panels shall be minimum 1”.

    c. Compression-type pressure fittings.

d. Equip panel instrument leads with globe type isolation valve.

e. Connection to devices not in the panel shall be terminated on tubing terminal plate.

f. Install tubing neatly and mount securely.

g. Do not route tubing in front of or in wiring raceways.

h. Code terminal plates.

i. Supply and install dual function filter regulator to serve pneumatic devices.

F. Panel Lighting and Power:

1. Receptacles:

a. Panels less than 4 feet long:

1) One electrical outlet.

2) One compact fluorescent light fixture with door switch(es) and separate circuit breakers.

b. Panels or panel faces greater than 4 feet long:

1) One electrical outlet per 4 feet of length.

2) Continuous fluorescent lighting strip with door switches and separate circuit breakers.

G. Environmental Controls:

1. NEMA 1:

a. Furnish circulation fans with filters and/or air conditioning as required to cool panel. Maintain panel temperature below 40 degrees Celsius or below requirements of equipment within the enclosure whichever is less.

b. Furnish panel heaters as required to prevent moisture condensation and maintain minimum temperature requirements of equipment within the enclosure.

2. Air conditioning applications shall include means of preventing moisture condensation.

3. For panels or control cabinets located outside, hazardous areas, classified areas or plans that require a NEMA 4 or 4X rating:

a. Furnish panel heaters as required to prevent moisture condensation and maintain minimum temperature requirements of equipment within the enclosure.

b. Furnish circulation fans with filters and/or air conditioning as required to cool panel. Maintain panel temperature below 40 degrees Celsius or below requirements of equipment within the enclosure whichever is less.

4. Maintain NEMA rating of original enclosure when installing heating or cooling equipment.

2.5 MAINTENANCE MATERIALS

A. Spare Parts:

1. Replacement Bulbs. Provide minimum 25 percent or 5 bulbs, whichever is greater, for each type of indicating light bulb for each type of indicator furnished in this Project.

2. Replacement Fuses. Provide minimum of 25 percent or 5 fuses, whichever is greater, for all sizes and types of control fuses provided within the control panel.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install free-standing panels on concrete housekeeping pads as detailed on the Drawings.

B. Anchor panel fronts rigidly into wall system with approved anchoring devices.

- END OF SECTION -

SECTION 16170 - GROUNDING

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. A ground grid system consisting of the indicated configuration of copper wires, and ground rods, or concrete encased grounding electrodes ("UFER's") shall be provided to minimize station potential gradient irregularities and drain leakage and fault currents to earth.

B. Whether indicated on the Plans or not, neutral conductors, cable shields, metallic conduits, cable terminations, junction boxes, poles, surge arresters, metal buildings, skid mounted equipment, and other non-current carrying metallic parts of equipment shall be grounded to the ground grid per NEC.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.3 REFERENCES

A. National Electrical Code (NEC) Article 250

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. A resistance of not greater than 25 ohms shall be provided, unless otherwise specified. Ground resistances shall be measured as herein described. Resistances of systems requiring separate ground rods, rather than a counterpoise, shall be measured separately before bonding below grade. The combined ground resistance of separate systems bonded together below grade may be used to meet the specified ground resistance, but the minimum number of rods indicated must still be provided.

2.2 GROUND RODS

A. Ground rods shall be copper-clad steel conforming to UL 467, 3/4 inch in diameter by 10 feet in length. Unless otherwise indicated, ground rods shall be driven into the ground until tops of rods are approximately 6 inches below finished grade. In counterpoise systems, tops of ground rods shall be approximately at elevations of counterpoises. Where the specified ground resistance cannot be met with the indicated number of ground rods, additional ground rods, longer ground rods, or deep-driven sectional rods shall be installed and connected until the specified resistance is obtained, except that not more than three additional ground rods shall be required at any one installation. Ground rods shall be spaced as evenly as possible at least 10 feet apart and 10 feet from structures. Connections shall be made below grade. Contractor shall install a minimum of two ground rods unless more are specified.

2.3 CONNECTIONS

A. Connections above grade shall be made with bolted solderless connectors, and those below grade shall be made by a fusion-welding process. In lieu of a fusion-welding process, a compression ground grid connector of a type which uses a hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

2.4 GROUNDING ELECTRODE CONDUCTOR

A. Service entrance grounding electrode conductors shall be sized in accordance with NEC Table 250.66, unless otherwise indicated on the Plans. After being located to provide maximum physical protection, exposed ground wires shall be securely attached to structural supports at not more than 2-foot intervals with suitable fasteners. Bends greater than 45 degrees in ground wires are not permitted. Routing of ground conductors through concrete should be avoided, except where specifically called for in these Documents. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit, so as to provide an opening for the ground wire. The opening shall be sealed with a suitable compound after installation of the ground wire.

2.5 EQUIPMENT GROUNDING CONDUCTOR

A. Neutral conductors shall be grounded where indicated. Equipment grounding conductors shall be sized in accordance with NEC Table 250.122, unless otherwise indicated. Ground wires shall be protected by conduit, where such wires run exposed above grade in non-fence enclosed areas, or are run through concrete construction. Where concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit, so as to provide an opening for the ground wire. The opening shall be sealed with a suitable compound after installation of the ground wire. Bends greater than 45 degrees in ground wire connections to the ground rods, or counterpoises are not permitted.

2.6 EQUIPMENT GROUNDING

A. Equipment frames of motor housings, equipment skids, metallic tanks, metallic equipment enclosures, metal splicing boxes, chain-link fencing, and other metallic non-current carrying metal items, shall be grounded. Connections to earth shall be made in the same manner as required for system grounding.

2.7 SURGE ARRESTER GROUNDING

A. Surge arresters shall be grounded. Resistance to ground for intermediate-class arresters shall be not more than 10 ohms and for distribution-class arresters shall be not more than 25 ohms. Ground wire connections shall be not less than No. 4 AWG for distribution arresters and No. 1/0 AWG for intermediate arresters. Connections to earth shall be made in the same manner as required for neutral conductors. Surge arrester grounds may use the same ground wires provided for equipment operating at more than 750 volts. Surge arrester and secondary neutral grounds shall be separate from and independent of each other.

2.8 LIGHTING POLE GROUNDING

A. Base of lighting poles shall be connected to an adjacent ground rod as indicated on Plans. A ground connection from poles back to neutral ground points shall also be provided utilizing equipment grounding conductor.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. It is the intent of these Contract Documents that all device and equipment grounds shall be run as a separate conductor in the conduit from the equipment to the distribution panels or system ground. Wireways and enclosures shall be properly bonded and grounded, and ground conductors shall be run for all circuits.

B. Equipment cases and devices shall be grounded. Ground rods shall be driven, and concrete encased conduits installed, before a building or structure is built, and ground conductors brought through the concrete to accessible points for grounding equipment. These systems shall be installed at each structure, where transformers, switchboards, panelboards, and MCC's are installed.

C. Ductbanks shall contain a bare copper ground conductor. The system ground conductors shall run continuously in ductbanks, through handholes and other raceway boxes. The system ground shall be connected to the structure grounding systems to provide a continuous grounding system. Each metallic raceway, panel, switchboard, and other metallic devices associated with the electrical and control systems shall be bonded to this grounding system.

D. Ground rods shall be installed not less than 6 inches below grade. Equipment, neutral, and surge arrester ground wires shall be connected to the ground grid as indicated.

3.2 TESTS

A. Pre-Energization Tests — Pre-energization tests shall include, but shall not be limited to, tests required to perform under paragraph "GENERAL REQUIREMENTS." No part of the electrical system shall be energized until all station grounding system components have been tested and demonstrated to comply with the requirements specified, and until associated test reports have been submitted and approved.

B. Ground-Resistance Measurements — Ground-resistance measurements of each ground rod shall be taken and certified by the Contractor to the Engineer. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and grounding system and submission of test results to the Engineer. Test reports shall indicate the location of the ground rod and grounding system and the resistance and the soil conditions at the time the test was performed. When the building water service is used as a ground or part of the grounding system, ground-resistance measurements shall also be made of this connection. Ground-resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 142 and Std 81.

3.3 TEST RESULTS

A. The Contractor shall perform the above tests and submit a certified test report to the Engineer prior to energizing the equipment.

- END OF SECTION -

SECTION 16190 - SUPPORTING DEVICES

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. Supports, anchors, sleeves, and seals, are indicated on the Plans, schedules, and specified in other sections of these Specifications.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:

1. One-hole Conduit Straps
2. One-Hole Conduit Straps with Clamp Backs
3. Two-Hole Conduit Straps
4. Conduit Hangers
5. I-beam Clamps
6. Channel Clamps
7. Round Steel Rods
8. Drop-in Anchors
9. Wedge Type Anchor Bolts
10. Lead Expansion Anchors
11. Toggle Bolts
12. Wall and Floor Seals
13. Cable Supports
14. U-Channel Strut System
15. Sleeves

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following: Abbeon Cal Inc., Ackerman Johnson Fastening Systems Inc., Elcen Metal

Products Co., Ideal Industries, Inc., Josyln Mfg and Supply Co., McGraw Edison Co., Rawlplug Co. Inc., Star Expansion Co., U.S. Expansion Bolt Co., Allied Tube and Conduit Corp., B-Line Systems, Inc., Greenfield Mfg Co., Inc., Midland-Ross Corp., O-Z/Gedney Div; General Signal Corp., Power-Strut Div.; Van Huffel Tube Corp., and Unistrut Div; GTE Products Corp., and Robroy Industries.

2.2 GENERAL

A. Provide supporting devices that comply with manufacturer standard materials, design, and construction, in accordance with published product information, and as required for complete installations, and as specified herein.

2.3 SUPPORTS

A. Provide supporting devices of types, sizes, and materials indicated, and having the following construction features:

1. One-Hole Conduit Straps: For supporting electrical metallic tubing, and liquid tight flexible conduit; zinc plated steel, stainless steel or galvanized steel; snap-on, heavy duty.

2. One-Hole Conduit Straps with Clamp Backs: For supporting rigid metal conduit, and intermediate metal conduit; cast galvanized steel.

3. Two-Hole Conduit Straps: For supporting electrical metallic tubing, rigid metal conduit, and intermediate metal conduit; zinc plated steel, stainless steel or galvanized steel.

4. Conduit Hangers: For supporting electrical metallic tubing, rigid metal conduit, and intermediate metal conduit; zinc plated steel, stainless steel or galvanized steel.

5. I-Beam Clamps: Electroplated zinc or hot dipped galvanized malleable iron.

6. Channel Clamps: Electroplated zinc or hot dipped galvanized steel.

7. Round Steel Rod: National coarse thread, electroplated.

2.4 ANCHORS

A. Provide anchors of types, sizes, and materials indicated, with the following construction features:

1. Lead Expansion Anchors: For CMU walls, 1/4”-20 threads, set tool required.

2. Toggle Bolts: Electroplated steel, size as required.

3. Drop-in Anchors: Stainless steel, size as required.

4. Anchor Bolts: Stainless steel, size as required.

5. Lag Bolts: Stainless steel, size as required.

6. Half-round head, non-removable anchor bolts shall not be used.

7. Self-Tapping screws shall not be used.

2.5 SEALS

A. Provide seals of types, sizes and materials indicated; with the following construction features:

1. Conduit sealing bushings shall be manufactured by O-Z/Gedney, Model CSMI, or equal.

2. The conductor sealing bushings shall be manufactured by O-Z/Gedney, Model CSBG, or equal.

2.6 CONDUIT CABLE SUPPORTS

A. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable-iron casting with hot-dip galvanized finish.

2.7 U-CHANNEL STRUT SYSTEM

A. Provide U-channel strut system for supporting electrical equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with the following fittings that mate and match with U-Channel:

1. Fixture hangers

2. Channel hangers

3. End caps

4. Beam clamps

5. Wiring stud

6. Thinwall conduit clamps

7. Rigid conduit clamps

8. Post Bases

9. U-bolts

B. Approved for use with the following types of conduit:

1. EMT

2. IMT

3. GRS

4. PVC (where above conduits are approved for the same location.)

2.8 PIPE SLEEVES

A. Provide pipe sleeves from the following:

1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

2.9 PVC COATED U-CHANNEL STRUT SYSTEM

A. Provide PVC Coated U-channel strut system for supporting electrical equipment, 20 mil PVC coated steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with all Stainless Steel hardware, and the following fittings that mate and match with PVC Coated U-Channel:

1. PVC Coated Strut nut

2. PVC Coated Pipe straps

3. Touch up compound (Gray)

B. Approved for use with the following types of conduit:

1. PVC Coated GRS

2. Aluminum

3. PVC

2.10 STAINLESS STEEL U-CHANNEL STRUT SYSTEM

A. Provide Stainless Steel U-channel strut system for supporting electrical equipment, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with all stainless steel hardware, and the following stainless steel fittings that mate and match with Stainless Steel U-Channel:

1. Fixture hangers

2. Channel hangers

3. End caps

4. Beam clamps

5. Wiring stud

6. Post bases

7. Rigid conduit clamps

8. U-bolts

B. Approved for use with the following types of conduit:

1. PVC Coated GRS

2. PVC

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of 2 or more parallel runs of conduits to be supported together on channel type hangers where possible. Install supports with spacing indicated and in compliance with NEC requirements.

D. Torque sleeve seal nuts, complying with manufacturer recommended values. Ensure that sealing grommets expand to form watertight seal.

E. Comply with manufacturer’s recommendations for touch up of field cut ends or damaged PVC coated U-channel and fittings.

F. Remove burrs and apply a cold zinc galvanizing paint to field cut galvanized U-channel strut prior to installation.

G. Provide a minimum of two anchors per piece of u-channel. Maximum spacing of anchors shall be 12”.

- END OF SECTION -

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SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. Electrical identification work specified in this section covers the following:

1. Buried cable warnings
2. Electrical power, control and communication conductors
3. Operational instructions and warnings
4. Danger signs
5. Equipment/system identification signs
6. Conduit
7. Instruments and Enclosures

1.2 SUBMITTALS

A. Submittals shall include the following:

1. Manufacturers data on electrical identification materials and products
2. Samples of each color, lettering style and other graphic representation required for each identification material or system
3. Table or list of equipment, panel, and disconnect switch labels

1.3 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering electrical identification products maybe incorporated in the work include, but not limited to, the following:

1. Brady, W.H. Co.
2. Ideal Industries, Inc.
3. Panduit Corp. or
4. equal

1.4 QUALITY COMPLIANCE

A. Comply with applicable requirements of UL Std. 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

B. Comply with applicable requirements of NEMA Std. WC-1 and WC-2 pertaining to identification of power and control conductors.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated provide manufacturer standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option. Installer should maintain a consistent selection for each application.

2.2 COLOR-CODED CONDUIT MARKERS

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment to conduit by adhesive, adhesive lap joint of marker, cable tie, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Except as otherwise indicated, provide lettering that indicates voltage of conductor(s) in conduit. Provide 8” minimum length for 2” and smaller conduit, 12” length for larger conduit.

B. Unless otherwise indicated or required by governing regulations, provide white markers with black letters.

C. Each end of conduits should be marked where the conduit enters and enclosure or junction of more than two conduits.

2.3 CABLE AND CONDUCTOR WIRE MARKERS

A. Cable and conductor wire markers shall be self laminating vinyl on white background, printed using a Brady TLS2200 printer, Seton printer, or equal. Handwritten wire markers are not acceptable.

B. Heat shrink tubing, or sleeve type wire markers are also acceptable. Markers shall be printed not hand written.

2.4 SELF-ADHESIVE PLASTIC SIGNS

A. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.

B. Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

C. Where approved by engineer engraved stainless steel tags fastened with 18 gauge stainless steel wire may be attached to valves and isolated equipment.

2.5 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.

B. Where identification is to be applied to surfaces that require finish, install identification after completion of painting.

C. Comply with governing regulations and requests of governing authorities for identification of electrical work.

D. Electrical identification shall contain identical markings on both ends of each conduit and cable. Identification shall be recorded on record drawings for both cables and conductors.

3.2 CONDUIT IDENTIFICATION

A. Where electrical conduit is exposed in spaces with exposed mechanical piping that is identified by a color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated use white as coded color for conduit.

3.3 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.4 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved plastic-laminate sign on each piece of electrical equipment; including a general label for each major electrical system, including communication, control, and signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2” high lettering on 1-1/2” high sign (2” high where 2 lines are required), black lettering in white field. Provide text matching terminology and numbering of the Contract Documents and shop drawings. Provide signs for each unit of the following categories of electrical work:

1. Panel boards, transformers, electrical cabinets and enclosures.

2. Access panel/doors to electrical facilities.

3. Major electrical switchgear.

4. Motor Control Center(s).

5. Service Entrance(s)

B. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of

equipment. Secure to substrate with stainless steel screws, except use adhesive where screws should not or cannot penetrate the substrate. Provide signs as required by NEC for multiple services.

C. Engraved three-layer laminated plastic, black letters on white background, unless otherwise specified by drawings or Engineer shall be provided for the following equipment:

1. TXs
2. Disconnect switches
3. Push button stations
4. Control devices
5. Instruments
6. Motors
7. All major pieces of process equipment
8. Actuators
9. Control valves
10. Solenoid valves
11. Any device relevant to the operation of the plant
12. Communications enclosures
13. Junction boxes

D. Stainless steel, 1/16” thick, with 1/8” stamped or engraved lettering, per Item C above. May be used in lieu of phenolic engraved nametags on instruments and valves as approved by the engineer. Tag shall be attached with #18 stainless steel wire.

3.5 CIRCUIT IDENTIFICATION

A. The 3-phase wires shall be identified at the switchgear, panelboards and motor control centers as Phases A, B, and C. At 277/480V, Phase A shall be brown, Phase B shall be orange, and Phase C shall be yellow. At 120/208V, Phase A shall be Black, Phase B shall be Red, and Phase C shall be Blue. The neutral shall be white.

B. In addition to color coding all conductors, each conductor shall be identified in each pull box, manhole, panelboard, cable tray, or termination with circuit identification markers. This identification is applicable to all power, control, alarm, and instrumentation conductors and these markings shall be recorded on the Record Documents. Markers shall be slip-on PVC sleeve type as manufactured by Brady, Seton, or equal.

C. Markers for other cabling shall be B-292 vinyl as manufactured by Brady, Seton, or equal.

D. Exposed medium voltage conduits shall be labeled at 50-foot intervals with 1-inch letters stating the voltage - example - “12,470 volts”. Labels shall be vinyl plastic as manufactured by Brady, Seton, or equal.

3.6 AUTOMATIC EQUIPMENT WARNING SIGNS

A. Permanent warning signs shall be mounted at all mechanical equipment that may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.

B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION

THIS EQUIPMENT STARTS

AUTOMATICALLY

BY REMOTE CONTROL

3.7 HIGH VOLTAGE WARNING SIGNS

A. Permanent and conspicuous warning signs shall be mounted on all equipment, doorways to equipment rooms, pull boxes, manholes, where the voltage exceeds 250 volts.

B. Signs shall be in accordance with OSHA regulation, and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.

C. Signs shall be 7 inches high by 10 inches wide, colored red and white, on not less than 18 gauge vitreous enameling stock. Sign shall read:

WARNING

HIGH VOLTAGE

KEEP OUT

3.8 CONDUCTOR FASTENERS

A. Glue-on type conductor fasteners shall not be used in any panels, panelboards, switchboards, switchgear, motor control centers, or other enclosures containing electrical devices and/or conductors.

- END OF SECTION –

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SECTION 16460 – ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This Section includes AC induction electric motors to be provided with associated driven equipment. Motor voltage, speed and enclosures are specified in the equipment specifications. Unless otherwise specified, motors shall be provided by the manufacturer of the driven equipment under the provisions of the individual equipment specification.

1.2 MOTOR RATING

A. Motor horsepower ratings as shown on the drawings and noted on the specifications are estimates only and it is the responsibility of the CONTRACTOR and/or VENDOR to furnish motors, electric circuits, power feeds and other equipment whose ratings meet the requirements for the submitted horsepower and amperage.

B. This section applies to electric motors rated 480 V and below.

1.3 CODE AND STANDARDS

A. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 220, 250, and 430, as applicable to installation, and construction of motor controllers.

B. AFBMA Compliance: Comply with applicable requirements of AFBMA 9 & 11, "Load Rating and Fatigue Life for Ball and Roller Bearings."

C. UL Compliance: Comply with applicable requirements of UL 674, “Electric Motors and Generators, for Use in Division 1 Hazardous (Classified) Locations” and UL 1004, “Electric Motors”.

D. IEEE Compliance: Comply with recommended practices contained in IEEE Standard 112, "Standard Test Procedures for Polyphase Induction Motors and Generators," and IEEE Standard 841, “Standard for Petroleum and Chemical Industry – Totally Enclosed Fan Cooled (TEFC) Squirrel Cage Induction Motors – Up to and Including 500 HP”.

E. NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies", NEMA Standard ICS 6, “Enclosures for Industrial Controls and Systems, ”Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)" and NEMA MG 1, “Motors and Generators”.

1.4 MAINTENANCE DATA

A. Submit maintenance data and parts list for each motor and auxiliary component; including troubleshooting maintenance guide. Also, provide product data and shop drawings in a maintenance manual, in accordance with requirements of the Contract Documents.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's data and installation instructions for each motor in accordance with the individual equipment specification and Section 01300. As a minimum, the following information shall be provided:

1. Manufacturer name, type and model number

2. Motor outline, dimensions and weight

3. Manufacturer’s general descriptive information relative to motor features

4. Type of bearing and method of lubrication

5. Rated size of motor and service factor

6. Temperature rise and insulation rating

7. Full-load rotative speed

8. Efficiency at full, ¾ and ½ load

9. Full load current

10. Locked-rotor current

11. Space heater wattage and voltage, if applicable

12. If a winding overtemperature device is required, provide a response curve for the temperature device, wiring diagram and specifications

13. If a moisture detection system is required, provide a typical wiring diagram and a moisture detection relay to be installed by the CONTRACTOR or VENDOR in the associated motor controller.

B. Shop Drawings: Submit shop drawings of electric motors showing accurately scaled equipment locations and spatial relationships to associated drive equipment.

C. Wiring Diagrams: Submit power and control wiring diagrams for electric motors showing connections to electrical power panels, feeders, and equipment.

D. Operations and Maintenance Data: Submit operation and maintenance information as required by Section 01730.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated, provide electric motors and ancillary components that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation.

2.2 SERVICE CONDITIONS

A. Unless specified otherwise, motors shall be suitable for continuous operation at an elevation of 0 to 5000 feet above mean sea level.

B. Unless specified otherwise, motors located outdoors shall be suitable for continuous operation from -25 to 50°C; motors located indoors shall be suitable for continuous operation from 0 to 50°C.

C. All motors shall be able to operate under power supply variations in accordance with NEMA MG 1 – 14.30.

2.3 NAMEPLATES

A. Motor nameplates shall be engraved or stamped stainless steel. Information shall include those items as enumerated in NEMA Standard MG 1, as applicable. Nameplates shall be permanently fastened to the motor frame and shall be visibly positioned for inspection.

2.4 CONSTRUCTION

A. All motors provided under this specification shall have the following features of construction:

1. Frames shall be steel for motors smaller than ½ horsepower and cast iron for motors ½ horsepower and larger.

2. Cast metal shrouds and covers for non-sparking fan blades.

3. Non-hygroscopic motor leads.

4. NEMA Design-B as standard design. Other designs if required must be submitted and approved in writing by the ENGINEER.

5. Motor Service Factor of 1.15 for Sine-Wave and 1.0 for Inverter Duty.

6. Grounding terminal

7. Windings shall be copper

8. Rotor cages shall be die cast aluminum or fabricated copper

9. Shafts shall be made from carbon steel.

2.5 MOTORS LESS THAN ½ HORSEPOWER

A. General:

1. Unless specified otherwise, motors less than ½ horsepower shall be squirrel cage, single phase, capacitor start, induction run type.

2. Single phase motors shall have class B insulation as a minimum.

3. Motors for fans less than 1/8 horsepower may be split-phase or shaded pole type.

4. Winding shall be copper.

B. Rating:

1. Unless specified otherwise, motors less than ½ horsepower shall be rated for operation at 115 volts, single phase, 60 Hz, and shall be continuous-time rated in conformance with NEMA Standard MG 1 – 10.35.

2. Dual voltage (115/230) rated motors are acceptable if all leads are brought out to the conduit box.

3. Motors shall be non-overloading at all points of the equipment operation.

2.6 MOTORS ½ HORSEPOWER and larger

A. General:

1. Unless specified otherwise, motors ½ horsepower and larger shall be 3 phase, squirrel cage, full voltage start induction type.

2. Unless otherwise specified, motors shall have a NEMA MG 1-1.16 design letter B or C torque characteristic as required by the driven equipment's starting torque requirement.

3. Winding shall be copper.

4. Motors shall be equipped with a set of thermal overload switches with dry contacts available at the motor terminal box for the following:

a. Motors between 5 and 200 hp.

B. Rating:

1. Unless specified otherwise, motors ½ horsepower and larger shall be rated for operation at 460 volts, 3 phase, 60 Hz, and shall be continuous-time rated in conformance with NEMA Standard MG 1 – 10.35.

2. Dual voltage (230/460) rated motors are acceptable if all leads are brought out to the conduit box.

3. Motors for variable frequency systems shall not be required to deliver more than 80% of the motor's service factor rating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

C. Enclosures and Insulation:

1. Motors shall be classified as Type 1 (Process) or Type 2 (Explosion proof) based upon the location of the motor and the associated area classification.

2. Temperature rise for all motors shall not exceed that permitted by Note II, Paragraph 12.42 of NEMA MG 1.

3. Motor Insulation shall be non-hygroscopic.

4. Type 1 motors (Process):

    a. Type 1 motors shall be premium energy-efficient motors, totally enclosed, fan cooled (TEFC)

    b. All motors shall have Class H insulation with Class B temperature rise.

    c. All internal surfaces shall be coated with an epoxy paint.

    d. Motors shall be rated for corrosive atmosphere duty.

5. Type 2 Motors (Explosion Proof):

    a. Explosion proof motors shall be UL listed in accordance with UL 674 for Class I, Group D hazardous atmospheres.

    b. The motor shall have Class H insulation.

    c. A UL-approved Type 316 stainless steel breather/drain device shall be provided in the motor drain hole.

    d. The motor shall be provided with a frame temperature thermostat which meets the UL frame temperature limit code T2A (280°C). The thermostat shall contain an automatically reset, normally closed contact rated 2 amperes at 230 VAC.

2.7 MOTORS FOR VARIABLE FREQUENCY DRIVES

A. Motors intended for use with variable frequency drives shall be compatible with the characteristics of the intended variable frequency inverter.

B. Motors shall be Type 1 or Type 2 as specified in 2.06C.

C. Motors shall be capable of withstanding a pulse voltage of at least 1750 volts with a rate of rise up to 750V per microsecond.

D. Motors shall be certified by the manufacturer as suitable for inverter duty and shall have as a minimum a 10:1 turndown ratio (6-60Hz).

E. Motors shall be capable of running above the rated RPM up to 70 Hz (116.67% of rated RPM) so long as the load current does not exceed the full load amps of the motor.

2.8 MOTOR EFFICIENCIES

A. Type 1 and Type 2 motors in accordance with NEMA MG 1 Table 12-11 and 12-12 and Type 2 in accordance with IEEE 841 Table 2 motor minimum nameplate efficiency for 900, 1200 and 1800 rpm motors, when operating on a sinusoidal power source shall conform to the following (in accordance with IEEE 112B testing procedures):

Motor Horsepower	Guaranteed Minimum Efficiency (%)	
	1200 RPM	1800 RPM
1	82.50%	85.50%
1.5	87.50%	86.50%
2	88.50%	86.50%
3	89.50%	89.50%
5	89.50%	89.50%
7.5	91.00%	91.70%
10	91.00%	91.70%
15	91.70%	92.40%
20	91.70%	93.00%
25	93.00%	93.60%
30	93.00%	93.60%
40	94.10%	94.10%
50	94.10%	94.50%
60	94.50%	95.00%
75	94.50%	95.40%
100	95.00%	95.40%
125	95.00%	95.40%
150	95.80%	95.80%
200	95.80%	96.20%
250	95.80%	96.20%

2.9 CONDUIT BOXES

A. Conduit boxes shall be sized based on the conduit number and conduit size indicated on the drawings. Provide over-sized boxes with the number of openings as required to accommodate the conduits required.

B. Conduit boxes shall be split construction with threaded hubs and shall conform to IEEE 841 for Type 1 and Type 2 motors. Motors shall be furnished with petroleum-resistant gaskets at the base of the conduit box and between the halves of the conduit box.

C. Conduit boxes shall be designed to rotate in order to permit installation in any of four positions 90 degrees apart.

2.10 BEARINGS

A. Bearings may be oil or grease lubricated ball or angle contact roller bearing rated for a minimum L-10 life of 100,000 hours in accordance with ABMA 9 or 100 at the ambient temperature specified. Motor designs employing cartridge type bearings will not be accepted. Bearings shall be fitted with lubricant fill and drain or relief fittings. Belt loads shall not exceed forces calculated from NEMA MG 1 Table 14-1.

2.11 LIFTING EYES

A. Motors weighing more than 50 pounds shall be fitted with at least one lifting eye and motors weighing over 150 pounds shall be fitted with two lifting eyes.

2.12 SPACE HEATERS

A. Motors that are located outdoors shall be equipped with Space Heaters to prevent condensation inside the motor enclosure after motor shutdown and maintain the temperature of the windings at not less than 5°C above outside ambient temperature.

B. Heaters shall be flexible wraparound type rated 120 volts, single phase, 60 Hz unless otherwise noted. The space heater rating in watts and volts shall be noted on the motor nameplate or on a second nameplate. Space heater leads H1 and H2 shall be brought to a separate terminal block or pigtails in the motor conduit box or separate conduit box with a threaded conduit opening.

PART 3 -- EXECUTION

A. Install electric in accordance with equipment manufacturer's written instructions, and with recognized industry practices. Comply with applicable requirements of NEC, UL, and NEMA standards, to insure that products fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

C. Ensure that the motor is properly grounded from the incoming motor leads and that the frame is bonded to the grounding electrode system.

D. Verify breather/drain fittings have been installed as specified.

E. Prior to energizing, check circuitry for electrical continuity, and for short-circuits. Winding insulation resistance for motors shall not be less than 10-megohms measured with a 1000-VAC megohmeter at 1-minute at or corrected to 40°C.

F. Check rotation of each motor for proper direction.

G. Upon completion of installation of motor controller equipment and electrical circuitry, energize controller circuitry and demonstrate functioning of equipment in accordance with requirements.

- END OF SECTION -–

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SECTION 16476 - LOW VOLTAGE CIRCUIT BREAKERS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish and install, low voltage circuit breakers, as indicated on the Drawings and specified herein.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and elsewhere in the Contract Documents, prior to installation.

1.3 QUALITY ASSURANCE

A. The breaker manufacturer's facilities shall be ISO 9001 certified.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Circuit breakers shall be as manufactured by Square D, Cutler-Hammer, Allen-Bradley, General Electric, or equal.

B. Circuit breaker frame, trip, short circuit, and interruption ratings shall be as indicated on the Drawings, except that they shall be coordinated with the ratings of the equipment actually furnished, and shall be modified where necessary to suit the equipment. Circuit breakers to be used in motor control centers shall be as indicated on the Drawings. Where no indication of type is given on the Drawings circuit breakers protecting motors shall be motor circuit protectors, and other circuit breakers shall be molded case type.

C. Circuit breaker for mounting in motor control centers, or for separate mounting shall be of the air-break type, quick-make and quick-break, 600 volt, with number of poles as indicated on the Drawings.

D. Each pole of the circuit breaker shall provide inverse time delay, and instantaneous circuit protection.

E. The breakers shall be operated by a handle, and shall have a switching mechanism that is mechanically trip free from the handle, so that the contacts cannot be held closed against short circuits, and abnormal currents. Tripping due to overload, or short circuit shall be clearly indicated by the handle automatically assuming a position between the manual ON and OFF positions. Latch surfaces shall be ground and polished. Poles shall be constructed so that they open, close, and trip simultaneously.

F. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. The minimum interrupting ratings of the circuit breakers shall be at least equal to the available short circuit current at the line terminals.

G. Circuit breakers shall conform to the applicable requirements of NEMA Standards Publication No. AB1.

H. Molded case circuit breakers shall be ambient temperature compensating that provides inverse time delay overload and instantaneous short circuit protection by means of a thermal magnetic element. Compensation shall be accomplished by a secondary bi-metal that will allow the breaker to carry rated current between 25 degrees C and 50 degrees C with tripping characteristics that are approximately the same throughout this temperature range.

I. On breakers with interchangeable, thermal, adjustable magnetic trip, the accessibility and position of the adjustment knob shall not be changed from those on the standard breaker.

J. Unless mounted in a switchboard, or panelboard, circuit breakers shall be housed in a NEMA rated enclosure as described elsewhere in these specifications.

K. Provide circuit breakers with shunt trip mechanisms where shown on the Drawings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Circuit breakers shall be installed as indicated on the Drawings and per manufacturer's instructions.

- END OF SECTION -

SECTION 16477 - 600 V FUSES

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. Extent of fuse work required by this section is indicated by drawings, and by requirements of this section.

B. Types of fuses specified in this section include the following:

1. Class L time-delay.

2. Class L fast-acting.

3. Class RK1 time-delay.

4. Class RK1 and Class J current limiting.

5. Class RK5 time-delay.

6. Class K5 time-delay, non-current limiting.

7. Class T current-limiting.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fuses of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 CODES AND STANDARDS

A. UL Compliance and Labeling: Comply with applicable provisions of UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide over-current protective devices which are UL-listed and labeled.

B. NEC Compliance: Comply with NEC as applicable to construction and installation of fusible devices.

C. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 "Low-Voltage Cartridge Fuses 600 Volts or Less".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data on fuses, including specifications, electrical characteristics, installation instructions, furnished specialties and accessories in accordance with Section 16000 General Electrical Requirements, and the Contract Documents. In addition, include voltages and current ratings, interrupting ratings, current limitation ratings, time-current trip characteristic curves, and mounting requirements.

1.5 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering fusible devices which may be incorporated in the work include, but are not limited to, the following: Bussmann, Gould-Shawmut, Reliance, or equal.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

2.2 Class L Time-Delay Fuses

A. Provide UL Class L time-delay fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting transformers, motors, and circuit-breakers.

2.3 Class L Fast-Acting Fuses

A. Provide UL Class L fast-acting fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting service entrances and main feeder circuit-breakers.

2.4 Class RK1 Time-Delay Fuses

A. Provide UL Class RK1 time-delay fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting motors and circuit-breakers.

2.5 Class RK1 Current-Limiting Fuses

A. Provide UL Class RK1 current-limiting fuses rated 250-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting circuit-breakers.

2.6 Class J Current-Limiting Fuses

A. Provide UL Class J current-limiting fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating.

2.7 Class RK5 Time-Delay Fuses

A. Provide UL Class RK5 time-delay fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting motors.

2.8 Class K5 One-Time Fuses

A. Provide UL Class K5 one-time fuses rated 250-volts, 60 Hz, with 100,000 RMS symmetrical interrupting current rating for protecting non-inductive loads.

2.9 Class T Fuses

A. Provide UL Class T fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protection of physically small devices.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Fuse types and sizes shall be as indicated on the Plans. Fuses shall be installed in accordance with the National Electric Code (NEC) requirements and the manufacturer's written instructions.

B. Install fuses in proper fuse holders.

C. Where fuses are installed in the motor starters, fuses shall be sized to match the actual motor full load current.

D. Where fuses are installed in disconnect switches at HVAC units, the fuse sizes shall be sized to meet the HVAC manufacturer's requirements.

E. Fuses for control transformers shall be sized in accordance with the National Electrical Code.

F. Fuses shall be installed with the labels clearly visible.

3.2 FIELD QUALITY CONTROL

A. Prior to energizing fusible devices, test devices for circuit continuity and for short-circuits.

3.3 SPARE PARTS

A. Furnish 10% of installed fuses or 3 sets whichever is greater for each type and ampere rating. The set shall equal the number of poles in the appropriate equipment.

B. Furnish a spare fuse cabinet equal to Bussmann for storing spare fuses. Mount on wall in Electrical room as directed by the Engineer.

- END OF SECTION -

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SECTION 16480 - MOTOR CONTROLLERS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. A motor controller is any device or group of devices normally used to start and stop a motor by making and breaking the motor circuit current. The motor controller and devices that make up the motor controller shall be governed by items indicated on the Plans, or elsewhere within these specifications.

B. Types of motor controllers specified in this section include the following:

1. Combination.

2. Fractional HP manual.

3. Solid-state reduced voltage.

4. Autotransformer reduced voltage.

5. Variable Frequency Drive (See also VFD Specification)

C. This section applies to motor controllers rated 480 V and below.

1.2 CODE AND STANDARDS

A. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 220, 250, and 430, as applicable to installation, and construction of motor controllers.

B. NFPA Compliance: Comply with applicable requirements of NFPA 70E, "Standard for Electrical Safety requirements for Employee Workplaces."

C. UL Compliance: Comply with applicable requirements of UL 486A and B, and UL 508, pertaining to installation of motor controllers. Provide controllers and components which are UL-listed and labeled.

D. IEEE Compliance: Comply with recommended practices contained in IEEE Standard 241, "Recommended Practice for Electrical Power Systems in Commercial Buildings," pertaining to motor controllers.

E. NEMA Compliance: Comply with applicable requirements of NEMA Standard ICS 2, "Industrial Control Devices, Controllers and Assemblies," and Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)," pertaining to motor controllers and enclosures.

1.3 MAINTENANCE DATA

A. Submit maintenance data and parts list for each motor controller and component; including troubleshooting maintenance guide. Also, provide product data and shop drawings in a maintenance manual, in accordance with requirements of the Contract Documents.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's data and installation instructions on motor controllers.

B. Shop Drawings: Submit shop drawings of motor controllers showing accurately scaled equipment locations and spatial relationships to associated motors and equipment.

C. Wiring Diagrams: Submit power and control wiring diagrams for motor controllers showing connections to electrical power panels, feeders, and equipment.

D. Submittal documents shall be provided in accordance with Section 16000 General Electrical Requirements, and other requirements of the Contract Documents.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Except as otherwise indicated, provide motor controllers and ancillary components that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation.

2.2 COMBINATION CONTROLLERS

A. Provide full-voltage alternating-current combination controllers, consisting of controller and circuit breaker disconnect switch mounted in a common enclosure, of types, sizes, rating, and NEMA sizes indicated on the Plans. Equip controllers with overload relays, control relays, and auxiliary contacts as required on the plans. Provide lockable operating handle for disconnect switch mechanisms, mechanically interlocked with enclosure door. Provide NEMA rated enclosure type as shown on the Plans.

B. Circuit breaker disconnect shall be molded case, motor circuit protector type (MCP), sized per NEC.

C. Provide control power transformer sized properly to accommodate device loads. The control power transformer shall have two (2) primary, and one (1) secondary fuse sized according to NEC.

D. Multi-speed and reversing starters shall have mechanical and electrical interlock.

E. Furnish controller with control and indicating devices as indicated on the plans. Auxiliary contacts, and field connections shall be connected to terminal strips for field connection.

F. Controllers shall be as manufactured Allen-Bradley, General Electric, Square D, Cutler-Hammer, or equal.

2.3 OVERLOAD PROTECTION

A. Overload Protection shall be provided with the motor starters. The unit shall detect overcurrent, phase current imbalance, phase loss.

B. The overload relay shall be Class 10, 600 Volt rated, and shall have a trip indicator. The unit shall have a manual reset feature, and a normally closed contact for control.

C. Each module shall provide individual trip indication and reset for each trip condition, visible without opening the motor control center compartment door. Provide a normally open auxiliary contact for remote trip indication.

D. Overloads shall be as manufactured by Allen-Bradley, Square D, Cutler-Hammer, General Electric, or equal.

2.4 MAGNETIC MOTOR STARTERS

A. Starters, Size 2 and larger, shall have arc quenchers on all load breaking contacts. All starters shall be NEMA rated for the horsepower ratings specified. The Contractor shall verify the motor ratings, and coordinate the starter and overload trip ratings with the actual horsepower ratings of the motors installed. Extended overload reset buttons shall be mounted so as to be accessible for operation without opening the door of the enclosure.

B. Magnetic contactors shall be factory adjusted and shall be chatter free.

C. Starters shall be furnished complete with a 120-volt control power transformer. Control circuit fuses shall be furnished both on the primary and secondary of the control circuit transformer. Control power shall be disconnected with the motor circuit protector.

D. Starters shall be designed to operate in ambient temperatures up to 40º C.

E. The minimum size starter shall be NEMA Size 1.

F. Magnetic Motor Starters shall be manufactured by Allen-Bradley, Square D, Cutler-Hammer, General Electric, or equal.

2.5 MANUAL STARTERS

A. Manual starters shall be rated for the motor load, and shall be equipped with built-in overloads.

B. Manual starters shall be provided with enclosures as indicated on the Plans, lockable handles that clearly indicate ON, OFF, and TRIPPED positions, pilot light, and positive, quick-make, quick-break mechanisms.

C. Manual Starters shall be manufactured by Allen-Bradley, Square D, Cutler-Hammer, General Electric, or equal.

2.6 MOTOR PHASE FAILURE RELAY

A. The relay shall detect voltage values below an adjustable value, loss of phase, and phase reversal. The unit shall automatically de-energize the control circuits of the motors to be protected, when one or all three phase voltages drop below the set point. The unit shall have a nominal trip delay time of two seconds and a reset time of two seconds. The relay shall automatically reset upon restoration of the line voltage. Relays shall be MotorSaver, Time Mark Corporation, or equal. Relays shall be installed if indicated on the drawings.

2.7 MOTOR PROTECTION RELAY

A. The motor protection relay, where shown on drawings, shall be capable of the following as a minimum:

1. Phase loss

2. Low voltage (adjustable)

3. Phase reversal

4. Phase unbalance

B. The motor protection relay shall be equipped with the following as a minimum:

1. Adjustable trip delay (2 to 20 seconds)

2. Automatic reset

3. Transient protection (2500 volts for 10 ms)

C. Motor protection relays shall be set during the project startup according to the individual motor characteristics and application parameters. The motor protection relays for the motors with variable frequency drives shall be set as to prevent low voltage tripping.

D. The motor protection relays shall be MotorSaver Model 777, Time Mark Model 264, or equal.

PART 3 -- EXECUTION

A. Install motor controllers in accordance with equipment manufacturer's written instructions, and with recognized industry practices. Comply with applicable requirements of NEC, UL, and NEMA standards, to insure that products fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

C. Install fuses, of sizes indicated, in each fusible disconnect switch, if any. Install overload heaters sized to approximately 115% of motor full load current as shown on each, individual motor nameplate.

D. Prior to energizing motor controller equipment, check with ground resistance tester, phase-to phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

E. Prior to energizing, check circuitry for electrical continuity, and for short-circuits.

F. Check rotation of each motor for proper direction.

G. Upon completion of installation of motor controller equipment and electrical circuitry, energize controller circuitry and demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

- END OF SECTION –

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SECTION 16505 – TRANSIENT VOLTAGE SURGE SUPPRESSION SYSTEM

PART 1 -- CLASS C MAIN ENTRANCE PANEL SURGE SUPPRESSION DEVICE

1.1 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a high energy transient voltage surge suppressor. The specified surge protective device shall provide effective high energy surge diversion for application in ANSI/IEEE C62.41-1991 Location Category C3 environments. Testing per ANSI/IEEE C62.45-1992 using ANSI/IEEE C62.41 Category C3 waveforms and amplitudes. UL 1449 second edition listed. The specified surge protective device shall provide:

1. 150,000 transient amps, per phase, of surge protection.
2. Protection modes: L-N, L-G, L-L, N-G.
3. Green, power present LED on front panel.
4. Remote alarms relay contact.
5. Ten year warranty on entire unit.

1.2 STANDARDS

A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, and C62.45)
2. Federal Information Processing Standards Publication 94 (FIP PUB 94)
3. National Electrical Manufacturer Association (NEMA LS-1)
4. National Fire Protection Association (NFPA 20, 70, 75 and 78)
5. Underwriters Laboratories (UL 1449 second edition) listed
6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516

B. The system individual units shall be UL listed under UL 1449 Second Edition Standard for Transient Voltage Surge Suppressions (TVSS) and the surge ratings shall be permanently affixed to the TVSS.

1.3 ENTRANCE PANEL EQUIPMENT ELECTRICAL REQUIREMENTS

A. Environmental Requirements:

1. Operating Temperature: Operating temperature range shall be -40 to +60 degrees C (-40 to +160 degrees F)
2. Storage Temperature: Storage temperature range shall be -40 to +85 degrees C
3. Relative Humidity: Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

4. Operating Altitude: The system shall be capable of operation up to an altitude of 10,000 feet above sea level.

5. Operating Voltage: Maximum continuous operating voltage shall be 115% of the nominal rated line voltage.

6. Power Frequency: The power frequency range shall be at 50 to 400 Hertz.

B. Electrical Requirements:

1. Unit Operating Voltage: The nominal unit operating voltage shall be indicated Table 1.0

Table 1.0

VOLTAGE DESCRIPTION	**JOULES 8/20 us**	**CLAMP @1Ma**	**VPEAK L-N (8/20us) 10k A**	**VPEAK L-N (8/20us) 3Ka**	**UL 1449 2ND EDITION RATINGS**
120T 120/240 VAC 1ph, 3W + gnd	6000	220V	730V	540V	500V
120Y 120/208 VAC 3ph, 4W + gnd, wye	8000	220V	730V	540V	500V
220Y 220/380 VAC 3ph, 4W + gnd, wye	20000	430V	1050V	810V	800V
240D 240 VAC 3ph, 3W + gnd, delta	20000	430V	1050V	810V	800V
240DCT* 240/120/120 3ph, 4W + gnd, hi-leg	15000	430/220 V	1050/730V	810/540V	800/500V
240Y 240/415 VAC 3ph, 4W + gnd, wye	20000	430V	1050V	810V	800V
277Y 277/480 VAC 3ph, 4W + gnd, wye	20000	510V	1230V	935V	900V
480D 480 VAC 3ph, 3W + gnd,delta	30000	865V	2020V	1530	1500V

*High-leg delta center tapped

2. Unit shall be installed in parallel with the protected equipment.

3. Protection per mode shall be: L-N 75kA, L-G 75kA, L-L 150 kA, N-G 75 kA.

4. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 150 kA. The surge life (8/20) shall be at least 10,000 occurrences @ 6 kA. The transient suppression capability shall be bi-directional and suppress both positive and negative impulses.

5. The suppressor shall be designed so as to minimize the internal surge path impedance. Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed as shown in the installation notes for best performance.

6. Equipment shall be as manufactured by MCG Electronics, Ditek, Transector or approved equal with supporting test data.

1.4 ENTRANCE PANEL PROTECTION SYSTEM COMPONENTS

A. Diagnostics: Green solid state LED indicators, per phase, shall be provided on the front cover to indicate protection status. Illuminated green LED's indicate full protection is present at the protector, and an extinguished LED shall indicate a reduction in protection on that phase.

B. NEMA 1, 12, or 4 Enclosure as indicated on the drawings: Minimum 18 gauge steel.

1.5 INSTALLATION AND MAINTENANCE

A. The unit shall be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed as close as possible to the panel board to which it is connected. Lead length shall be less than 18".

C. Detailed maintenance instructions shall be printed on the front panel to insure safety of maintenance personnel.

1.6 WARRANTY

A. Manufacturer to provide 10 year warranty to cover repair or replacement with a new device.

PART 2 -- CLASS B BRANCH PANEL SURGE SUPPRESSION DEVICE

2.1 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a high energy transient voltage surge suppressor. The specified surge protective device shall provide effective high energy surge diversion for application in ANSI/IEEE C62.41-1991 Location Category B3 environments. Testing per ANSI/IEEE C62.45-1992 using ANSI/IEEE C62.41 Category B3 waveforms and amplitudes. UL 1449 second edition listed. The specified surge protective device shall provide:

1. 100,000 transient amps, per phase, of surge protection.

2. Protection modes: L-N, L-G, L-L, N-G.

3. Green, power present LED, one per phase, on front panel.

4. Remote alarm relay contacts, Form C.

5. Ten year warranty on entire unit.

2.2 STANDARDS

A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, and C62.45)

2. Federal Information Processing Standards Publication 94 (FIP PUB 94)

3. National Electrical Manufacturer Association (NEMA LS-1)

4. National Fire Protection Association (NFPA 20, 70, 75 and 78)

5. Underwriters Laboratories (UL 1449 second edition) listed

6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516

B. The system individual units shall be UL listed under UL 1449 Second Edition Standard for Transient Voltage Surge Suppressions (TVSS) and the surge ratings shall be permanently affixed to the TVSS.

2.3 BRANCH PANEL EQUIPMENT ELECTRICAL REQUIREMENTS

A. Environmental Requirements:

1. Operating Temperature: Operating temperature range shall be -40 to +60 degrees C (-40 to +160 degrees F)

2. Storage Temperature: Storage temperature range shall be -40 to +85 degrees C

3. Relative Humidity: Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

4. Operating Altitude: The system shall be capable of operation up to an altitude of 10,000 feet above sea level.

5. Operating Voltage: Maximum continuous operating voltage shall be 115% of the nominal rated line voltage.

6. Power Frequency: The power frequency range shall be at 507 to 400 Hertz.

B. Electrical Requirements:

1. Unit Operating Voltage: The nominal unit operating voltage shall be indicated Table 2.0

Table 2.0

VOLTAGE DESCRIPTION	JOULES 8/20us	CLAMP @1Ma	VPEAK L-N (8/20us) 10Ka	VPEAK L-N (8/20us)	UL 1499 2ND EDITION 3kA
120/240 VAC 1ph, 3W + gnd	4500	220V	780V	560V	500V
120/208 VAC 3ph, 4W + gnd, wye	6000	220V	780V	560V	500V
220/380 VAC 3ph, 4W + gnd, wye	15000	430V	1150V	826V	800V
240 VAC 3ph, 3W + gnd, delta	15000	430V	1150V	826V	800V
240/120/120* 3ph, 4W + gnd, hi-leg	10000	430/220V	1150/780V	826/560V	800/500V
240/415 VAC 3ph, 4W + gnd, wye	15000	430V	1150V	826V	800V
277/480 VAC 3ph, 4W + gnd, wye	15000	510V	1330V	950V	900V
480 VAC 3ph, 3W + gnd,delta	30000	865V	2200V	1580V	1500V

*High-leg delta center tapped

2. Unit shall be installed in parallel with the protected equipment. No series connected protective elements shall be used.

3. Protection per mode shall be: L-N 50kA, L-G 40kA, L-L 100 kA, N-G 50 kA.

4. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 100 kA. The surge life (8/20) shall be at least 10,000 occurrences @4 kA. The transient suppression capability shall be bi-directional and suppress both positive and negative impulses.

5. The suppressor shall be designed so as to minimize the internal surge path impedance. Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed as shown in the installation notes for best performance.

6. Equipment shall be as manufactured by MCG Electronics, Ditek, Transector approved equal with supporting test data.

2.4 BRANCH PANEL PROTECTION SYSTEM COMPONENTS

A. Diagnostics: One green solid state LED indicators, per phase, shall be provided on the front cover to indicate protection status. Illuminated green LED's indicate full protection is present at the protector, and an extinguished LED shall indicate a reduction in protection on that phase.

B. NEMA 1, 12, or 4 Enclosure as indicated on drawings: Minimum 18 gauge steel.

2.5 INSTALLATION AND MAINTENANCE

A. The unit shall be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed as close as possible to the panel board to which it is connected. Lead length shall be less than 18”.

C. Detailed maintenance instructions shall be printed on the front panel to insure safety of maintenance personnel.

2.6 WARRANTY

A. Manufacturer to provide 10 year warranty to cover repair or replacement with a new device.

PART 3 -- CLASS A LOCAL PANEL/CONTROL PANEL SURGE SUPPRESSION DEVICE

3.1 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a shunt installed AC power line surge suppressor. The specified surge protective device shall provide effective energy surge diversion for application in ANSI/IEEE C62.41-1991 Location Category B3 environments. Testing per ANSI/IEEE C62.45-1992 using ANSI/IEEE C62.41 Category B3 waveforms and amplitudes. UL 1449 second edition listed. The specified surge protective device shall provide:

1. 50,000 transient amps, per phase, of surge protection.

2. Protection modes: L-N, L-G, L-L, N-G

3. Green, power present LED, red, protection reduced LED on front panel.

4. Ten year warranty on entire system.

3.2 STANDARDS

A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, and C62.45)

2. Federal Information Processing Standards Publication 94 (FIP PUB 94)

3. National Electrical Manufacturer Association (NEMA LS-1)

4. National Fire Protection Association (NFPA 20, 70, 75 and 78)

5. Underwriters Laboratories (UL 1449 second edition) listed

6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516

B. The system individual units shall be UL listed under UL 1449 Second Edition Standard for Transient Voltage Surge Suppressions (TVSS) and the surge ratings shall be permanently affixed to the TVSS.

3.3 LOCAL PANEL EQUIPMENT ELECTRICAL REQUIREMENTS

A. Environmental Requirements:

1. Operating Temperature: Operating temperature range shall be -40 to +60 degrees C (-40 to +160 degrees F)

2. Storage Temperature: Storage temperature range shall be -40 to +85 degrees C

3. Relative Humidity: Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

4. Operating Altitude: The system shall be capable of operation up to an altitude of 10,000 feet above sea level.

5. Operating Voltage: Maximum continuous operating voltage shall be 115% of the nominal rated line voltage.

6. Power Frequency: The power frequency range shall be at 50 to 400 Hertz.

B. Electrical Requirements:

1. Unit Operating Voltage: The nominal unit operating voltage shall be indicated in Table 3.0

Table 3.0

VOLTAGE DESCRIPTION	**JOULES 8/20us**	**CLAMP @1Ma**	**UL 1449 2ND EDITION 500A (8/20us)**
120/240 VAC 1phase, 3W + gnd	2000	220V	500V
120/208 VAC 3phase, 4W + gnd, wye	2500	220V	500V
220/380 VAC 3phase, 4W + gnd, wye	6000	430V	800V
240/120/120* 3phase, 4W + gnd, hi-leg	4000	430/220V	800/500V
240/415 VAC 3phase, 4W + gnd, wye	6000	430V	800V
240 VAC 3phase, 3W + gnd, delta	6000	430V	800V
277/480 VAC 3phase, 4W + gnd, wye	6000	510V	900V
480 VAC 3phase, 4W + gnd, delta	12000	865V	1500V

*High-leg delta center tapped

2. Unit shall be installed in parallel with the protected equipment.

3. Protection per mode shall be: L-N 25 kA, L-G 25 kA, L-L 50 kA, N-G 25 kA.

4. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 50 kA, the surge life shall be at least 200 events @ 6kA and 20,000 events @2kA. The transient suppression capability shall be bi-directional and suppress both positive and negative impulses.

5. The suppressor shall be designed so as to minimize the internal surge path impedance. Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed as shown in the installation notes for best performance.

6. Equipment shall be as manufactured by MCG Electronics, Ditek, Transector or

approved equal with supporting test data.

3.4 LOCAL PANEL PROTECTION SYSTEM COMPONENTS

A. MOVS: The suppressor shall be constructed of multiple 32 mm metal oxide varistors.

B. Self-Diagnostics: Solid state red and green LED indicators shall be provided on the front cover to indicate AC power present at the device and protection status

C. NEMA 1, 12, or 4Enclosure as indicated on the drawings: Minimum 18 gauge steel provided with mounting flanges.

3.5 INSTALLATION AND MAINTENANCE

A. The unit shall be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed as close as possible to the panelboard to which it is connected. Lead length shall be less than 18”.

C. Detailed maintenance instructions shall be printed on the front panel to insure safety of maintenance personnel.

3.6 WARRANTY

A. Manufacturer to provide 10 year warranty to cover repair or the providing of a new device.

PART 4 -- CLASS A SURGE SUPPRESSION DEVICE INSTALLED WITHIN PROTECTED EQUIPMENT

4.1 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a series installed AC power line surge suppressor. The specified surge protective device shall proved effective energy surge diversion for application in ANSI/IEEE C62.41-1991 Location Category A3 environments. Testing per ANSI/IEEE C62.45-1992 using ANSI/IEEE C62.41 Category A3 waveforms and amplitudes. UL 1449 recognized. The specified surge protective device shall provide:

1. 10,000 transient amps of surge protection.

2. L-N, L-G, H-G protected modes.

3. Green protection present LED.

4. EMI-RFI Filter.

5. Low profile construction.

6. Ten year warranty.

4.2 STANDARDS

A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41, and C62.45)

2. Federal Information Processing Standards Publication 94 (FIP PUB 94)

3. National Fire Protection Association (NFPA 20, 70, 75 and 78)

4. Underwriters Laboratories (UL Second Edition 1449 Recognized)

5. National Electrical Manufacturer Association (NEMA LS-1)

6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516

B. The system individual units shall be UL recognized under UL 1449 Second Edition Standard for Transient Voltage Surge Suppressors (TVSS)

4.3 LOCAL EQUIPMENT ELECTRICAL REQUIREMENTS

A. Environmental Requirements:

1. Operating Temperature: Operating temperature range shall be –40 to +60 degrees C (-40 to +140 degrees F).

2. Storage Temperature: Storage temperature range shall be –40 to +85 degrees C.

3. Relative Humidity: Operating shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

4. Operating Altitude: The system shall be capable of operation up to an altitude of 13,000 feet above sea level.

5. Operating Voltage: Maximum continuous operating voltage shall be 115% of the nominal rated line voltage.

6. Power Frequency: The power frequency range shall be 50-400 Hertz.

4.4 ELECTRICAL REQUIREMENTS

A. Unit Operating Voltage: The nominal unit operating voltage shall be indicated in Table 4.0.

Table 4.0

VOLTAGE DESCRIPTION	**JOULES (8/20us)**	**CLAMP @1Ma**	**VPEAK L-N**
120 VAC 1phase, 2W + G	500	220V	392V
240 VAC 1phase, 2W + G	900	425V	760V

B. Unit shall be installed in series or in parallel with the protected equipment.

C. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 10 kA. The surge life (8/20us) shall be at least 10,000 occurrences @ 500A. The transient suppression capability shall be by-directional and suppress both positive and negative impulses.

D. The suppressor shall be designed so as to minimize the internal surge path impedance.

Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed as shown in the installation notes for best performance.

E. Equipment shall be as manufactured by MCG Electronics, Ditek, Transector or approved equal with supporting test data.

F. The suppressor shall contain a common mode noise filter with specifications as in Table 4.1:

Table 4.1

FILTER ATTENUATION (50 ohm)	**FREQUENCY**
-20db	45 kHz
-30db	75 kHz
-40db	150 kHz
-50db	250 kHz
-60db	450 kHz

4.5 EQUIPMENT LEVEL PROTECTION SYSTEM COMPONENTS

A. MOVS: The suppressor shall be constructed of multiple metal oxide varistors.

B. Self-Diagnostics: An illuminated green solid state LED indicator shall be provided on the front cover to indicate protection is present at the device.

C. Connection: Solderless Screw Terminals or hard wired leads less than 12 inches.

D. Enclosure: High-impact plastic.

4.6 INSTALLATION AND MAINTENANCE

A. The unit shall be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed within the equipment to which it is connected.

4.7 WARRANTY

A. Manufacturer to provide 2 year warranty to cover repair or replacement with a new device.

- END OF SECTION -

SECTION 16611 - STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section covers the requirements for uninterruptible power supplies (UPS's) to be provided as shown on the Plans.

1.2 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000 General Electrical Requirements, and the Contract Documents, prior to installation.

1.3 REFERENCES

A. National Electrical Code (NEC) Article 250

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The UPS equipment shall be manufactured by Powerware, or equal.

B. The UPS shall be sized for a minimum of 30 minutes of backup power for its connected load.

C. The UPS shall be a line-interactive type, consisting of a ferroresonant or linear transformer, battery charger, batteries, inverter, and microprocessor control. The batteries shall be maintenance free, premium type.

D. The UPS shall pass lightning and surge protection ANSI/IEEE C62.41 standards, Category A and B. The UPS shall be UL 1449 listed.

E. The output waveform shall be a pure sine-wave with less than 5% total harmonic distortion on the inverter.

F. The UPS shall have a digital display for load-dependent runtime, volts in, volts out, battery voltage, percent loading, and alarm codes.

G. The UPS shall operate between 0 and 40 degrees C, at a minimum of 95% efficiency on-line.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the UPS equipment in accordance with the manufacturers' recommendations.

B. The UPS shall be provided with a 2 year parts and factory service warranty.

- END OF SECTION -

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SECTION 16902 - ELECTRICAL CONTROLS, RELAYS, AND ALARMS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This Section includes the following:

1. Pushbutton and Selector Switches
2. Relays
3. Alarms
4. Intrinsic Safety Barriers
5. Wire-ways
6. Watt-hour Transducers
7. Elapsed Time Meters and Time Clocks

1.2 RELATED SECTIONS

A. Section 16000 General Electrical Requirements

B. Section 16160 Enclosures

1.3 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control Systems.

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

D. NEMA ST 1 - Standard for Specialty Transformers (except General Purpose Type).

1.4 SUBMITTALS

A. Data - a complete list of equipment and material including manufacturer's descriptive data and technical literature, performance charts, catalog cuts and installation instructions, spare parts data for each of the different items of equipment specified. The data shall include a complete Bill of Materials.

B. Drawings - containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, anchorage, support and appurtenances of equipment and equipment relationship to other parts of the work including clearances for maintenance and operations.

C. Submit shop drawings in accordance with the Contract Documents, and NEMA ICS 1 specifications indicating control panel layouts, dimensions, support points, wiring connections and diagrams.

1.5 PROJECT RECORD DOCUMENTS

A. Submit record documents in accordance with the Contract Documents.

B. Accurately record actual locations of control equipment. Revise diagrams included in Drawings to reflect actual control device connections.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation data in accordance with the Contract Documents.

B. Include instructions for adjusting and resetting time delay relays, timers, and counters.

C. Submit maintenance data in accordance with the Contract Documents.

D. Include recommended preventative maintenance procedures and materials.

PART 2 -- PRODUCTS

2.1 PUSHBUTTONS AND SELECTOR SWITCHES

A. Pushbuttons, pilot lights and selector switches shall be of the full size, heavy-duty industrial, oil tight, 120 volt, with interchangeable pilot lights, plug-in construction, double break silver contacts, chrome plated lock rings, with modular contacts, and NEMA rating equal to that of the enclosure on which devices are installed. All components shall be flush mounted on front of panel, unless otherwise noted.

B. Provide individual legend plates for indication of switch, pushbutton, and light function (e.g., Open, Closed, Hand-Off-Auto). A list shall be submitted for review and approval.

C. Pilot lights shall be high intensity LED type. Pilot lights shall have clear lenses and LED lamps colored as shown on the Plans. Common, remote push-to-test circuitry shall be provided for each control panel to simultaneously test all indicating lights on the panel using a single pushbutton when there are 10 or more lights on the panel. Control panels with less than 10 lights shall utilize individual push-to-test lights and control circuitry.

D. Pushbuttons shall be maintained as shown on the Drawings. Momentary requirements shall be followed. Provide extended head pushbutton for all stop functions, mushroom head for emergency stop functions, and flush head pushbuttons for all other functions. Where indicated on the Drawings pushbuttons shall be illuminated type. Provide locking mechanism for all lock out functions. Selector switches shall have black knob operator, be maintained contact type unless noted otherwise. The number and arrangement will be able to perform intended functions specified but not less than one double pole, double throw, double break contact per switch. Contact rating shall be compatible with AC or DC throughput current of devices simultaneously operated by the switch contact but not less than 10 amperes resistive at 120 volts AC or DC continuous.

E. Potentiometers shall be provided with operators and resistive elements of the type. The quantity will be indicated on the Drawings and as required with legend plates indicating percent of span.

F. The above devices shall be manufactured by Square D, Allen Bradley, General Electric, or equal.

2.2 RELAYS

A. TIMING RELAYS shall be heavy duty, 300V A.C., 10 amps, solid state design, poles as required per application, -10°C to +60°C, have timing repeatability of ±2.0% of setting, and be UL listed. The range shall be determined from the control descriptions and or schematic drawings. Provide mounting accessories, as required. The timing relays shall be manufactured by Allen Bradley, Square D, Cutler Hammer, or equal.

B. CONTROL RELAYS shall be of the plug-in socket base type with dust-proof plastic enclosures, with silver-cadmium oxide contacts rated 300-volt, 10 amperes, with contact arrangement and operating coils of the proper voltage as required by the control circuit sequence. Relays shall have indicating lamp to show energized state. Each relay shall have a minimum of two double pole, double throw contacts, or as required. Control relays shall be Allen Bradley, Square D, Cutler Hammer, or equal.

C. ALTERNATING RELAYS shall be UL listed, 120 VAC, with contacts rated for 10 amperes at 120 VAC, life expectancy of 100,000 operations, load indicating LED's, and switch for load locking and load selecting options. Alternating relays shall be manufactured by TimeMark models 261, 271, and 471, and Diversified Electronics model ARA for duplex, triplex, and quadplex alternators.

2.3 ALARMS

A. AUDIBLE ALARMS shall be UL listed, 120 VAC, with solid state circuitry, vibrating horn, non-metallic corrosion resistant housing, with required mounting hardware, suitable for outdoor use capable of producing 100 dB at 10 feet. The audible alarm shall be manufactured by Federal Signal model 350, Edwards model 870-EX, or equal.

B. ROTATING BEACONS for interior and/or exterior locations shall be UL listed, 120 VAC, with motor and cooling fan, rotating lights at 60 times per minute minimum, capable of producing 36000 candlepower with required mounting hardware. Lens color shall be verified at the time of construction. The rotating beacons shall be manufactured by Federal Signal model 371L or equal.

2.4 INTRINSIC SAFETY BARRIERS

A. INTRINSIC SAFETY BARRIERS shall permit connection of devices located in a hazardous area to other devices located in a safe area. Intrinsic safety barriers shall be EMC compliant, 10 to 35 V dc, 35 mA output current, hazardous area terminals identified by blue labels, terminals accommodating conductors up to 12 AWG, ambient temperature rating of –20 to +60°C. The intrinsic safety barriers shall be manufactured by MTL Inc., Ronan Engineering Co., Phoenix Contact, R. Stahl Inc., or equal.

2.5 WIREWAYS

A. WIRE-WAYS shall be PVC, snap-in slot design, with non-slip cover. Safe area wire-ways shall be light gray and marked "Safe Area Wiring." Hazardous area wire-ways shall be intrinsic blue and marked "Hazardous Area Wiring." The wire-ways shall be manufactured by Panduit Corporation, or equal.

2.6 WATT-HOUR TRANSDUCERS

A. WATT-HOUR TRANSDUCERS for active or reactive power shall be DIN rail and surface mount, single phase or three phase with balanced or unbalanced load, electrically isolated input and output signals, 4 to 20 mA output signal, 0-10 mA to 0-10

A input current, 0-10 V to 0-600 VAC input voltage, 16-500 Hz selectable frequency. The watt-hour transducers shall be manufactured by Sineax model PQ502, or equal.

2.7 ELAPSED TIME METERS AND TIME CLOCKS

A. ELAPSED TIME METERS shall be self powered, non-reset, solid state counter which provides silent, accurate and noise immune operation. Elapsed time meters shall require no external power, five year minimum battery life, 120 VAC power, accessories for panel mounting, nameplate below LCD display reading “HOURS”, liquid crystal display with 6 digits approximately 2 inches high with 50,000 hour minimum display life and indication of sufficient battery power. The elapsed time meters shall be manufactured by Durant, Automatic Timing and Controls a Division of Sycon Corp., or equal.

B. TIME CLOCKS shall be microprocessor based, have 24 hour time control, up to 24 operations per day, programmable from panel face keys, skip-a-day feature allowing schedule to be skipped for one to seven days, SPDT switch contact rated at 15 amps at 120 V AC, with battery carryover to maintain time and program during power outage for 275 hours. The time clocks shall be manufactured by Tork, Paragon Electric Company, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasteners shall be type 304 stainless steel.

B. Install devices in strict accordance with NEC requirements and per manufacturer’s recommendation.

C. Coordinate with other trades as necessary during installation of these devices.

3.2 ACCEPTANCE

A. All installations are subject to evaluation in accordance with NEC requirements and manufacturers recommendations. Contractor shall remove the unacceptable work and correct work at no charge to Owner.

- END OF SECTION -

SECTION 16903 - PROGRAMMABLE LOGIC CONTROLLERS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section covers the programmable logic controller (PLC) used for control and monitoring, as indicated on Plans. The Contractor will provide PLC programming unless otherwise indicated on the drawings.

B. Provide one full version copy of RSLogix 5000 with RSLinx programming software, and support and debugging time for a period of fifteen (15) days after start-up of the equipment under PLC control.

C. Provide one full version copy of Operator interface software if operator interface is provided for this project.

1.2 SUBMITTALS

A. Submittals shall include the following:

1. Manufacturer's data on electrical characteristics, capabilities and physical properties.

2. Wiring diagrams showing connections to all devices; input and output (I/O), analog and discrete. The wiring diagrams shall indicate the I/O address point to be used in the PLC programs.

1.3 MANUFACTURERS

A. The PLC shall be manufactured by Allen Bradley and shall be a CompactLogix or ControlLogix series, no equal.

PART 2 – PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLER

A. PLCs shall be furnished with hardware and software necessary to monitor and control equipment, as listed in the specifications, and shown on the Plans. Each field input and output shown as an I/O Point shall be connected as per the manufacturers' recommendations. Additionally, the Contractor shall provide the hardware, software, and installation necessary for connecting additional future equipment as indicated on the Plans. The type of field input and output shall be defined as follows unless specified on the plans:

1. Analog inputs and outputs (4-20 mA DC).

2. Discrete inputs (dry contact).

3. Discrete outputs (24 VDC, form "C" relay)

B. Vendor supplied PLC's shall be programmed and factory tested by the Vendor. Programming of PLC's shall be per Section 17700.

C. Contractor supplied PLC's shall be programmed as noted in section 1.01 of this specification. The programming of Contractor supplied PLC's shall be per Section 17700 if required.

D. The programmable controllers shall be supplied with Ethernet/IP communication modules or have the Ethernet/IP communication port directly on the processor, and with a TOD clock and battery back as shown on the Plans.

2.2 CENTRAL PROCESSING UNIT (CPU)

A. The PLC CPU shall be a microprocessor based industrial controller with a temperature rating of 0 to 60 degrees C, and a humidity rating of 5 to 85% non-condensing, minimum. The CPU shall have internal memory of a minimum 768 kbytes for user-programmed instructions and 64 megabytes of CompactFlash non-volatile memory available.

B. The PLC shall have tag-based memory which shall retain information on power failure. Each tag shall be capable of storing 32 bits of data. This information shall represent process set points, timer and counter presets, accumulated values, positions, or other measured process variables.

C. Program control and logic functions shall be solved sequentially during each CPU scan. The scanning tasks shall include, at a minimum:

1. Update of time reference from a built-in real-time clock.

2. Diagnostic self-test of PLC to include input and output.

3. Reset watchdog timer which shall be used to verify correct functioning of the PLC and which shall be preset to 100 to 250 milliseconds.

D. The CPU shall have an I/O capacity of 500 points, 64 analog loops, and be capable of addressing a minimum of 3 local and remote I/O racks.

E. LED indicators shall display RUN, LAN ACT, and LAN ST status information.

F. A network interface module, mounted on the base, or integral port within the CPU, shall be provided for TCP/IP and IPX protocols.

2.3 INPUT/OUTPUT MODULES

A. Input and output bases shall have screw-in type terminals.

B. Analog inputs and outputs shall have a minimum of 12 bits resolution. Analog modules shall be configurable for 4 to 20 mA DC, or 1 to 5 Volt DC signals. Provide external, or user power, as needed.

C. Each discrete output module shall be fused and shall have interposing relays, with fuse blown indicators on each module. Indicator lights shall also be provided on each I/O point to indicate status of each signal. Each individual input or output point shall be optically isolated to protect the controller I/O circuitry from high voltage transients.

D. The power supply shall provide power for the processor, and I/O modules. The power supply shall have built-in over-voltage and under-voltage detection circuitry, protection against overcurrent conditions, and automatic power-up sequence that enables outputs only when proper operating tolerances are reached. Power requirements shall be 24 VDC.

E. The I/O system shall be field expandable to the maximum I/O capacity of the CPU, without modifications of the processor. Provide 25% blank, or empty base space for future bases.

F. The PLC system shall be provided with base type I/O, connected to the CPU via a dedicated remote I/O bus port, and be able to communicate over a shielded twisted pair cable at rate of one million bits per second, or greater.

2.4 STORAGE AND DOWNLOADING OF PLC PROGRAMS

A. The PLC shall be programmable through an RS-232 port, or Network Port, connected to a personal computer through a standard cable. The PLC programming software shall be provided with the user's manuals, original CDs, and licensing agreement for registration by the Owner. Cables, adapters, connectors, or other hardware required to connect a PC to the PLC, shall be provided to the Owner.

B. The PLC programming software shall enable the user to write the PLC program on-line or off-line. The software shall include utilities to manage PLC program files, document and print the programs, configure the programming environment, monitor and force the PLC addresses while on-line, and configure the PLC memory and addressing structure.

2.5 OPERATOR INTERFACE

A. The operator interface shall communicate over the buss structure or Ethernet. The operator interface if not specified on the plans shall be an 10” color touch screen. The contractor shall supply the owner with a copy of the programming software and required programming cables for the operator interface. The operator interface shall have 64 MB of memory minimum and shall be powered by 24V DC. The following manufacturers will be acceptable if not specified on the plans:

1. Allen Bradley Panel View Plus 1000

2. Modicon Magelis XBGT5330

PART 3 - EXECUTION

3.1 INSTALLATION

A. PLC shall be installed as indicated on the Plans and according to the manufacturer's instructions.

3.2 START UP AND TESTING

A. Upon completion of the installation, start-up shall be performed by a factory-trained manufacturer representative. Operating and maintenance instruction books shall be supplied upon delivery of the unit and procedures explained to operating personnel.

B. The PLC program and I/O shall be thoroughly tested. Each input and output signal shall be tested for correct indication and control function. The Contractor shall demonstrate operation of the PLC inputs and outputs with simulated signals, and then tested with the Owners programmer and the control logic before the entire system is started, and run in automatic mode.

3.3 TRAINING

A. Provide four (4) hours of training on the control system. Instruction shall include a description of the control system hardware operation and equipment troubleshooting.

3.4 SPARES

A. Furnish a minimum of one (1) spare I/O base of each type, one (1) spare processor, One (1) spare Modbus Option Adapter, and one (1) power supply module.

B. Furnish twelve (12) fuses of each type and size, used in the power supply and I/O modules.

- END OF SECTION -

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SECTION 16940 – COMMUNICATION CABLING SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENTS

A. The CONTRACTOR shall implement a Structured Cabling System (SCS) complete and operable in accordance with the Contract Documents.

B. The requirements of this Section apply to all components of the SCS unless indicated otherwise.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 – Contractor Submittals and the following:

1. The CONTRACTOR shall coordinate the installation of the SCS such that the complete SCS will be provided and will be supported by accurate Shop Drawings and Record Drawings

2. Exchange of Technical Information: During the period of these submittals, the CONTRACTOR shall authorize a direct, informal liaison with the ENGINEER for exchange of technical information. As a result of this liaison, certain minor refinements and revisions in the systems as indicated may be authorized informally by the ENGINEER, but will not alter the scope of work or cause increase or decrease in the Contract Price. During this informal exchange, no oral statement by the ENGINEER shall be construed to give approval of any component or method, nor shall any statement be construed to grant exception to or variation from these Contract Documents.

B. Shop Drawings

C. Technical Manuals

D. Record Drawings

1.3 SPECIAL WARRANTY REQUIREMENTS

A. Manufacturer Warranty

1. CONTRACTOR shall provide a Ten (10) year warranty on the following items:

B. Fiber Optic Cabling

C. Fiber Optic Terminations and Cross-Connect Equipment

D. Outside-Plant (OSP) Category 5e Cabling

E. Copper Patch Panels and Indoor Category 6 Cabling

F. CTC Hardware (excluding UPS and other electronic devices)

G. Extended Period for Correction of Defects: The CONTRACTOR shall correct all defects in the SCS upon notification from the OWNER within 2 years from the date of Substantial Completion. Corrections shall be completed within 5 days after notification.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Code and Regulatory Compliance

1. Telecommunications Industry Association / Electronic Industries Association (TIA/EIA) 568B – Commercial Building Telecommunications Cabling Standards

2. TIA/EIA 569B – Commercial Building Standard for Telecommunications Pathways and Spaces

3. International Standards Organization/International Electrotechnical Commission (ISO/IEC) 11801 – Information Technology – Generic cabling for customer premises

4. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program

5. National Electrical Manufacturers Association (NEMA)

6. American Society for Testing Materials (ASTM)

7. National Electric Code (NEC®)

8. Institute of Electrical and Electronic Engineers (IEEE)

9. UL Testing Bulletin

B. Current Technology: Cabling, Hardware and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the Shop Drawings unless otherwise required to match existing equipment.

C. Hardware Commonality: All fiber cabling

2.2 EQUIVALENT PRODUCTS

A. Equivalent products may be considered for substitution for those products specified, however, the equivalent product must be approved and show demonstrated and documented equivalence to the product specified. Documentation shall include, but is not limited to: product samples, data sheets, and actual test data. The request for product substitution and supporting documentation must be submitted in writing prior to submitting the bid. Written approval for product substitution must be submitted with the bid.

2.3 FIBER OPTIC CABLING

A. Fiber optic cabling shall be provided between facilities and furnished with the quantity of fibers as designated on the contract drawings.

B. All fiber in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers may not be used without written permission.

C. Multimode Fiber Specifications

1. All fiber optic cables within the premises shall use multimode, graded-index fibers with 50 micron cores only.

2. Optical Specifications

a. Fibers shall have dual wavelength capability at 850nm and 1300nm.

b. Attenuation: ≤ 3.0 dB/km at 850nm and 1.5 dB/km at 1300nm.

c. Bandwidth: Effective Modal Bandwidth of 4700 MHz*km and shall guarantee operation of 10 Gigabit Ethernet at 550 meters at 850nm.

d. Numerical Aperture: 0.200 ± 0.015

3. All fibers shall be color coded to facilitate individual fiber identification. Fibers shall have CPC® or approved equivalent color coatings that resist color degradation, minimize microbending losses and improve handling. The coating shall be mechanically strippable.

4. Dimensional Specifications

a. Core Diameter: 50.0 ± 2.5 µm

b. Cladding Diameter: 125.0 ± 2.0 µm

c. Core-Clad Concentricity: ≤ 1.5 µm

d. Cladding Non-Circularity: ≤ 1.0%

e. Core Non-Circularity: ≤ 5.0%

f. Coating Diameter: 245 ± 5 µm

g. Coating-Cladding Concentricity: < 12 µm

5. Environmental Specifications

a. Operating Temperature: -60ºC to +85ºC

6. Mechanical Specifications

a. Minimum tensile strength: 100,000 psi

b. Fiber Minimum Bending Radius: 0.75 Inches

c. Cable Minimum Bending Radius (During Installation): 20 times cable diameter

d. Cable Minimum Bending Radius (After Installation): 10 times cable diameter

e. Cable shall be rated for Underground, Buried and Aerial, OSP

f. Cable shall bear OFNP (Plenum Rated), OFNR (Riser Rated) and/or appropriate markings for the environment in which they are installed.

g. Cable shall be UV resistant, waterproof, and utilize 3.0mm buffer tubes containing up to twelve 250 µm color-coded optical fibers.

7. Fiber Cabling shall be Corning FREEDM LST 012SSF-T4190D20 or approved equal.

D. Innerduct

1. All fiber cabling shall be run in innerduct and terminated in the CTC. The innerduct shall be sized by the CONTRACTOR.

E. Buffer Tube Fiber Fan-Out Kits

1. Buffer Tube Fan-Out Kits shall be supplied for the termination of each buffer tube at end of the installed fiber cables.

2. Fan-Out Kits shall be color coded to match the color scheme of the fiber cabling.

3. Fan-Out Kits shall have a minimum length of 25 inches

4. Fan-Out Kits shall be Corning FAN-BT25-12 or approved equal.

F. Fiber Optic Connectors

1. Fiber Optic Connectors shall not require the use of epoxy of polish.

2. Fiber Optic Connectors shall be of ceramic construction for 50 µm fiber at bandwidths of 4700 MHz and shall have a loss ≤ 0.5 dB.

3. Fiber Optic Connectors shall utilize the SC type connector.

4. Fiber Optic Connectors shall be Corning UniCam 95-050-41-X or approved equal.

G. Fiber Patch Cords

1. The fiber patch cord shall be duplex and consist of buffered, graded-index fiber with a 50 µm core and a 125 µm cladding for multimode. The fiber cladding shall be covered by aramid yarn and a jacket of flame-retardant PVC.

2. The fiber patch cord shall be rated for 10 Gigabit Ethernet.

2.4 FIBER TERMINATION TOOLKIT

A. Fiber Termination Toolkit shall be provided to the OWNER following the completion of the SCS installation. The Toolkit shall be compatible with the Connectors used for terminating the fiber cabling and shall have the necessary components to make at least 100 additional terminations.

B. The Toolkit shall contain hard copies of installation instructions as well as an installation video that illustrates the step-by-step procedure for installing the Fiber Optic Connectors.

C. The Toolkit shall have test equipment that is capable of determining if a Connector was installed correctly.

D. The Toolkit must be an approved installation system of the manufacturer of the fiber optic cabling and connectors.

E. The Toolkit shall be the Corning TKT-UNICAM-ELITE or equal.

2.5 CROSS-CONNECT EQUIPMENT

A. Cross-Connect Housings shall be provided within each CTC for permanent termination of the fiber optic cabling. The Housing shall be 19" rack mountable and shall be capable to support the termination of four 12-strand fiber optic cables.

B. The Housing shall be suitable for both loose tube, tight-buffered and optical fiber ribbon cables.

C. The Housing shall have a slide-out drawer for easy connector access.

D. The Housing shall be lockable.

E. The Housing shall be the Corning CCH-02U or approved equal.

F. Adapter Panels for the Cross-Connect Housings shall utilize SC type connectors and shall be of ceramic construction for 50 µm fiber at bandwidths of 4700 MHz and shall have a loss ≤ 0.5 dB. The Adapter Panel shall be the Corning CCH-CP12-E7 or approved equal.

2.6 19" ALUMINUM RACK SYSTEM

A. The 19" Aluminum Rack System shall be able to support and organize electronic equipment, cross-connection and/or termination hardware for fiber optic cabling, station cabling, riser cabling, or building entrance cabling as may be required by design. The rack face shall have a conventional equipment mounting width of 19". The rack must be designed for cable and jumper management and have hardware to organize and support cabling and patch cords in the vertical and horizontal planes. The rack system shall be equipped for electrical grounding to meet EIA/TIA 606 Standards. The fastening system for the equipment shall facilitate easy installation with roll-formed threads in the screw holes for greater strength and durability. The mounting screws shall have pilot points. All rack components shall be charcoal black in color and made of lightweight 6061-T6 extruded aluminum. The rack shall be shipped with all necessary hardware to assemble the included frame. It shall be packed in cartons with suitable shipping inserts such that no damage occurs to the rack finish. The finish shall not be scratched, chipped or marred.

B. Rack Specifications

1. Self Supported Rack Framework

a. The self-supporting equipment rack shall be inside the Communications. Termination Cabinet (CTC). Standard grade frames shall be capable of supporting equipment to be mounted inside the CTC.

b. Dimensions: As required to fin in CTC with 19 inch center mounting and a minimum of 67” of usable vertical space. Base Footprint of 20.25” wide by 15” deep.

c. Hole Pattern: EIA310-D 5/8” – ½” alternating

d. Mounting Screws: #12-24 thread combination Phillips/straight heads and pilot points.

e. Materials: 6061-T6 high strength aluminum

f. Flanges: Flange edge to edge internal measurement is 17.75”

2. Communications Termination Cabinets (CTC)

a. Racks shall be mounted inside NEMA 1 Enclosures with front and rear access doors.

b. Enclosures shall have glass front doors and solid vented rear doors.

c. Approved ground lug and #6 AWG jacketed green ground wire.

d. CTC’s shall be installed with at least 36” clear working space in front and behind cabinet.

e. CTC’s shall be installed in the Electrical equipment room at each building.

f. CTC’s shall be minimum 72” tall free standing enclosures.

g. CTC’s shall have a slide-out shelf suitable for a laptop computer to be placed on it for system configuration/programming. The shelf shall be vented. The shelf shall be CPI 12335-719 or approved equal.

h. CTC’s shall have a vertical power strip installed with a minimum of 10 outlets rated at 15 amp. The vertical power strip shall be surge protected.

i. CTC’s shall be Rittal, Great Lakes, CPI or equal.

2.7 FIBER SPLICING AND CLOSURES

A. No fiber splicing or closures are allowed.

2.8 COPPER NETWORK CABLING

A. Outside Plant Cabling (OSP)

1. All building-to-building fiber optic cabling will have run with it two shielded, outside plant (OSP), Category 5e cables for miscellaneous use such as analog telephones or modems.

2. The cabling shall be terminated in the CTC in each building and shall be punched down at the patch panel on the CTC. The shield shall be grounded only on one end of the cable inside the CTC.

3. Shielded OSP Category 5e Specifications

a. Category 5e Transmission performance characterized to 100MHz.

b. Aluminum metallic shield tape for protection against EMI/RFI

c. Four 24 AWG solid twisted pairs

d. UV/Sunlight resistant black jacket

e. Cable shall be Superior Essex BBDNE 04-003-54 or approved equal.

B. Indoor Cabling

1. Network cabling from the CTC's to wall jacks, control panels, MCCs, phones and all other Ethernet devices shall utilize Category 6 unshielded cable. The Category 6 cable shall be rated for Plenum use if it is ran through any Plenum rated areas, otherwise it shall be rated for Riser use.

2. The following color scheme shall be utilized for indoor network cabling:

a. Blue – Wall Jacks for computers, printers, phones, etc.

b. Gray – Control Panels or MCCs

c. Yellow – Patch Cables within the CTC

d. Black – Outside Plant (OSP) cables

e. Red – Security System / Fire System Cables

f. Pink – Miscellaneous Ethernet devices

3. Unshielded Category 6 Specifications

a. Category 6 Transmission performance characterized to 500MHz.

b. Four 23 AWG solid twisted pairs

c. Plenum rated cable shall have FEP insulation with a FRPVC jacket

d. Riser rated cable shall have FRPE insulation with a PVC jacket.

4. Patch Cords

a. Patch cords shall be TIA/EIA Category 6 Compliant. Cords shall be straight through unless cross-over is necessary. Cords shall be 24AWG stranded copper with FRPE insulation and a PVC jacket. RJ45 jack shall have contacts with 50 micro-inch gold plating and a high-impact, UL 94V-0 rated thermoplastic housing.

b. Patch cords shall have a molded boot cover for protecting the RJ45 connector.

c. All patch cords in the CTC shall be yellow.

2.9 PATCH PANEL

A. The patch panel shall be a 19” rack mountable 110 punch down to RJ45 jack panel. The panel shall support Category 3, 5, 5e and 6 applications. The 110 punch blocks shall support wiring and be labeled for both T568A and T568B standards. The patch panel shall have at a minimum 48 RJ45 ports and at least 12 spare ports. Each RJ45 port shall have a plastic label holder for custom labels.

2.10 WALL JACKS AND PLATES

A. Jacks shall be TIA/EIA Category 6 Compliant and shall support wiring and be labeled for both T568A and T568B standards. Plates shall be constructed of high-impact, flame-retardant, UL 94V-0 thermoplastic. Plates shall be available in single gang with 1-4 ports and double gang with 8 ports. Color of jacks and plates shall be determined by the OWNER.

2.11 UNINTERUPTIBLE POWER SUPPLY (UPS)

A. Each CTC shall have a 1000VA UPS installed in it for surge protection and battery backup of critical network equipment. The UPS shall be 19” rack mountable.

B. UPS Specifications

1. Electrical Input Specifications

a. Nominal Voltage: 120VAC

b. Voltage Range: 80-144VAC

c. Input Power Factor: > 0.95

d. Frequency: 60 Hz

e. Frequency Range: 57-63 Hz.

2. Electrical Output Specifications

a. Voltage Regulation: ± 3% of Nominal

b. Efficiency: > 85%

c. Frequency Regulation: ± 3 Hz on utility, ± 1 Hz on battery

3. Communications Specifications

a. A RS-232 serial port and/or a USB port shall be available for monitoring and configuring the UPS. An appropriate cable shall be supplied to connect to the UPS with a PC.

b. An Ethernet port shall be available as an option with the ability to monitor and configure the UPS over an Ethernet network.

4. Battery Specifications

a. All batteries shall be sealed, lead-acid batteries and shall be maintenance free. Batteries shall be hot-swappable. The UPS will indicate when the battery is weak and needs to be replaced.

b. The UPS shall be able to accept additional battery modules to extend the runtime of the UPS. Each UPS shall be capable of running the connected load for a minimum of 30 minutes.

c. UPS shall be Powerware 9125-1000 05146002-6501 or approved equal.

PART 3 -- EXECUTION

3.1 WORKMANSHIP

A. Components of the SCS system shall be installed in a neat, workmanlike manner. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the system. Identification markings and systems shall be uniform. TIA/EIA 568B wiring codes as shown on the drawings shall standardize all SCS wiring.

3.2 INSTALLATION

A. The CONTRACTOR shall utilize personnel to accomplish, or supervise the physical installation of all elements, components, accessories, or assemblies which it provides. The CONTRACTOR shall employ installers who are skilled and experienced in the installation and connection of all elements, components, accessories, and assemblies it provides.

B. All components of the SCS shall be the installation responsibility of the CONTRACTOR unless specifically noted otherwise. After the installation of the SCS is completed, the installation shall be inspected jointly by the CONTRACTOR and the Equipment Manufacturer's representatives. Any problems shall be corrected, and when both are satisfied with the installation, a written certification of the installation shall be delivered to the ENGINEER. The certification shall state that all cabling, terminations, CTCs and grounds have been inspected and are installed in accordance with the manufacturer's guidelines.

C. All installations shall be done in conformance with EIA/TIA 568B standards and with the manufacturer's installation requirements. The CONTRACTOR shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the CONTRACTOR to provide in a timely fashion the additional material and labor necessary to properly rectify the failure. Any and all damage to the cables during the construction of this project is the sole responsibility of the CONTRACTOR.

D. Bonding and Grounding

1. The CONTRACTOR shall be responsible for providing an approved ground at all newly installed CTC as well as ensuring bonding to any existing facilities. The CONTRACTOR shall be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes and framework. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Grounding must be in accordance with the NEC, NFPA and all local codes and practices.

E. Power Separation

1. The CONTRACTOR shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus.

F. Miscellaneous Equipment

1. The CONTRACTOR shall provide any necessary screws, anchors, clamps, tie wraps, distribution rings, wire molding, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the SCS.

G. Special Equipment and Tools

1. It shall be the responsibility of the CONTRACTOR to furnish any special installation equipment or tools necessary to properly complete the SCS. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable wrenches.

H. Labeling

1. The CONTRACTOR shall be responsible for printed labels for all cables and cords, distribution frames, and outlet locations, according to OWNER specifications. No labels are to be written by hand.

I. Cable Storage

1. The CONTRACTOR shall not roll or store cable reels without an appropriate underlay and the prior approval of the OWNER.

3.3 DAMAGES

A. The CONTRACTOR will be held responsible for any and all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:

1. Damage to any portion of the building caused by the movement of tools, materials or equipment

2. Damage to any component of the construction of spaces “turned over” to the CONTRACTOR.

3. Damage to the electrical distribution system and/or space “turned over” to the CONTRACTOR.

4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the CONTRACTOR or other actions of CONTRACTOR.

3.4 PENETRATIONS OF WALLS, FLOORS AND CEILINGS

A Prior Consent

1. The CONTRACTOR shall make no penetration of existing walls, floors and/or ceilings without the prior consent of the OWNER.

B Sealing penetrations

1. Where penetrations through acoustical walls, fire-rated doors or other walls for cableways are to be installed, such penetrations shall be sealed by the CONTRACTOR in compliance with applicable code requirements.

3.5 TESTING

A. Optical Fiber Cable Testing

1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless approved in writing by the ENGINEER. Testing shall consist of a bidirectional end to end OTDR trace performed per EIA/TIA 455-61 or a bidirectional end to end power meter test performed per EIA/TIA 455-53A. All tests shall be conducted using 200ft launch cables. The system loss measurements shall be provided at 850 and 1310 nanometers for multimode fibers.

2. The CONTRACTOR shall test all fiber optic cable prior to the installation of the cable. The CONTRACTOR shall assume all liability for the replacement of the cable should it be found defective at a later date.

3. Loss Budget: Fiber links shall have a maximum loss of:

a. (3.0 dB loss/km)*(km of fiber in link) + (0.5dB) * (number of connectors)

b. Note that a mated connector to connector interface is defined as a single connector for the loss calculation.

c. Any link not meeting the requirements of the standard shall be brought into compliance by the CONTRACTOR, at no charge to the OWNER.

4. Documentation of all fiber optic cabling tests shall be provided in both hard and electronic copies to the ENGINEER.

B. Copper cable testing

1. Testing of all copper wiring shall be performed prior to system commissioning. All Ethernet cabling shall be certified for conformance to EIA/TIA 568B for Category 6. Testing shall be done with a TIA/EIA Certified Level 3 test set. Test shall include length, mutual capacitance, characteristic impedance, attenuation, near-end and far-end crosstalk. Any pairs not meeting the requirements of the standard shall be brought into compliance by the CONTRACTOR at no charge to the OWNER.

2. Documentation of all copper cabling tests shall be provided in both hard and electronic copies to the ENGINEER.

3.6 COMPLETION OF WORK

A. At the completion of the SCS, the CONTRACTOR shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above will be by the CONTRACTOR and at no cost to the OWNER. If the CONTRACTOR fails in its duties under this paragraph, the OWNER may upon notice to the CONTRACTOR

perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the CONTRACTOR.

3.7 INSPECTION

A. On-going inspections shall be performed during construction by the CONTRACTOR and by the ENGINEER to ensure that all work is performed in a high quality manner and the overall appearance is clean, neat and orderly. The following points will be examined and must be satisfactorily complied with:

- Is the design documentation complete? Are all cables properly labeled, from end-to-end?
- Have all terminated cables been properly tested in accordance with the specifications for the specific category as well as tested for opens, shorts, polarity reversals, transposition and presence of AC and/or DC voltage?
- Is the cable type suitable for its pathway? Are the cables bundled in parallel?
- Have the pathway manufacturer's guidelines been followed? Are all cable penetrations installed properly and fire stopped according to code?
- Has excessive cable bending been avoided?
- Have potential EMI and RFI sources been considered?
- Is Cable Fill Correct?
- Are hanging supports within 1.5 meters (5 feet)?
- Does hanging cable exhibit some sag?
- Are telecommunications closet terminations compatible with applications equipment?
- Have Patch Panel instructions been followed?

  - jacket removal point

  - termination positions

  - all pair terminations tight with minimal pair distortions

  - twists maintained up to Index Strip
- Are identification markings uniform, permanent and readable?

- END OF SECTION -

SECTION 16950 - ELECTRICAL TESTING

PART 1 – GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):

   a. 450, Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generator Stations and Substations.

   b. C2, National Electric Safety Code.

   c. C37.20.1, Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

   d. C37.20.2, Metal-Clad and Station-Type Cubicle Switchgear.

   e. C37.20.3, Metal-Enclosed Interrupter Switchgear.

   f. C62.33, Standard Test Specifications for Varistor Surge Protective Devices.

2. American Society for Testing and Materials (ASTM):

   a. D665, Standard Test Method for Rust Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water.

   b. D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

   c. D923, Standard Test Method for Sampling Electrical Insulating Liquids.

   d. D924, Standard Test Methods for A-Class Characteristics and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.

   e. D971, Standard Test Method for Interfacial Tension of 0.1 against Water by the Ring Method.

   f. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.

   g. D1298, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.

   h. D1500, Standard Test Method for ASTM Color of Petroleum Products.

   i. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.

   j. D1533, Standard Test Methods for Water in Insulating Liquids.

   k. D1816, Standard Test Method for Dielectric Breakdown Voltage on Insulating Oils of Petroleum Origin Using VDE Electrodes.

l. D2285, Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin against Water by the Drop-Weight Method.

3. Institute of Electrical and Electronics Engineers (IEEE):

a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.

b. 48, Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminators.

c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

d. 95, Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage.

e. 118, Standard Test Code for Resistance Measurement.

f. 400, Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.

4. National Electrical Manufacturers Association (NEMA):

a. AB 4, Guideline for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.

b. PB 2, Deadfront Distribution Switchboards.

c. WC 7, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

d. WC 8, Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

5. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

6. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC).

b. 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.2 SUBMITTALS

A. Administrative Submittals: Submit 30 days prior to performing inspections or tests:

1. Schedule for performing inspection and tests.

2. List of references to be used for each test.

3. Sample copy of equipment and materials inspection form(s).

4. Sample copy of individual device test form.

5. Sample copy of individual system test form.

B. Quality Control Submittals: Submit within 14 days after completion of test:

1. Test or inspection reports and certificates for each electrical item tested.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data:

a. In accordance with references elsewhere in these specifications.

b. After test of inspection reports and certificates have been reviewed by ENGINEER and returned, insert a copy of each in operation and maintenance manual.

1.3 QUALITY ASSURANCE

A. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.

B. Test instrument calibration shall be in accordance with NETA ATS.

1.4 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment has been installed.

B. Perform tests with apparatus de-energized whenever feasible.

C. Inspection and electrical tests on energized equipment are to be:

1. Scheduled with OWNER prior to de-energization.

2. Minimized to avoid extended period of interruption to the operating plant equipment.

D. Notify OWNER at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

A. Tests specified in this section are to be performed in accordance with the requirements elsewhere in these specifications.

B. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer’s tolerances.

2. Installation operates properly.

3. Equipment is suitable for energization.

4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, and ANSI C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Adjust mechanisms and moving parts for free mechanical movement.

E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

F. Verify nameplate data for conformance to Contract Documents.

G. Realign equipment not properly aligned and correct un-levelness.

H. Properly anchor electrical equipment found to be inadequately anchored.

I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

K. Provide proper lubrication of applicable moving parts.

L. Inform OWNER of working clearances not in accordance with NFPA 70.

M. Investigate and repair or replace:

1. Electrical items that fail tests.

2. Active components not operating in accordance with manufacturer's instructions.

3. Damaged electrical equipment.

N. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.

2. Vacuum and wipe clean enclosure interior.

3. Remove corrosion found on metal surfaces.

4. Repair or replace, as determined by OWNER, door and panel sections having dented surfaces.

5. Repair or replace, as determined by OWNER, poor fitting doors and panel sections.

6. Repair or replace improperly operating latching, locking, or interlocking devices.

7. Replace missing or damaged hardware.

8. Finish:

a. Provide matching paint and touch up scratches and mars.

b. If required due to extensive damage, as determined by OWNER, refinish the entire assembly.

O. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents.

3.2 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect Each Individual Exposed Power Cable No. 4 and Larger For:

a. Physical damage.

b. Proper connections in accordance with single-line diagram.

c. Cable bends that do not conform with manufacturer's minimum allowable bending radius where applicable.

d. Color coding conformance with specifications.

e. Proper circuit identification.

2. Mechanical Connections For:

a. Proper lug type for conductor material.

b. Proper lug installation.

c. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.

3. Shielded Instrumentation Cables For:

a. Proper Shield grounding.

b. Proper terminations.

c. Proper circuit identification.

4 Control Cables For:

a. Proper termination.

b. Proper circuit identification.

5. Cables Terminated Through Window Type CTs: Verify that neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests:

1. Insulation Resistance Tests:

a. Applied megohm-meter dc voltage in accordance with NETA ATS, Table 10.2.

b. Phase-to-phase and phase-to-ground for 1 minute on each pole.

c. Insulation resistance values equal to, or greater than ohm values established by manufacturer.

d. Provide test reports to Engineer and Owner that show where test measurements were taken and the results

2. Contact Resistance Tests:

a. Contact resistance in micro-ohms across each switch blade and fuse holder.

b. Investigate deviation of 50% or more form adjacent poles or similar switches.

3.3 MOLDED CASE CIRCUIT BREAKERS

A. General: Inspection and testing limited to circuit breakers rated 400 amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.

2. Proper conductor size.

3. Feeder designation according to nameplate and one-line diagram.

4. Cracked casings.

5. Connection bolt torque level in accordance with NETA ATS, Table 10.1.

6. Operate frame size and trip setting with circuit breaker schedules or one-line diagram.

7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.

8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:

1. Insulation Resistance Tests:

a. Utilize 1,000-volt dc megohm-meter for 480- and 600-volt circuit breakers.

b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.

c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.

d. Test values to comply with NETA ATS, Table 10.2.

2. Contact Resistance Tests:

a. Contact resistance in micro-ohms across each pole.

b. Investigate deviation of 50% or more from adjacent poles and similar breakers.

3.4 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually Check Current, Potential, and Control Transformers for:

   a. Cracked insulation.

   b. Broken leads or defective wiring.

   c. Proper connections

   d. Adequate clearances between primary and secondary circuit wiring.

2. Verify Mechanically that:

   a. Grounding and shorting connections have good contact.

   b. Withdrawal mechanism and grounding operation, when applicable, operate properly.

3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 7.1.1.

3.5 METERING

A. Visual and Mechanical Inspection:

1. Verify meter connections in accordance with appropriate diagrams.

2. Verify meter multipliers.

3. Verify that meter types and scales conform to Contract Documents.

4. Check calibration of meters at cardinal points.

5. Check calibration of electrical transducers.

3.6 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in motor control centers and panelboards assemblies for proper connection and tightness.

2. Ground bus connections in motor control centers and panelboards assemblies for proper termination and tightness.

3. Effective transformer core and equipment grounding.

4. Accessible connections to grounding electrodes for proper fit and tightness.

5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

6. Test ground system using 3 point fall of potential test equipment. Ground system must provide less than 5 ohms to ground resistance. Provide test reports to Engineer and Owner that show where test measurements were taken and the results. System must be tested at all ground rods, concrete encased electrodes, ground busses and service entrance locations.

3.7 AC INDUCTION MOTORS

A. General: Inspection and testing limited to motors rated 10 hp and larger.

B. Visual and Mechanical Inspection:

1. Proper electrical and grounding connections.

2. Shaft alignment.

3. Blockage of ventilating air passageways.

4. Operate Motor and Check for:

a. Excessive mechanical and electrical noise.

b. Overheating.

c. Correct rotation.

d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for proper operation.

e. Excessive vibration.

5. Check operation of space heaters.

C. Electrical Tests:

1. Insulation Resistance Tests:

a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 10.2 for:

1) Motors above 200 hp for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.

2) Motors 200 hp and less for 1-minute duration with resistances tabulated at 30 and 60 seconds.

b. Insulation resistance values equal to, or greater than, ohm values established by manufacturers.

2. Calculate polarization index ratios for motors above 200 hp. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.

3. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.

4. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

5. Provide test reports to Engineer and Owner that show where test measurements were taken and the results

3.8 LOW VOLTAGE MOTOR CONTROL

A. Visual and Mechanical Inspection:

1. Proper barrier and shutter installation and operation.

2. Proper operation of indicating and monitoring devices.

3. Proper overload protection for each motor.

4. Improper blockage of air cooling passages.

5. Proper operation of draw out elements.

6. Integrity and contamination of us insulation system.

7. Check Door and Device Interlocking System By:

a. Closure attempt of device when door is in OFF or OPEN position.

b. Opening attempt of door when device is in ON or CLOSED position.

8. Check Nameplates for Proper Identification Of:

a. Equipment title and tag number with latest one-line diagram.

b. Pushbuttons.

c. Control switches.

d. Pilot lights.

e. Control relays.

f. Circuit breakers.

g. Indicating meters.

9. Verify that fuse and circuit breaker sizes and types conform to Contract Documents.

10. Verify that current and potential transformer ratios conform to Contract Documents.

11. Check Bus Connections for High Resistance by Low Resistance Ohmmeter and Calibrated Torque Wrench Applied to Bolted Joints:

a. Ohm value to be zero.

b. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.

12. Check Operation and Sequencing of Electrical and Mechanical Interlock Systems by:

    a. Closure attempt for locked open devices.

    b. Opening attempt for locked closed devices.

13. Verify performance of each control device and feature furnished as part of the motor control center.

14. Control Wiring:

    a. Compare wiring to local and remote control, and protective devices with elementary diagrams.

    b. Check for proper conductor lacing and bundling.

    c. Check for proper conductor identification.

    d. Check for proper conductor lugs and connections.

15. Exercise active components.

16. Inspect Contactors For:

    a. Correct mechanical operations.

    b. Correct contact gap, wipe, alignment, and pressure.

    c. Correct torque of all connections.

17. Compare overload heater rating with full-load current for proper size.

18. Compare fuse, motor protector, and circuit breaker with motor characteristics for proper size.

19. Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.

B. Electrical Tests:

1. Insulation Resistance Tests:

    a. Applied megohm-meter dc voltage in accordance with NETA ATS, Table 10.2.

    b. Bus section phase-to-phase and phase-to-ground for 1 minute on each phase.

    c. Contactor phase-to-ground and across open contacts for 1 minute on each phase.

    d. Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.

    e. Test values to comply with NETA ATS, Table 10.2.

2. Current Injection through Overload Unit at 300% of Motor Full-Load Current and Monitor Trip Time:

   a. Trip time in accordance with manufacturer's published data.

   b. Investigate values in excess of 120 seconds.

3. Control Wiring Tests:

   a. Apply secondary voltage to control power and potential circuits.

   b. Check voltage levels at each point on terminal boards and each device terminal.

   c. Insulation resistance test at 1,000 volts dc on control wiring except that connected to solid state components.

   d. Insulation resistance to be 1 megohm minimum.

   e. Operational test by initiating control devices to affect proper operation.

   f. Provide test reports to Engineer and Owner that show where test measurements were taken and the results

- END OF SECTION -

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DIVISION 17 – INSTRUMENTATION AND CONTROLS

SECTION 17000 - INSTRUMENTATION

PART 1 - GENERAL

1.1 APPLICABLE SECTIONS

A. The General Conditions, Supplementary General Conditions, alternates and Addenda, applicable drawings and the technical specification herein shall apply to work under this Section.

1.2 SCOPE

A. It is the intent of this specification to set forth the minimum acceptable requirements for the design, construction, and vendor support, requirements for the controls panels and instrumentation herein specified.

B. Furnish all labor, material, and equipment associated with the fabrication of the new control panels and associated instrumentation complete in strict accordance with this section of the specification and applicable drawings and subject to the terms and conditions of the contract.

C. Install, calibrate, and perform functional loop tests prior to plant start up. Start up of instrumentation to coincide with the mechanical equipment and process start up as scheduled by the owner, engineer and general contractor.

D. Provide owner with any required operator and maintenance training by factory authorized representatives.

E. Instrumentation equipment, installation, submittal, and record drawings shall be the responsibility of a single party. This party shall be responsible for all parts of this division 17000 and associated requirements.

1.3 WORK INCLUDED

A. All instruments and all control panels provided for this project. This shall also include vendor and owner supplied equipment.

1.4 SHOP DRAWINGS/SUBMITTALS

A. Furnish Updated S20 instrumentation specification sheets indicating exact make, model and part number of instrument to be supplied.

B. Furnish manufacturers specifications and literature on all instruments to be supplied.

C. Furnish complete working shop drawings of all control systems including individual loop wiring diagrams for each instrument to be supplied. Reference design documents for sequence, basic components and suggested piping and wiring. Review the project with the Engineer prior to making submittal. Submit manufacturer's data sheets for all equipment, devices and materials.

D. After initial review, make corrections requested and resubmit in clean format. Work only from final review set.

E. Maintain record drawings in the field. Clean up originals at completion of work and resubmit for Owner's use in operation of the systems.

1.5 OPERATION AND MAINTENANCE MANUALS

A. O&M manuals shall comply with other sections of this specification. Manuals should include the following:

1. Full drawn size as built loop diagrams, schematics and control diagrams indicating all conductor information, connection information, and device identification.

2. As built S20 specification sheets.

3. Calibration sheets

4. Identification of and lists of all replaceable parts.

5. Periodic service requirements

6. Start up procedure

7. Fault reset instruction

8. Factory manuals

9. Prior to start up the contractor shall provide owner and owners integrator with items A, B and C.

PART 2 - EXECUTION

2.1 WIRING

A. All control wiring, 120 volt and below shall be installed in conduit and wiring boxes. The installation of conduits into control panels shall not permit water to enter the control panels from the conduit.

B. All analog signals shall be terminated on separate terminal blocks from other control conductors. Analog signals should be shielded type conductor as called for on drawings. The shield on each individual conductor should be terminated at one end only in order to prevent ground loops.

C. All conductors in control panels shall be run within wireways. Each conductor shall be labeled and indicated on as built control drawings. One copy of such as-builts shall be affixed to inside of each control panel.

D. Contractor shall use care to not exceed the recommended bending radius of all cables.

E. Contractor shall install and label all termination points for external wiring. This labeling shall coordinate with control as-built drawings.

F. Use no wire smaller than #14 AWG for 120 volt power and #16 AWG for 120 volt control wiring. Use no wire smaller than #20 AWG for DC voltage or current signal wiring.

2.2 INSTALLATION

A. Field mounting and conductor connections shall be provided by the contractor. Piping, tubing and process connections shall be provided by the contractor.

B. Installation shall be done per the instrument manufacturer's specifications and project drawings and specifications. Any discrepancies shall be brought to the attention of the Owner's engineer for resolution.

2.3 CALIBRATION

A. All instruments shall be calibrated using the manufacturers recommended calibration procedures and equipment.

B. All analog instruments shall be calibrated or tested with three process data points.

C. Factory calibrated equipment shall be tested to verify calibration.

D. Contractor shall supply owner with a written calibration report on each instrument. Calibration reports shall indicate:

1. Instrument by tag Number
2. Test method used
3. Test equipment used
4. Numerical test results (preferably graphed)
5. Date of test
6. Technician

2.4 FUNCTIONAL LOOP TEST

A. Contractor shall notify Owner in advance of final loop test. Final loop test shall take place with the participation of Owner, Owner's integrator and engineer.

B. Owner shall approve final loop check procedures and sign off on check out.

C. Loop check shall be from instrument to HMI screen indication with actual process connection simulating two or three data points per instrument.

2.5 WARRANTY

A. The vendor shall furnish a written warranty consisting of the following:

1. Warranty parts and labor for two years after start up.

ATTACHMENTS

S20 Instrument data sheets

	Ultrasonic Level Instrument			Sheet	of
				Spec No.	Rev
	Rev	By	Date		
				Contract	Date 4/12/2001
				Requsition	P. O.
				BY	CHK'D / APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Equipment Located on _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 ___ High humidity/wet ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
14 Pulse Outputs: _____ Volts DC ___ Sink ___ Source ___ Programmable value
15 Transducer Drive: _____ KHz _____ Volts _____ ms Durration _____ ms Repetition
16 Temperature Compenstion _____ ___
17 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
18 Special Functions Required _____
19 ___ Digital Display ___ Digits ___ Analog display
20 _____ Range _____ % Accuracy
21 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
22 Manufacturer _____
23 Model/Part # _____ Serial # _____

Element

24 Process Service _____
25 Face Material _____
26 Range _____ Beam Angle _____ deg
27 Cable Length _____ ft Cable Spec. _____
28 Internal Temperature Compensation _____ Type _____ _____
29 Mounting: Pipe _____ in Flange _____ in _____ lb Conduit _____ in Wall bracket ___
30 Cone or stand pipe required ___ Size _____
31 Blanking Distance Required _____ _____
32 Manufacturer _____ Model/Part # _____

Other

33 _____
34 _____
35 _____
36 _____
37 _____
38

Notes:

	Ultrasonic Open Channel Flow Instrument			Sheet		of
				Spec No.		Rev
	Rev	By	Date			
				Contract		Date 4/12/2001
				Requsition		P. O.
				BY	CHK'D	APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Flume/Weir: Type _____ Size _____
4 Max Flow _____ gpm at _____ in Head _____ Exponent for flume
5 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
6 ___ High humidity/wet ___ Other _____
7 _____ ft Altitude
8 _____ to _____ deg f Ambient Temperatures
9 Area Classification ___ Unclassified Class _____ Division _____ Group _____
10 Power Supply _____ Volts _____ Watts _____ Hz ___ DC
11 Other _____

Transmitter

12 Output 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
14 Pulse Outputs: _____ Volts DC ___ Sink ___ Source ___ Programmable value
15 Transducer Drive: _____ KHz _____ Volts _____ ms Durration _____ ms Repetition
16 Temperature Compenstion _____ ___
17 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
18 Special Functions Required _____
19 ___ Digital Display ___ Digits ___ Analog display
20 _____ Range _____ % Accuracy
21 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
22 Manufacturer _____
23 Model/Part # _____ Serial # _____

Element

24 Process Service _____
25 Face Material _____
26 Range _____ Beam Angle _____ deg
27 Cable Length _____ ft Cable Spec. _____
28 Internal Temperature Compensation _____ Type _____ _____
29 Mounting: Pipe _____ in Flange _____ in _____ lb Conduit _____ in Wall bracket ___
30 Cone or stand pipe required ___ Size _____
31 Blanking Distance Required _____
32 Manufacturer _____ Model/Part # _____

Other

33 _____
34 _____
35 _____
36 _____
37 _____

Notes:

	Suspended Solids			Sheet	of
				Spec No.	Rev
	Rev	By	Date		
				Contract	Date 4/12/2001
				Requsition	P. O.
				BY	CHK'D / APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Equipment Located on _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 _____ to _____ Humidity ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Output 2: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____
16 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
17 Communications Port: ___ RS232 ___ RS485 _____ Protocol
18 Special Functions Required _____
19 ___ Digital Display ___ Digits ___ Analog display
20 Units _____ Range _____ _____ % Accuracy _____ Repeatability
21 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
22 Mounting: ___ Panel ___ Surface ___ Pipe
23 Other _____
24 _____
25 Manufacturer _____ ___ Or Equal
26 Model/Part # _____ Serial # _____

Element

27 Process Service _____
28 Sensor Type: Light absorbtion _____ Back Scattered Light ___ 90 deg light Scattering sensor ___
29 Wetted Materials _____
30 Cable Length _____ ft Cable Spec. _____ _____
31 Mounting: Handrail pivot pipe _____ Flotation mounting _____
32 Submersion mount _____ Flow through mounting _____ Line size _____
33 Hot tap assembly with Ball valve _____ Line size _____
34 Manufacturer _____ ___ Or Equal
35 Model/Part # _____

Other

36 _____
37 _____
38 _____

Notes:

ORP			Sheet	of
Rev	By	Date	Spec No.	Rev
			Contract	Date 4/12/2001
			Requsition	P. O.
			BY	CHK'D / APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Equipment Located on _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 ___ High humidity/wet ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Output 2: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____
16 Temperature Compenstion _____
17 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables
18 Communications Port: ___ RS232 ___ RS485 _____ Protocol
19 Special Functions Required _____
20 ___ Digital Display ___ Digits ___ Analog display
21 Range _____ _____ % Accuracy _____ Repeatability
22 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
23 Mounting: ___ Panel ___ Surface ___ Pipe ___ Other _____
24 Other _____
25 Manufacturer _____ ___ Or Equal
26 Model/Part # _____ Serial # _____

Element

27 Process Service _____
28 Cell Type: ___ Standard ___ Differential ___ Epoxy body ___ Ryton
29 ___ Liquid Crystal Polymere Wetted Materials _____
30 Cable Length _____ ft Cable Spec. _____
31 ___ Internal Temperature Compensation Type _____
32 Mounting: Handrail pivot pipe _____ Flotation mounting _____
33 Submersion mount _____ Flow through mounting _____ Line size _____
34 Hot tap assembly with Ball valve _____ Line size _____
35 Manufacturer _____ ___ Or Equal
36 Model/Part # _____ Serial # _____

Other

37 _____
38

Notes:

Dissoved Oxygen			Sheet	of
Rev	By	Date	Spec No.	Rev
			Contract	Date 4/12/2001
			Requsition	P. O.
			BY / CHK'D	APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Equipment Located on _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 ___ High humidity/wet ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Output 2: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____
16 Temperature Compenstion _____
17 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
18 Communications Port: ___ RS232 ___ RS485 _____ Protocol
19 Special Functions Required _____
20 ___ Digital Display ___ Digits ___ Analog display
21 Range _____ _____ % Accuracy _____ Repeatability
22 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
23 Other _____
24 Mounting: ___ Panel ___ Surface ___ Pipe
25 Manufacturer _____ ___ Or Equal
26 Model/Part # _____ Serial # _____

Element

27 Process Service _____
28 Cell Type _____ Wetted Materials _____
29 Catode Matl. _____ Anode Matl. _____ Ref Electrode Matl. _____
30 Cable Length _____ ft Cable Spec. _____
31 Internal Temperature Compensation _____ Type _____
32 Mounting: Handrail pivot pipe _____ Flotation mounting _____
33 Submersion mount _____ Flow through mounting _____ Line size _____
34 Manufacturer _____ ___ Or Equal
35 Model/Part # _____ Serial # _____

Other

36 _____
37 _____
38 _____

Notes:

Thermal Mass Flow				Sheet		of
				Spec No.		Rev
Rev	By	Date				
				Contract		Date 4/12/2001
				Requsition		P. O.
				BY	CHK'D	APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Line Number _____ Gas _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 ___ High humidity/wet ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Output 2: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
15 Pulse Outputs: _____ Volts DC ___ Sink ___ Source ___ Programmable value
16 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____
17 Temperature Compenstion _____
18 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
19 Communications Port: ___ RS232 ___ RS485 _____ Protocol
20 Totalizer _____ Special Functions Required _____
21 ___ Digital Display ___ Digits ___ Analog display
22 Range _____ _____ % Accuracy _____ Repeatability
23 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
24 Other _____
25 Mounting: ___ Panel ___ Surface ___ Pipe ___ On flow element
26 Manufacturer _____ ___ Or Equal
27 Model/Part # _____ Serial # _____

Flow Element

28 Process Service _____
29 Flow Range _____ to _____ fps Flow Element Materials _____
30 Line Pressure _____ Line Temperature _____ degf Process Tap Size _____ in
31 Cable Length _____ ft Cable Spec. _____
32 Probe Length _____ Probe Diameter _____ Probe Connection _____
33 Mounting: Hot tap assembly with Ball valve _____ Direct in Line _____ Line size _____
34 Manufacturer _____ ___ Or Equal
35 Model/Part # _____ Serial # _____

Other

36 _____
37 _____
38 _____

Notes:

	Magnetic Flow Meter			Sheet		of
				Spec No.		Rev
	Rev	By	Date			
				Contract		Date 4/12/2001
				Requsition		P. O.
				BY	CHK'D	APPR.

	1 Process Location / Service _____ Line Number _____
General	2 ___ High humidity/wet ___ Other _____
	3 _____ ft Altitude
	4 _____ to _____ deg f Ambient Temperatures
	5 Area Classification ___ Unclassified Class _____ Division _____ Group _____
	6 Other _____
Fluid	7 Fluid _____ Min Conductivity _____ Vacuum possibility _____
	8 Line Pressure _____ Line Temperature _____ to _____
	9 Flow Range _____ to _____ gpm Max Velocity _____
Line Connection	10 Line Pressure _____ Line Material _____ Piping Class/ Schedule _____
	11 Line Size _____ Connection Type _____ Connection Materials _____
Flow Meter Tube	12 Tag No. _____
	13 Tube Material _____ Liner Material _____ Meter Casing _____
	14 Electrode Type _____ Electrode Material _____ Grounding Type _____
	15 Enclosure : Nema _____ Power supply _____
	16 Cable Length _____ ft Cable Spec. _____
	17 Other _____
	18 _____
	19 Manufacturer _____ ___ Or Equal
	20 Model/Part # _____ Serial # _____
Transmitter	21 Tag No. _____
	22 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
	23 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
	24 Pulse Outputs: _____ Volts DC ___ Sink ___ Source ___ Programmable value
	25 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
	26 Communications Port: ___ RS232 ___ RS485 _____ Protocol
	27 Totalizer _____ Special Functions Required _____
	28 ___ Digital Display ___ Digits ___ Analog display
	29 Range _____ _____ % Accuracy _____ Repeatability
	30 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
	31 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
	32 Other _____
	33 _____
	34 Mounting: ___ Integral to Flow tube ___ Remote ___ Panel ___ Surface ___ Pipe
	35 Manufacturer _____ ___ Or Equal
	36 Model/Part # _____ Serial # _____
Other	37 _____
	38 _____

Notes:

	Magnetic Flow Meter			Sheet	of
				Spec No.	Rev
	Rev	By	Date		
				Contract	Date 4/12/2001
				Requsition	P. O.
				BY	CHK'D / APPR.

General	1 Process Location / Service _____ Line Number _____ 2 ___ High humidity/wet ___ Other _____ 3 _____ ft Altitude 4 _____ to _____ deg f Ambient Temperatures 5 Area Classification ___ Unclassified Class _____ Division _____ Group _____ 6 Other _____
Fluid	7 Fluid _____ Density _____ to _____ 8 Line Pressure _____ Line Temperature _____ to _____ 9 Flow Range _____ to _____ gpm Max Velocity _____
Line Connection	10 Line Pressure _____ Line Material _____ Piping Class/ Schedule _____ 11 Line Size _____ Connection Type _____ Connection Materials _____
Density Meter Tube	12 Tag No. _____ 13 Tube Material _____ Liner Material _____ Meter Casing _____ 14 Sensor type _____ Sensor Locations _____ 15 Enclosure : Nema _____ Power supply _____ 16 Cable Length _____ ft Cable Spec. _____ 17 Other _____
Transmitter	18 Manufacturer _____ ___ Or Equal 19 Model/Part # _____ Serial # _____ 20 Tag No. _____ 21 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated 22 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes 23 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables 24 Communications Port: ___ RS232 ___ RS485 _____ Protocol 25 ___ Digital Display ___ Digits ___ Analog display 26 Range _____ _____ % Accuracy _____ Repeatability 27 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic 28 Power Supply ___ _____ Volts _____ VA/Watts _____ Hz ___ DC 29 Mounting: ___ Integral to Flow tube ___ Remote ___ Panel ___ Surface ___ Pipe 30 Other _____ 31 _____ 32 _____ 33 Manufacturer _____ ___ Or Equal 34 Model/Part # _____ Serial # _____
Other	35 _____ 36 _____ 37 _____ 38 _____

Notes:

	Resistance Temperature Detector			Sheet	of
				Spec No.	Rev
	Rev	By	Date		
				Contract	Date 4/12/2001
				Requsition	P. O.
				BY / CHK'D	APPR.

General

1 Process Location / Service _____ Line Number _____
2 ___ High humidity/wet ___ Other _____
3 _____ ft Altitude
4 _____ to _____ deg f Ambient Temperatures
5 Area Classification ___ Unclassified Class _____ Division _____ Group _____
6 Other _____

Head

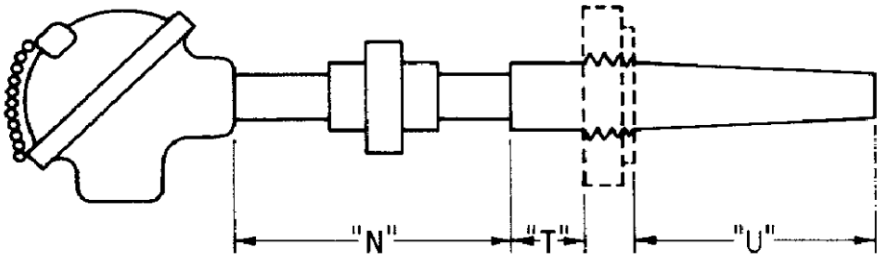
7 Complete Assembly ___ Other ___
8 Head Material _____ Conduit Connection _____
9 Nipple Size _____ Dimension "N" _____ Union _____

Element

10 Platinum ___ Nickel ___ Copper ___ Other ___ Ice Point Resistance _____ohm
11 Temperature Range _____ To _____ deg___
12 Leads: Standard ___ Potted ___ Hermeticaly Sealed ___
13 Sheath Material _____ O.D. _____ Mounting Thread _____
14 Connection: 2-Wire___ 3-Wire___ 4-Wire___
15 Lead Wires ___ Receptacle ___ Bayonet Lock ___
16 Other _____

Well or Tube

17 Material _____
18 Construction: Tapered ___ Straight ___ Drilled ___ Built up ___ Closed End ___
19 Internal Thread Process Connection



Rev.	Tag No.	Process Conn.	Well Dimension		Element Length	Single or Dual	Service
			U	T			

Notes:

Pressure Instrument				Sheet	of
				Spec No.	Rev
Rev	By	Date			
				Contract	Date 4/12/2001
				Requsition	P. O.
				BY	CHK'D / APPR.

General

1 Tag No. _____
2 Process Location / Service _____
3 Equipment Located on _____
4 Service Conditions: ___ Indoor ___ Outdoor ___ Corrosive _____
5 ___ High humidity/wet ___ Other _____
6 _____ ft Altitude
7 _____ to _____ deg f Ambient Temperatures
8 Area Classification ___ Unclassified Class _____ Division _____ Group _____
9 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
10 Other _____
11 _____

Transmitter

12 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
13 Output 2: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
15 Alarms _____ Control _____ Timer Self and Sensor diagnostics _____
16 ___ Guage Pres ___ Absolute ___ Vacuum ___ Compound
17 Range _____ To _____ ___ PSIG ___ PSIA ___ in H2O ___ in HG
18 _____ % Accuracy _____ Repeatability
19 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
20 Communications Port: ___ RS232 ___ RS485 _____ Protocol
21 Special Functions Required _____
22 ___ Digital Display ___ Digits ___ Analog display
23 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
24 Other _____
25 Mounting: ___ Panel ___ Surface ___ Pipe ___ Yoke
26 Manufacturer _____ ___ Or Equal
27 Model/Part # _____ Serial # _____

Element

28 Process Service _____
29 Process Pressure: _____ To _____
30 Process Connection ___ 1/4" NPT ___ 1/2" NPT _____ Flange
31 ___ Guage Pres ___ Absolute ___ Vacuum ___ Compound
32 Type: ___ Diaphram ___ Bourdon ___ Helix ___ Bellows ___ Other _____
33 Material: ___ 316 SS ___ Hasteloy ___ Ber. Copper ___ Other _____
34 Range: ___ Fixed ___ Adjustable ___ Set at _____ To _____
35 Element Range _____ Normal _____ Max _____ Proof
36 Other _____

Other

37 _____
38 _____

Notes:

– END OF SECTION –

SECTION 17111 - FLOAT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. This section includes furnishing all float switches as indicated on the drawings and specified herein.

B. Related work specified elsewhere includes, but is not limited to, Section 16000, General Electrical Requirements. Also refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.2 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.3 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.1 BALL TYPE FLOAT WITH INTEGRAL MERCURY SWITCH AND ATTACHED CABLE

A. Float switch shall be direct acting and consist of 316 type stainless steel housing, mounting clamp, a flexible three-conductor cable with a synthetic rubber jacket and a mercury switch. The float housing shall be a sphere of at least 4 1/2 inches in diameter.

B. The mercury switch shall be embedded in a metal housing inside the float. The cable shall be 3/C #14, "SO" TYPE with 105 strands per conductor, made specifically for underwater use and heavy flexing service.

C. The mercury switch shall be connected to two of the three conductors of the cable. The third conductor shall be an internal ground and shall be colored green. The switch shall have a 20 ampere rating at 115 volts AC.

D. An additional synthetic rubber jacket shall act as a hinge between the float and where the cable is held by the stationary clamp. This clamp shall be stainless steel with an adapting fitting and two yokes for mounting on a vertical 1-inch pipe.

E. A liquid rise of 1 inch from the reset position shall operate the float switch, and reset shall occur when the liquid level drops to 1 inch. Operating temperature shall be 0 degrees F to + 180 degrees F.

F. Weight and buoyancy shall be such that contaminants like a cake of grease will not result in the float switch changing operating level more than 1 inch.

G. A cast aluminum, NEMA 4 junction box shall be supplied for termination of the float cable(s), to allow conventional wiring and conduit to be run from the junction box to a control panel. It shall have terminal blocks for the required number of circuits and shall accept sealed fittings furnished with the float switch.

H. Float switches shall be as manufactured by Consolidated Electric Co., or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment and materials specified in this section shall be installed and connected as specified and as shown on the drawings. Contractor shall coordinate with Mechanical and Structural for optimum location of float switches.

3.2 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications.

– END OF SECTION –

SECTION 17126 – SUBMERSIBLE LEVEL TRANSMITTERS

PART 1 -- GENERAL

1.1 SCOPE

A. This section includes furnishing Submersible Level Transmitters as shown on the Plans and specified herein.

B. Related work specified elsewhere includes, but is not limited to Section 16000, General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.2 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.3 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Submit instrument Data sheet for each instrument provided.

3. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 -- PRODUCTS

2.1 SUBMERSIBLE LEVEL TRANSMITTER

A. The level measurement system shall consist of a submersible transducer, electronic transmitter, support cable, and interconnecting cable with cable shield and vent tube for atmospheric reference. The vent tube shall be provided with a replaceable moisture barrier. The submersible transducer shall be the strain gauge type suitable for sensing pressure equivalent to the liquid level range indicated. The transducer shall have 316 stainless steel process wetted parts and shall be provided with a waterproof interconnecting cable. The transducer shall be suspended by a corrosion resistant cable as recommended by the manufacturer. The installation shall allow easy removal of the transducer and cable assembly for maintenance purposes. The electronic level transmitter shall be remote mounted and shall produce a 4 - 20 mA DC signal linearly proportional to the level range indicated and be capable of driving a load of 700 ohms. The interconnecting cable shall have a pull strength of 200 pounds, be factory attached to the transducer, and shall be terminated in a weather proof enclosure furnished with the unit. The weatherproof enclosure shall house the vent tube moisture barrier and local indication. The measurement system shall be suitable for the area classification and operation over a temperature range of 32 to 122 degrees Fahrenheit with an

accuracy of plus or minus 0.5 percent of span. The transmitter shall have a non-fouling, large diaphragm (greater than 2”). The diaphragm shall be protected by a spacer assembly that also allows the transducer to sit on the floor of the wet well.

B. For lengths greater than 20 feet the transducer shall have ½” threads and shall be suspended in the wet well by ½” stainless steel conduit.

C. Submersible level transmitters shall be KPSI model 700 or approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Equipment and materials specified in this section shall be installed, connected, and tested in accordance with the manufacturers’ recommendations, and as shown on the Plans. Contractor shall coordinate with other trades to insure proper connection to piping and other mechanical equipment.

3.2 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation.

– END OF SECTION –

SECTION 17137 - MAGNETIC FLOWMETERS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. This section covers the Magnetic Flowmeters to be provided where indicated on the Drawings. The Flowmeters shall consist of two parts with manufacturer supplied interconnecting wiring, the field installed flow element and the flow indicating transmitter.

B. Related work specified elsewhere includes, but is not limited to section 16000 General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.2 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.3 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Submit Instrument Data Sheet for each instrument provided.

3. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 -- PRODUCTS

1.4 MAGNETIC FLOWMETERS:

A. Acceptable Manufacturers:

1. Endress and Hauser, Promag 53 Series, with remote mount transmitter unless specified as compact version.

2. Siemens SITRANS F, Magflo 5100W Series, with remote mount transmitter unless specified as compact version.

3. Or Approved Equal.

B. Materials:

1. All mounting hardware shall be 316 stainless steel, the instrument enclosure and the spool mag shall be rated NEMA 4X, the flow sensor liner shall be Polyurethane lined, and the electrode material shall be 316 stainless steel.

2. Spool size shall be as specified on the drawings.

3. All applications with flow element below grade where no de-watering means or in submersible applications shall provide the flow element as NEMA 6P (IP-67).

C. Design and fabrication

1. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.

2. Provide flanged end connections per ANSI B16 rated for piping system operating and test conditions.

3. Operating pressure: 150 psi.

4. Operating temperature: 122 DegF.

5. Grounding requirements:

   a. Inlet and outlet grounding rings of same material as electrode.

6. Provide cable between magnetic flowmeter and transmitter.

7. Pulsed DC magnetic field excitation.

8. Automatic zero

9. Adjustable low flow cutoff.

10. 16-character alphanumeric display shall indicate user-defined flow units and total flow. All menu advice and commands shall be viewed on this display.

11. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.

12. Accuracy:

    a. +/- 0.5% of rate above 1 fps.

    b. +/- 0.01 fps below 1.0 fps.

    c. 4-20 mA DC isolated output into maximum 800 ohms.

    d. Scaled frequency output, 24 VDC.

    e. Power supply: 117 V +/- 10 percent, 60 HZ.

    f. Meter operable as specified in liquids with 5.0 micromho/cm or more conductivity.

PART 3 -- EXECUTION

1.5 INSTALLATION

A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The Contractor shall coordinate the installation with the other trades, to insure proper installation of the flow element, transmitter, and associated conduit and cables.

B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

1.6 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

1.7 SPARE PARTS

A. Provide the Owner with a list of the manufacturers' recommended spare parts.

Magnetic Flow Meter Instrument Data Sheet

Magnetic Flow Meter						
Rev	By	Date	Sheet	of		
			Spec No.	Rev		
			Contract	Date 4/12/2001		
			Requsition	P. O.		
			BY	CHK'D	APPR.	

General

1 Process Location / Service _____ Line Number _____
2 ___ High humidity/wet ___ Other _____
3 _____ ft Altitude
4 _____ to _____ deg f Ambient Temperatures
5 Area Classification ___ Unclassified Class _____ Division _____ Group _____
6 Other _____

Fluid

7 Fluid _____ Min Conductivity _____ Vacuum possibility _____
8 Line Pressure _____ Line Temperature _____ to _____
9 Flow Range _____ to _____ gpm Max Velocity _____

Line Connection

10 Line Pressure _____ Line Material _____ Piping Class/ Schedule _____
11 Line Size _____ Connection Type _____ Connection Materials _____

Flow Meter Tube

12 Tag No. _____
13 Tube Material _____ Liner Material _____ Meter Casing _____
14 Electrode Type _____ Electrode Material _____ Grounding Type _____
15 Enclosure : Nema _____ Power supply _____
16 Cable Length _____ ft Cable Spec. _____
17 Other _____
18 _____
19 Manufacturer _____ ___ Or Equal
20 Model/Part # _____ Serial # _____

Transmitter

21 Tag No. _____
22 Output 1: 4-20 ma ___ 1-5 v ___ Other _____ ___ Isolated
23 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes
24 Pulse Outputs: _____ Volts DC ___ Sink ___ Source ___ Programmable value
25 ___ Programmable Digital ___ Keypad Entry ___ PC software and cables
26 Communications Port: ___ RS232 ___ RS485 _____ Protocol
27 Totalizer _____ Special Functions Required _____
28 ___ Digital Display ___ Digits ___ Analog display
29 Range _____ _____ % Accuracy _____ Repeatability
30 Enclosure : Nema _____ Material : Steel ___ Stainless Steel ___ Non metalic
31 Power Supply _____ Volts _____ VA/Watts _____ Hz ___ DC
32 Other _____
33 _____
34 Mounting: ___ Integral to Flow tube ___ Remote ___ Panel ___ Surface ___ Pipe
35 Manufacturer _____ ___ Or Equal
36 Model/Part # _____ Serial # _____

Other

37 _____
38 _____

Notes:

– END OF SECTION –

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SECTION 17222 - SIGNAL CONDITIONERS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This section contains specifications for analog (4-20 mA DC) signal conditioners, used for loop isolation, protection, and switching. Refer to the Plans and provide the devices as indicated.

B. Related work specified elsewhere includes, but is not limited to section 16000 General Electrical Requirements. Refer to requirements of General Conditions for testing, adjusting and balancing of systems.

1.2 QUALITY ASSURANCE

A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.3 SUBMITTALS

A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:

1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.

2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

1.4 MANUFACTURERS

A. Products specified herein shall be as manufactured by AGM Electronics, or equal.

PART 2 – PRODUCTS

2.1 CURRENT-TO-CURRENT CONVERTER

A. Current-to-current converters shall provide electrical isolation between the input and output. Current-to-current converters shall be supplied where indicated on the Plans, and wherever the circuit impedance exceeds the capability of a transmitter.

B. The converter shall receive a 4-20 mA DC analog current input signal and produce an identical 4-20 mA DC output signal into a 0-1000 ohm load. Accuracy shall be +/-0.1% of span. The converter shall be provided with an enclosure suitable for back of panel mounting.

C. Power requirements shall be 120 VAC, or 24 VDC, as indicated on the Plans.

2.2 DUAL CHANNEL CURRENT ISOLATOR

A. Dual channel current isolators shall provide electrical isolation between the input and output. The instruments shall receive a 4-20 mA DC analog current input signal and produce two identical 4-20 mA DC output signals.

B. Each channel shall be fully isolated, and capable of driving a 0-650 ohm load. Accuracy shall be +/-0.1% of span. The isolators shall be provided with an enclosure suitable for back of panel mounting.

C. Power requirements shall be 120 VAC, or 24 VDC, as indicated on the Plans.

2.3 SET POINT RELAY

A. The set point relays shall be solid state devices, and shall provide dual output relay contact closures from a 4-20 mA DC input. Each relay shall be controlled by an adjustable set point from a 10-turn potentiometer.

B. The dual deadbands shall be adjustable from 0 to 100 percent. The output relay shall be DPDT with contacts rated 10 amps at 120 VAC. Accuracy and repeatability shall be within 0.1 percent of span.

C. The instruments shall be immune to humidity and line voltage regulation problems. Power requirements shall be 120 VAC, or 24 VDC. The unit shall be housed in a general purpose type housing suitable for subpanel mounting in a control panel enclosure.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans.

3.2 ACCEPTANCE

A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications.

3.3 WARRANTY

A. The equipment listed in this section shall have a seven year warranty from the manufacturer.

– END OF SECTION –

SECTION 17300 – CONTROL STRATEGIES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. These control strategies are intended to address systems that will be installed or modified as part of this project and to describe the general operation of the systems and processes. These control strategies are not intended to be all-inclusive operational procedures for the operation of the complete facility. Any necessary refinements, modifications, and additions to these strategies shall be submitted to and approved by the ENGINEER.

B. The requirement includes all PLC, Operator Interface, and HMI programming and all other programming of interface, network and communication devices.

1.02 COMMON ABBREVIATIONS

A. The following abbreviations are used throughout the control strategies:

1. SS Start/Stop
2. HOA Hand/Off/Auto
3. HOR Hand/Off/Remote
4. LR Local/Remote
5. LOR Local/Off/Remote
6. PLC Programmable Logic Controller
7. HMI Human Machine Interface
8. SCADA Supervisory Control and Data Acquisition
9. RST Reset
10. RVSS Reduced Voltage Soft Starter
11. LCP Local Control Panel
12. GPM Gallons Per Minute

1.03 COMMON TERMS

A. The following terms are used throughout the control strategies:

1. Operator Settings: Operator set or entered values shall be constants that are adjustable or set from operator displays. Examples of operator set or entered values are controller set points, batch set points, etc. Specific values that are required to be operator set are noted in the process control strategy descriptions.

2. Tunable Values: Tunable values are constants that are adjustable at engineer level displays without requiring any software reconfiguration. These values are not adjustable from operator level displays.

1.04 UNIVERSAL REQUIREMENTS

A. The following universal requirements shall be required throughout the project:

1. All analog and discrete inputs to the PLC shall be displayed. Both RUNNING and OFF input states shall be displayed.

2. All equipment with run indications and/or run commands shall have a non-resettable run hour meter displayed on the SCADA system which is calculated in the PLC. Also Todays hours, previous day hours, and one resettable run hour meter will be provided for each piece of equipment with run indications and/or run commands.

3. All analog inputs shall have instrument failure alarms when the input is below 0 percent or above 100 percent for a tunable time initially set at 10 seconds.

4. All discrete FAIL inputs shall be alarmed. Other discrete inputs shall be alarmed as noted in the control strategy descriptions.

5. Where alarms are specified in the control strategy descriptions, alarms shall be initiated from the applicable inputs. If discrete inputs are not available, the specified alarms shall be initiated from the applicable analog input; alarm set points shall be operator adjustable. All alarms shall be annunciated on the operator workstation and transmitted to SCADA. The list of alarms will include all motor, device, supervisory, interlock and process alarms.

6. All analog inputs shall be trended and recorded.

7. All flow inputs and equipment run times shall be totalized and recorded. All totalized values shall be displayed. Flow totals shall be displayed in current day total, previous day total, and elapsed total. Daily totals shall reset at midnight.

8. Displays shall be grouped functionally for ease of operation. Both analog and discrete functions associated with an item of equipment or a group of equipment shall be provided on the same display.

9. Unless otherwise stated or shown, all discrete outputs shall be maintained outputs. For START/STOP PLC functions, the PLC shall issue a maintained START command until a FAIL state is detected or when a STOP command is issued. When a momentary command is required, the PLC shall issue the command for 2 seconds and then remove the signal.

10. For equipment that is controllable from the PLC, a control mode status signal will be sent to the PLC to indicate when the PLC is allowed to control the equipment. It will be tagged as the REMOTE STATUS. The PLC shall monitor the discrete input for control mode status (LOCAL/REMOTE, HAND/OFF/AUTO, LOCAL/OFF/REMOTE,) and attempt to control only that equipment which is in the REMOTE or AUTO mode.

11. For equipment that the PLC is allowed to control, the PLC shall provide a READY STATUS. The READY STATUS tag will indicate whether the equipment is ready to run or if there is an alarm condition. The PLC shall provide a FAIL alarm if the equipment fails to comply with a PLC command signal (START, STOP, OPEN, CLOSE, SPEED REFERENCE) that has been present for more than a tunable time period. In this event, the command shall be removed subsequent to the expiration of the tunable time period.

12. For equipment that is controllable from the PLC in either a MANUAL or AUTOMATIC mode, the operator shall be provided with a software AUTO/MANUAL selector switch at the operator workstation. Transfer between the MANUAL and AUTOMATIC modes shall be bumpless.

13. When equipment is tagged OUT OF SERVICE, by the operator, all associated equipment shall have their alarms inhibited until the tagged equipment is re-tagged IN SERVICE.

14. Wherever 2 or more pieces of equipment are provided for the same functions, the SCADA system shall alternate the equipment after each use unless otherwise instructed by the ENGINEER.

1.05 COMMON FUNCTIONS

A. Common functions that are generally applicable to all loops or to many similar loops are described below. These functions are not repeated in the descriptions for each individual control strategy. The following general control system functions shall be provided:

1. All equipment motors will have FAIL TO START and FAIL TO STOP alarms. Once the start control criteria are met a START/STOP COMMAND will be generated and the motor should start. Once the START/STOP COMMAND has been issued the FAIL TO START ELAPSED TIME will start. The PLC will expect to see a RUN INDICATION before the FAIL TO START Timer has reached the FAIL TO START TIME DELAY SET POINT. Failure to receive the Run Indication in the allotted time will trigger a FAIL TO START alarm. Once the stop control criteria are met the START/STOP COMMAND will be removed and the motor should stop. Once the Start/Stop Command has been removed the FAIL TO STOP ELAPSED TIME will start. The PLC will expect to lose the Run Indication before the Fail to Stop Timer has reached the FAIL TO STOP TIME DELAY SET POINT. Failure to lose the Run Indication in the allotted time will trigger a FAIL TO STOP alarm. The FAIL TO STOP and FAIL TO START alarms may only be reset by the HMI ALARM RESET pushbutton on the HMI. The delay set points will accept values from 0-9999 seconds.

2. When a motor generates an overload input a FAIL INDICATION alarm will be generated.

3. All equipment with an AUTO or REMOTE indication will have an alarm when it is not in AUTO or REMOTE position, i.e., “Manual control”.

4. All PID control functions (P, PI, and PID) shall be provided with standard analog controller functions and operator interfaces including, but not limited to, the following:

   a. AUTO/MANUAL mode selection: In AUTO, the output of controller shall be based on the PID control calculation. In MANUAL, the output of the controller shall be operator adjustable. Transfer between operational modes shall be bumpless.

   b. LOCAL/REMOTE set point selection: In LOCAL, the set point shall be operator adjustable from the equipment. In REMOTE, the set point shall be adjustable from a REMOTE set point input.

   c. Set point, process variable, and controller output shall be displayed.

d. Provisions shall be included to prevent reset windup.

5. All pressure transmitters will have HIGH PRESSURE and HIGH-HIGH PRESSURE alarms. The HIGH PRESSURE SET POINT and HIGH-HIGH PRESSURE SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

6. All pressure transmitters will have a LOW PRESSURE alarm. Certain pressure transmitters will also have a LOW-LOW PRESSURE alarm. The LOW PRESSURE SET POINT and LOW-LOW PRESSURE SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

7. All flow transmitters will have a HIGH FLOW alarm. Certain flow transmitters will also have a HIGH-HIGH FLOW alarm. The HIGH FLOW SET POINT and HIGH-HIGH FLOW SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

8. All flow transmitters will have a LOW FLOW alarm. Certain flow transmitters will also have a LOW-LOW FLOW alarm. The LOW FLOW SET POINT and LOW-LOW FLOW SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

9. High level switches will have a HIGH LEVEL and/or HIGH-HIGH LEVEL alarm. High level switches will be mounted as specified in the plans. Sufficient cable length shall be coiled to allow for changes to the mounting height.

10. Low level switches will have a LOW LEVEL or LOW-LOW LEVEL alarm. Low level switches will be mounted as specified in the plans. Sufficient cable length shall be coiled to allow for changes to the mounting height.

11. All level transmitters will have HIGH LEVEL and HIGH-HIGH LEVEL alarms. The HIGH LEVEL SET POINT and HIGH-HIGH LEVEL SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

12. All level transmitters will have a LOW LEVEL alarm. Certain level transmitters will also have a LOW-LOW LEVEL alarm. The LOW LEVEL SET POINT and LOW-LOW LEVEL SET POINT will be determined by the ENGINEER at startup unless specified otherwise.

1.06 ETHERNET NETWORK

A. All equipment data available over the Ethernet network shall be available on the Control System software.

B. Motor Protection Relays – All information, including but not limited to: Phase Voltages, Kilowatts, Kilovars, Power Factor, and Frequency shall be brought into the SCADA system. Values shall be trended.

C. Power Monitoring - All information, including but not limited to: Phase Voltages, Phase Amps, Kilowatts, Kilovars, Power Factor, and Frequency shall be brought into the SCADA system. Values shall be trended.

PART 2 - PRODUCTS

2.01 GENERAL

A. Refer to Section 17000.

PART 3 - EXECUTION

3.01 GENERAL

A. Refer to Section 17000.

- END OF SECTION -

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SECTION 17301 – PUMP CONTROL LOOP

LOOP 0001

1.01 LOOP SUMMARY:

A. Each of the pump locations will have a similar function.

1.02 ALARMS: The following alarms are associated with this loop.

A. KASXXX - Fail to Start (See 17300 Common Functions)

B. KAPXXX - Fail to Stop (See 17300 Common Functions)

C. MMAXXX - Motor Moisture Alarm. If a motor moisture condition is detected for a preset amount of time, an alarm is generated and must be reset by the operator.

D. TAHXXX - High Motor Temperature. If a high motor temperature is detected for a preset amount of time, an alarm is generated and must be reset by the operator.

E. YAXXX - Motor Fail. If a Motor overload fail condition occurs for a preset amount of time, an alarm is generated and must be reset by the operator.

1.03 HARDWIRED PERMISSIVES: There are no hardwired permissives associated with this loop.

1.04 SOFTWARE PERMISSIVES: There are no software permissives associated with this loop.

1.05 HARDWIRED INTERLOCKS: The following hardwired interlocks are associated with this loop.

A. LAL-XXX: If the sump water level is low the pump will not operate (This can either be a level from the level transmitter or a float switch)

B. TAH-XXX: If the temperature alarm is received the pump will not operate

C. MMA-XXX: if the motor moisture alarm is received the pump will not operate

1.06 CONTROLS: The following controls are associated with this loop.

A. **LOCAL MANUAL Control Mode:** The following LOCAL MANUAL controls are associated with this loop.

1. HOR. The equipment may be locally started and stopped when the HOR switch is placed in the HAND and OFF positions, respectively. When the HOR switch is in the HAND position the equipment will start. When the HOR switch is in the OFF position the equipment will stop.

B. **LOCAL AUTO Control Mode:** There are no LOCAL AUTO controls associated with this loop.

C. **PLC MANUAL Control Mode (Future provision):** The following PLC MANUAL controls are associated with this loop.

1. When the HOR switch is in the REMOTE position and the SCADA MANUAL/AUTO switch is in the MANUAL position, the equipment may be controlled manually from SCADA.

2. SCADA SS. When in SCADA MANUAL, the equipment may be started and stopped manually. Pressing the SCADA START pushbutton will start the equipment and pushing the SCADA STOP pushbutton will stop the equipment.

D. **PLC AUTO Control Mode:** The following PLC AUTO controls are associated with this loop.

1. When the HOR switch is in the REMOTE position and the PLC MANUAL/AUTO switch is in the AUTO position, the equipment may be controlled automatically from SCADA.

2. See common logic below for pump control

PART 2 - 2nd PUMP IF SO EQUIPPED

2.01 This loop is identical to prior Loop (see Part 1).

PART 3 - COMMON LOGIC FOR PUMP STATION

3.01 <u>EQUIPMENT AUTO START/STOP LOGIC</u>

A. All controls will utilize the level indication from level transmitter or float switches depending upon the pump.

B. When the level rises to an operator adjustable pump on set point, the lead pump will start (hi float switch if so equipped).

C. Once the level of the water is at or below the operator adjustable pump off setpoint the operating pump will turn off (Lo float switch if so equipped)

- END OF SECTION -

SECTION 17700 – PLC PROGRAMMING STANDARDS

PART 1 -- GENERAL

1.1 SCOPE OF WORK

A. General: All equipment that is being furnished with Programmable Logic Controllers (PLC's) shall be programmed in accordance with this specification and with division 17.

B. The Requirements of Section 17000 – Instrumentation apply to this section.

C. The Requirements of Section 17300 – Control Strategies apply to this section.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300 – Contractor Submittals

B. All PLC programs shall be submitted to the ENGINEER in PDF format for review and approval before the equipment has been delivered to the site.

PART 2 -- PRODUCTS

2.1 GENERAL

A. It is the purpose of this document to describe the standard programming requirements of all PLCs to be delivered to the OWNER. All PLC programs will conform to the standards specified in this document. Any deviation from these standards without prior approval from the ENGINEER will be corrected by the CONTRACTOR or VENDOR at no cost to the OWNER.

B. All PLC hardware shall be in accordance with Section 16903 – Programmable Logic Controllers.

C. A well-organized back-up disk of all PLC programs and configuration files shall be provided. In addition, the disk shall contain a PDF of the current PLC logic and programming configuration.

PART 3 – EXECUTION

3.1 PROGRAMMING

A. PLC Configuration: The ControlLogix PLC shall use 1769 I/O types, refer to Section 16903 for specific parts approved for PLCs. Arrangement of PLC cards shall be in an orderly fashion with space for future expansion. A description of each card and its setup is as follows:

1. Processor (1756-L6X): The processor shall be named PLC-XX-YYY where XX represents the process area (such as HW for Headworks) and YYY represents the PLC number (such as 001). See the contract drawings for PLC names.

2. Ethernet Card (1756-ENBT): The Ethernet Card shall be named RXSY-ENBT where RX represents the rack number of that PLC (for example R1 for Rack 1) and SY represents the slot number that the module is in the rack (for example S1 for Slot 1). The IP address, subnet mask, and default gateway shall be provided by the ENGINEER.

3. IO cards: IO cards shall be named RXSY-ZZZZ where RX represents the rack number of that PLC (for example R1 for Rack 1), SY represents the slot number that the module is in the rack (for example S1 for Slot 1) and ZZZZ represents the model of the card (for example a 32 point discrete input module might be IB32).

B. Program Structure: The ControlLogix PLC uses RS Logix 5000 programming software. This software allows the PLC program to be made up of programs, tasks, and routines. The program structure shall use the “Main Task”, “Main Program”, and “Main Routine”. All other logic will be included in subroutines created under the “Main Task”.

1. Routines: All PLCs shall have three types of routines: Internal, Loop, and Communication routines. Internal routines shall contain all the logic that is not directly related to process controls and/or communication. This would include panel power faults and start-up logic. Loop routines shall contain all logic used to directly control and/or monitor control loops as described in Section 17300 Control Strategies and as depicted on the Process & Instrumentation Diagrams. Communication routines would include all the logic utilized to communicate with other PLCs, HMI machines, and Operator Interfaces. The names of these routines will use the prefixes: IXX, LXXXX, and CXX respectively. XX represents the number of the routine (or loop number), all routines will have names that adequately describe the logic contained within. For example, scaling of analog inputs would be called I01_AnalogScaling. All routines shall be ordered in a structured and logical fashion.

Routine Name	Routine Description
I01_AnalogScaling	Contains all the scaling of the analog inputs.
C01_Messaging	Contains the messages used in SCADA communications.
L1261_ScumLevel	Contains all the logic associated with the monitoring and control of the Scum Pit Level

2. Program Name: The program file shall be the same name as the processor as described above. RSLogix 5000 automatically creates revision files every time the program file is updated and saved. Each time a revision is made, a comment should be logged when given the opportunity describing the changes made.

C. Tag Naming: All data items within the CompactLogix require tag names. The most important aspect in naming tags is consistency. The following guidelines will help in creating consistent tag named across the plant.

1. All tags that may be referenced over the SCADA system and/or plant network shall be created as “Controller Tags” unless noted. These tags are global to the entire controller.

2. Some tags shall be created as “Program Tags”. These are internal PLC tags that are used as temporary memory and will never be read by the HMI or an Operator Interface. Examples of “Program Tags” are as follows:

a. Misc. Timers and Counters.

b. Temporary registers used in mathematical operations.

c. One shot bits.

3. All physical I/O shall have an alias tag that matches the tag name specified in the loop descriptions under Section 17300 Control Strategies.

4. HMI tags shall be named using the tag names given under the HMI Tags section of the loop descriptions in Section 17300 Control Strategies. For other tags not listed in Section 17300 but necessary for correctly programming the process, the tag name shall be created with the following guidelines:

   a. If the tag is associated with a certain piece of equipment, the corresponding loop number must follow the prefix used in the tag. Prefixes for tags are created using the ISA Instrument Identification Table. A copy of this table can be found in part f. If two tags share the same name they shall be appended with a capital letter starting at A, going in alphabetical order to Z. If there are more tags than letters of the alphabet succeeding tags will start back at A and double the corresponding letter creating tags appended with AA, BB, etc.

   b. If the tag is associated with a group of equipment, for example three RAS pumps, then the internal tags will use the loop number of lowest numeric value and the appropriate prefix. Prefixes for tags are created using the ISA Instrument Identification Table. A copy of this table can be found in part f. If two tags share the same name they shall be appended with a capital letter starting at A, going in alphabetical order to Z. If there are more tags than letters of the alphabet succeeding tags will start back at A and double the corresponding letter creating tags appended with AA, BB, etc.

   c. If the tag is not associated with any physical equipment the PLC name shall be used. All "-"'s and the prefix "PLC" shall be deleted. This will follow the prefix selected from the ISA Instrumentation Identification Table. A copy of this table can be found in part f. If two tags share the same name they shall be appended with a capital letter starting at A, going in alphabetical order to Z. If there are more tags than letters of the alphabet succeeding tags will start back at A and double the corresponding letter creating tags appended with AA, BB, etc.

   d. Tag arrays used for messaging shall use the names of the point of message origination. If an array stores values received from the HMI the array will start with HMI. If an array stores values read from PLC-RS-1 then the array will start with RS1. The prefix shall be followed by a descriptive name that adequately describes what is included in the array.

   e. Other arrays may be used when it simplifies the programming and configuration of the process. Naming for these arrays shall use the same naming convention as described for regular tags.

   f. The ISA table shall be used for Tag prefixes. The following is a table of acceptable tag prefixes. If there are ISA prefixes that a programmer would like to use that do not appear on this list, they must be first approved by the ENGINEER.

ISA PREFIX				INSTRUMENT IDENTIFICATION			
A	A	H		ANALYSIS	ALARM	HIGH	
A	A	H	H	ANALYSIS	ALARM	HIGH	HIGH
A	A	L		ANALYSIS	ALARM	LOW	
A	A	L	L	ANALYSIS	ALARM	LOW	LOW
A	C			ANALYSIS	CONTROL		
A	C	H		ANALYSIS	CONTROL	HIGH	
A	C	H	H	ANALYSIS	CONTROL	HIGH	HIGH
A	C	L		ANALYSIS	CONTROL	LOW	
A	C	L	L	ANALYSIS	CONTROL	LOW	LOW
A	I			ANALYSIS	INDICATE		
A	I	C		ANALYSIS	INDICATE	CONTROL	
A	I	R		ANALYSIS	INDICATE	RECORD	
E	A			VOLTAGE	ALARM		
E	I			VOLTAGE	INDICATE		
E	I	R		VOLTAGE	INDICATE	RECORD	
F	A	H		FLOW	ALARM	HIGH	
F	A	H	H	FLOW	ALARM	HIGH	HIGH
F	A	L		FLOW	ALARM	LOW	
F	A	L	L	FLOW	ALARM	LOW	LOW
F	C			FLOW	CONTROL		
F	C	H		FLOW	CONTROL	HIGH	
F	C	H	H	FLOW	CONTROL	HIGH	HIGH
F	C	L		FLOW	CONTROL	LOW	
F	C	L	L	FLOW	CONTROL	LOW	LOW
F	I	C		FLOW	INDICATE	CONTROL	
F	I	R		FLOW	INDICATE	REMOTE	
F	Q	C		FLOW	TOTAL	CONTROL	
F	Q	I		FLOW	TOTAL	INDICATE	
F	Q	I	R	FLOW	TOTAL	INDICATE	RECORD
F	Q	Y		FLOW	TOTAL	RELAY	
H	S			HAND	SWITCH		
I	I			CURRENT	INDICATE		
I	I	R		CURRENT	INDICATE	RECORD	
I	A	H		CURRENT	ALARM	HIGH	
I	A	H	H	CURRENT	ALARM	HIGH	HIGH
I	C	H		CURRENT	CONTROL	HIGH	

I	C	H	H	CURRENT	CONTROL	HIGH	HIGH
J	A	H		TORQUE	ALARM	HIGH	
J	A	H	H	TORQUE	ALARM	HIGH	HIGH
K	A	C		TIME	ALARM	CLOSE	
K	A	N		TIME	ALARM	NORMAL	
K	A	O		TIME	ALARM	OPEN	
K	A	P		TIME	ALARM	STOP	
K	A	S		TIME	ALARM	START	
K	C			TIME	CONTROL		
K	C	C		TIME	CONTROL	CLOSE	
K	C	N		TIME	CONTROL	NORMAL	
K	C	O		TIME	CONTROL	OPEN	
K	C	P		TIME	CONTROL	STOP	
K	C	S		TIME	CONTROL	START	
K	I			TIME	INDICATE		
L	A	H		LEVEL	ALARM	HIGH	
L	A	H	H	LEVEL	ALARM	HIGH	HIGH
L	A	L		LEVEL	ALARM	LOW	
L	A	L	L	LEVEL	ALARM	LOW	LOW
L	C			LEVEL	CONTROL		
L	C	H		LEVEL	CONTROL	HIGH	
L	C	H	H	LEVEL	CONTROL	HIGH	HIGH
L	C	L		LEVEL	CONTROL	LOW	
L	C	L	L	LEVEL	CONTROL	LOW	LOW
L	C	S		LEVEL	CONTROL	START	
L	C	P		LEVEL	CONTROL	STOP	
L	D	A	H	LEVEL	DIFFERENTIAL	ALARM	HIGH
L	D	A	L	LEVEL	DIFFERENTIAL	ALARM	LOW
L	D	C	H	LEVEL	DIFFERENTIAL	CONTROL	HIGH
L	D	C	L	LEVEL	DIFFERENTIAL	CONTROL	LOW
L	D	I		LEVEL	DIFFERENTIAL	INDICATE	
L	D	I	C	LEVEL	DIFFERENTIAL	INDICATE	CONTROL
L	D	I	R	LEVEL	DIFFERENTIAL	INDICATE	RECORD
L	I			LEVEL	INDICATE		
L	I	C		LEVEL	INDICATE	CONTROL	
L	I	R		LEVEL	INDICATION	REMOTE	
M	M	A		MOTOR	MOISTURE	ALARM	

P	A	H		PRESSURE	ALARM	HIGH	
P	A	H	H	PRESSURE	ALARM	HIGH	HIGH
P	A	L		PRESSURE	ALARM	LOW	
P	A	L	L	PRESSURE	ALARM	LOW	LOW
P	C			PRESSURE	CONTROL		
P	C	H		PRESSURE	CONTROL	HIGH	
P	C	H	H	PRESSURE	CONTROL	HIGH	HIGH
P	C	L		PRESSURE	CONTROL	LOW	
P	C	L	L	PRESSURE	CONTROL	LOW	LOW
P	D	A	H	PRESSURE	DIFFERENTIAL	ALARM	HIGH
P	D	A	L	PRESSURE	DIFFERENTIAL	ALARM	LOW
P	D	C	H	PRESSURE	DIFFERENTIAL	CONTROL	HIGH
P	D	C	L	PRESSURE	DIFFERENTIAL	CONTROL	LOW
P	D	I		PRESSURE	DIFFERENTIAL	INDICATE	
P	D	I	C	PRESSURE	DIFFERENTIAL	INDICATE	CONTROL
P	D	I	R	PRESSURE	DIFFERENTIAL	INDICATE	RECORD
P	I			PRESSURE	INDICATE		
P	I	C		PRESSURE	INDICATE	CONTROL	
P	I	R		PRESSURE	INDICATION	REMOTE	
S	A	H		SPEED	ALARM	HIGH	
S	A	L		SPEED	ALARM	LOW	
S	A	N		SPEED	ALARM	NORMAL	
S	C			SPEED	CONTROL		
S	C	H		SPEED	CONTROL	HIGH	
S	C	L		SPEED	CONTROL	LOW	
S	C	N		SPEED	CONTROL	NORMAL	
S	I			SPEED	INDICATE		
S	I	C		SPEED	INDICATE	CONTROL	
S	I	R		SPEED	INDICATE	RECORD	
S	K			SPEED	CONTROL STATION		
T	A	H		TEMPERATURE	ALARM	HIGH	
T	A	H	H	TEMPERATURE	ALARM	HIGH	HIGH
T	A	L		TEMPERATURE	ALARM	LOW	
T	A	L		TEMPERATURE	ALARM	LOW	LOW
T	C			TEMPERATURE	CONTROL		
T	C	H		TEMPERATURE	CONTROL	HIGH	
T	C	H	H	TEMPERATURE	CONTROL	HIGH	HIGH
T	C	L		TEMPERATURE	CONTROL	LOW	

T	C	L	L	TEMPERATURE	CONTROL	LOW	LOW
T	I			TEMPERATURE	INDICATE		
T	I	C		TEMPERATURE	INDICATE	CONTROL	
T	I	R		TEMPERATURE	INDICATE	REMOTE	
V	A	H		VIBRATION	ALARM	HIGH	
V	C	H		VIBRATION	CONTROL	HIGH	
V	I			VIBRATION	INDICATE		
V	I	R		VIBRATION	INDICATE	RECORD	
W	A	H		WEIGHT	ALARM	HIGH	
W	A	H	H	WEIGHT	ALARM	HIGH	HIGH
W	A	L		WEIGHT	ALARM	LOW	
W	A	L	L	WEIGHT	ALARM	LOW	LOW
W	C			WEIGHT	CONTROL		
W	C	H		WEIGHT	CONTROL	HIGH	
W	C	H	H	WEIGHT	CONTROL	HIGH	HIGH
W	C	L		WEIGHT	CONTROL	LOW	
W	C	L	L	WEIGHT	CONTROL	LOW	LOW
W	I			WEIGHT	INDICATE		
W	I	C		WEIGHT	INDICATE	CONTROL	
W	I	R		WEIGHT	INDICATE	RECORD	
Y	A			EVENT	ALARM		
Y	C			EVENT	CONTROL		
Y	I			EVENT	INDICATE		
Y	L			EVENT	LIGHT		
Y	Y			EVENT	RELAY		
Z	A			POSITION	ALARM		
Z	A	H		POSITION	ALARM	HIGH	
Z	A	H	H	POSITION	ALARM	HIGH	HIGH
Z	A	L		POSITION	ALARM	LOW	
Z	A	L	L	POSITION	ALARM	LOW	LOW
Z	A	N		POSITION	ALARM	NORMAL	
Z	C			POSITION	CONTROL		
Z	C	H		POSITION	CONTROL	HIGH	
Z	C	H	H	POSITION	CONTROL	HIGH	HIGH
Z	C	L		POSITION	CONTROL	LOW	
Z	C	L	L	POSITION	CONTROL	LOW	LOW
Z	C	N		POSITION	CONTROL	NORMAL	

Z	I		POSITION	INDICATE	
Z	I	O	POSITION	INDICATE	OPEN
Z	I	C	POSITION	INDICATE	CLOSE
Z	I	R	POSITION	INDICATE	RECORD

D. Data Types: No user defined data types shall be used without approval from the Engineer. Data types shall be selected to best suit the application. Where possible use DINT in place of INT data types.

E. Documentation: The following requirements shall be met with regards to documentation:

1. Tags used within the program shall have a descriptor that adequately describes the tag's equipment and function.

2. Rung comments shall be used to adequately describe the functions being performed.

3. Arrays shall have base descriptions that describe their function.

F. Messaging: All communication will take place over the plant fiber-optic network. All PLC's will perform reads only. No PLC writes will be accepted without approval from the Engineer. Any control that requires network communications shall have associated logic for communications alarming and watchdog. In the event of a communications alarm, logic shall be written on a case-by-case basis to follow the safest and most logical consequence for that particular control strategy.

G. Alarming: All alarms shall be announced on the HMI and be one of two types of alarms: sealed alarms or self-healing alarms. A sealed alarm is sealed in until an operator uses the alarm reset pushbutton on the HMI. A self-healing alarm clears itself once the alarm condition clears. Process alarms for each piece of equipment are detailed in the loop descriptions found in Section 17300 - Control Strategies. In addition to process alarms each PLC will have the following alarms:

1. Power Failure Alarm

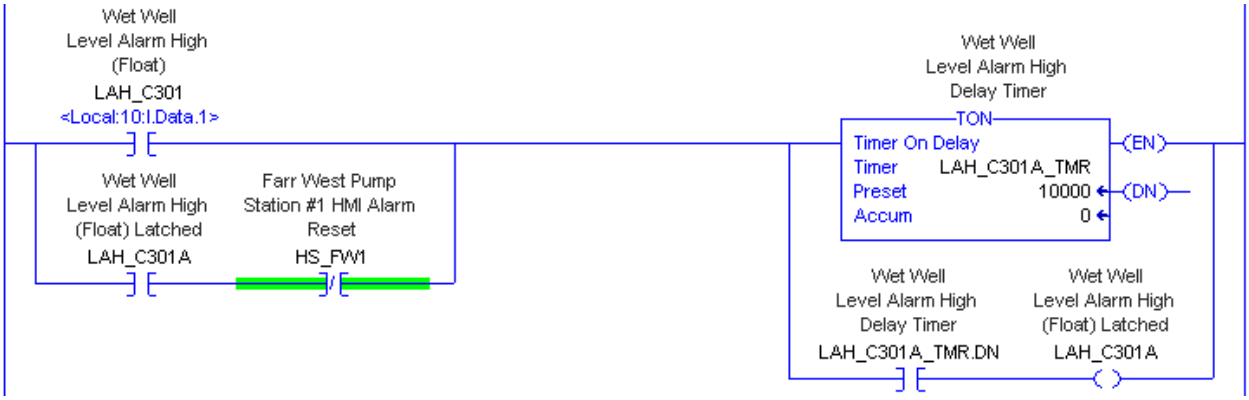
2. Communication Failure Alarm

3. PLC Card Failure

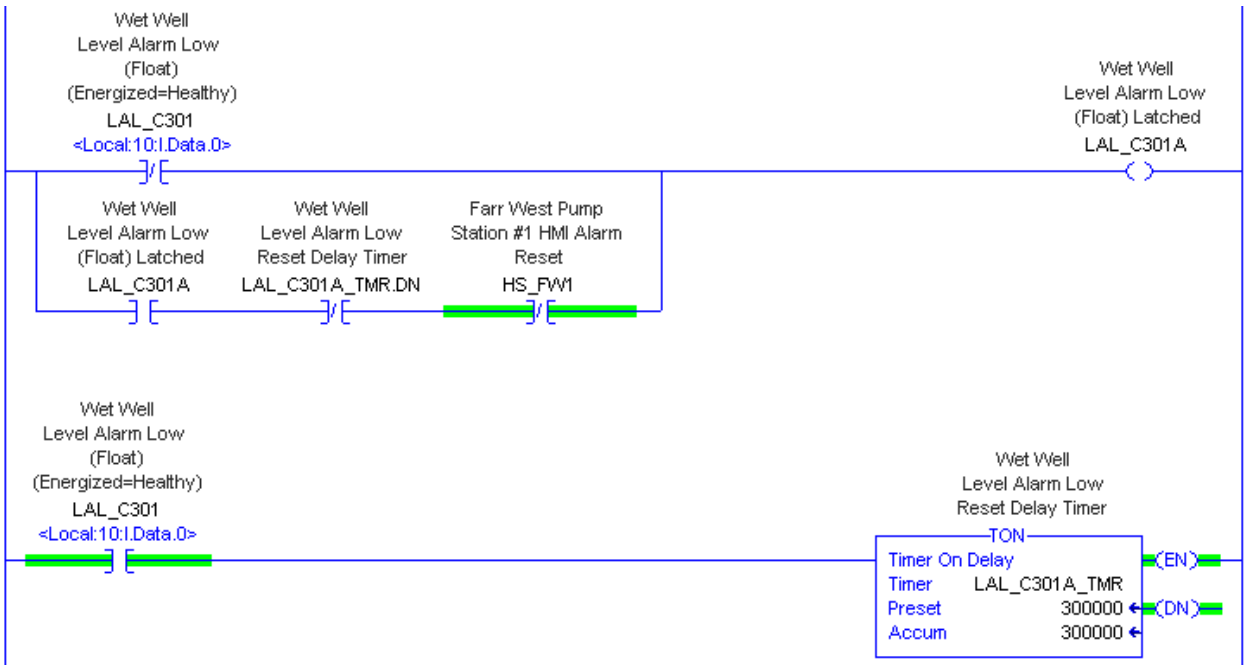
4. PLC Fault

H. Standard Logic: This section contains descriptions and logic examples used in standard motor and valve control. Where appropriate this logic is to be used as is to maintain consistency throughout the plant.

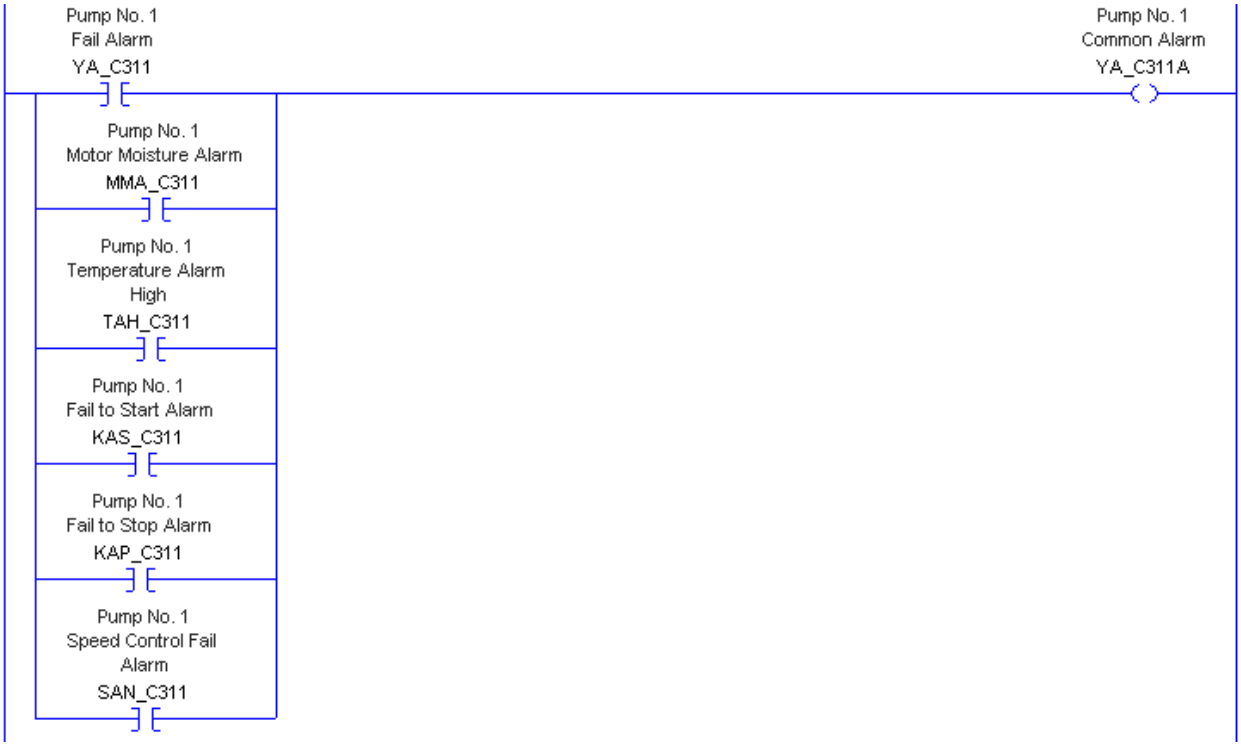
1. General Sealed Alarms: All sealed alarms will be latched using the alarm itself and are un-latched by using the appropriate Alarm Reset button on the HMI. General sealed alarms shall use the following logic:



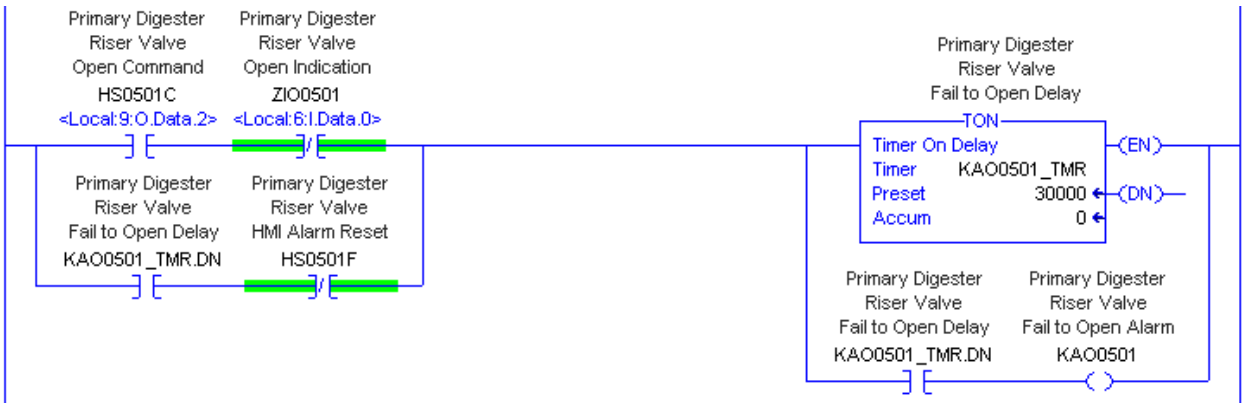
2. General Self-Healing Alarms: All self-healing alarms will be announced on the HMI. Once the alarm condition clears the alarm will clear itself and operation will proceed as normal. General Self-Healing Alarms shall use the following logic:



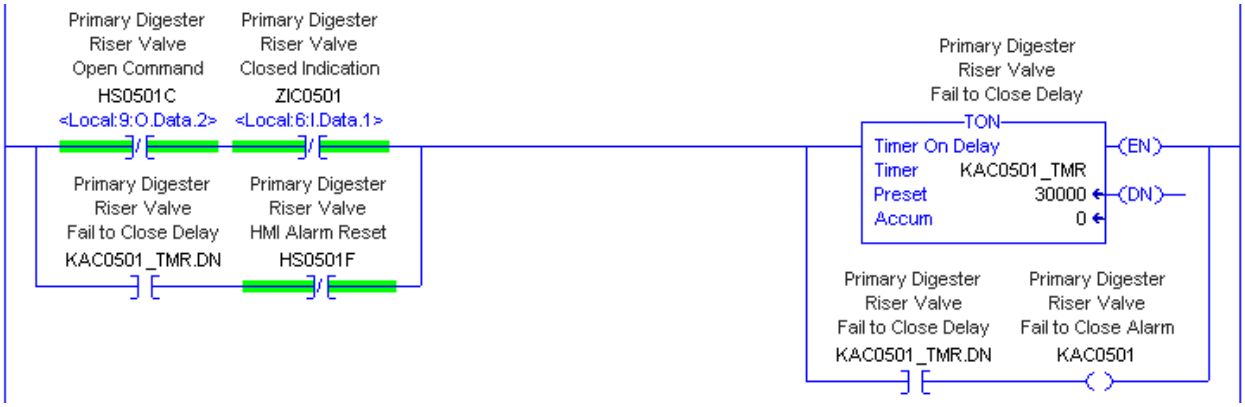
3. Equipment Common Alarm: All pieces of equipment shall have a Common Alarm that is energized any time an alarm occurs at that given piece of equipment. An example of this logic is found below:



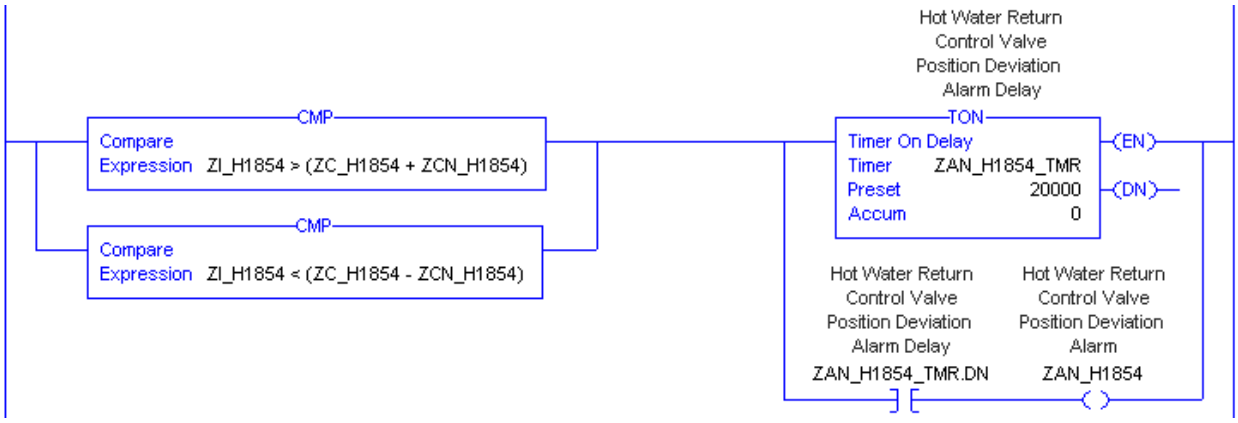
4. Valve Fail to Open: All valves with an Open Command or Open/Close Command shall have a Valve Fail to Open alarm. All Valve Fail to Open alarms shall use the following logic:



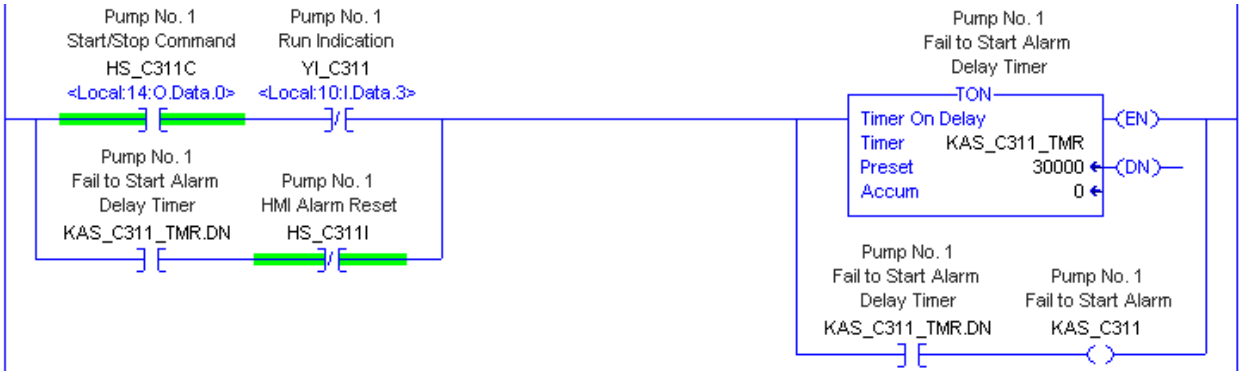
5. Valve Fail to Close: All valves with a Close Command or Open/Close Command shall have a Valve Fail to Close alarm. All Valve Fail to Close alarms shall use the following logic:



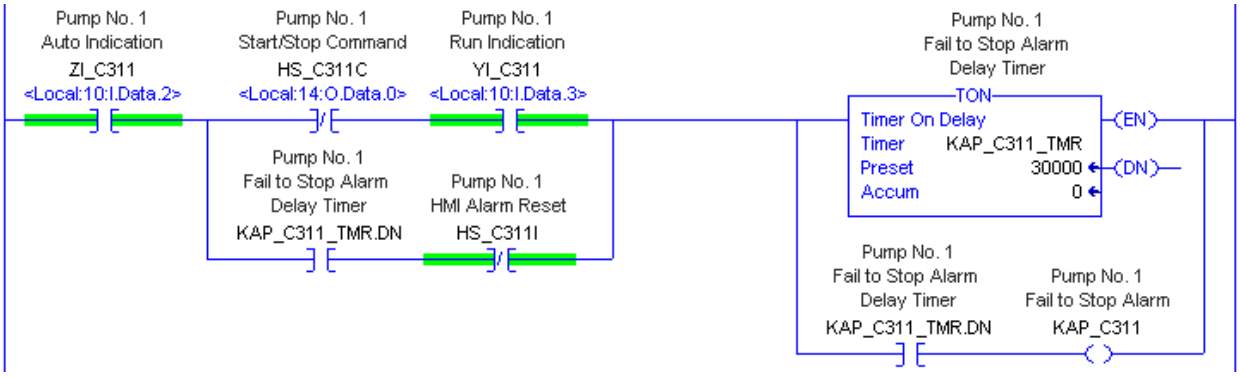
6. Valve Position Failure: All modulating valves with position control shall have a Valve Position Failure Alarm. The position failure alarm occurs when the Position Indication and Position Control are not within a specified tolerance for a user specified delay time. All Valve Position Failure alarms shall use the following logic:



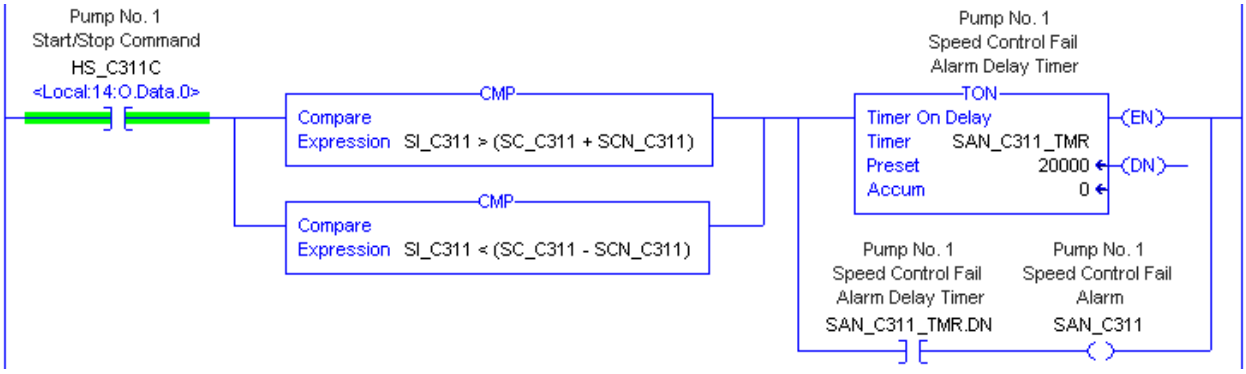
7. Fail to Start: All motors with start commands from the PLC shall have a Fail to Start Alarm. All Fail to Start Alarms shall use the following logic:



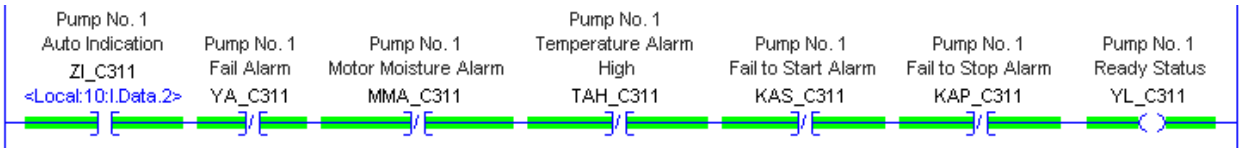
8. Fail to Stop: All motors with start commands from the PLC shall have a Fail to Stop Alarm. All Fail to Stop Alarms shall use the following logic:



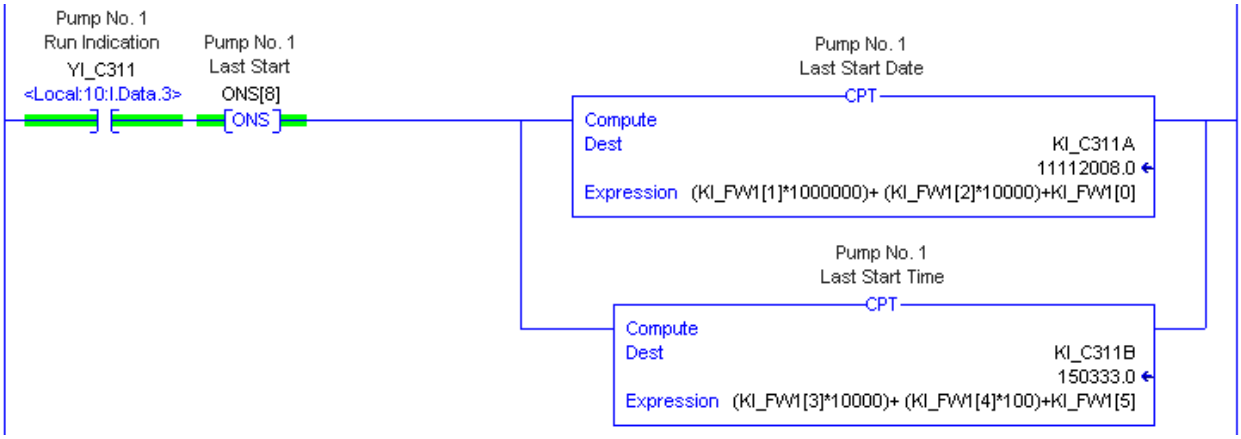
9. Speed Failure: All motors with speed control shall have a speed failure alarm. The speed failure alarm condition occurs when the Speed Indication and Speed Control are not within a user specified tolerance for a user specified delay time. All Speed Failure Alarms shall use the following logic:



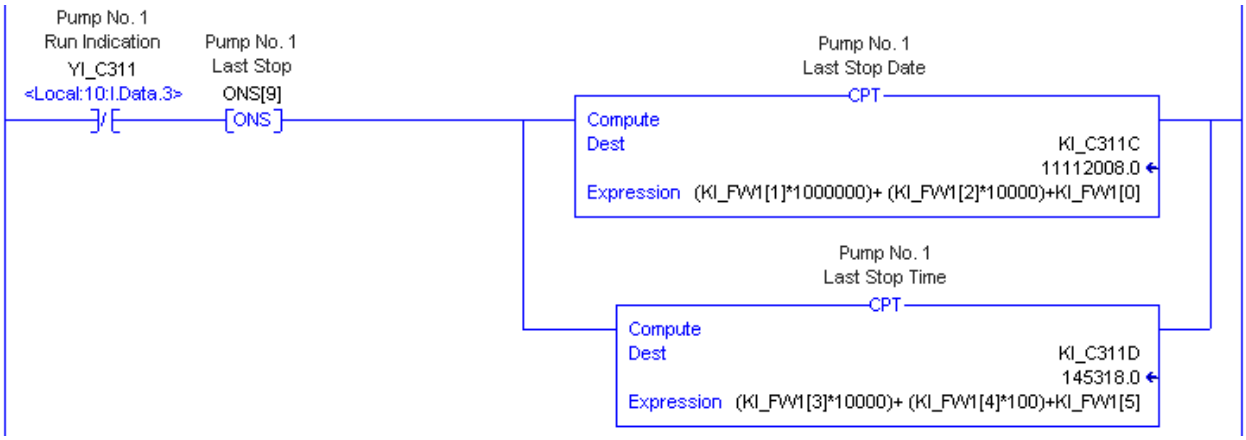
1. Motor Ready: All motors with Start/Stop controls shall have a ready status. The ready status is energized if and only if no alarm conditions are present, the pump is in remote control, and any backspin or delay timers have been completed. The ready status signifies that the pump is available to run or is running. An example of this logic is found below:



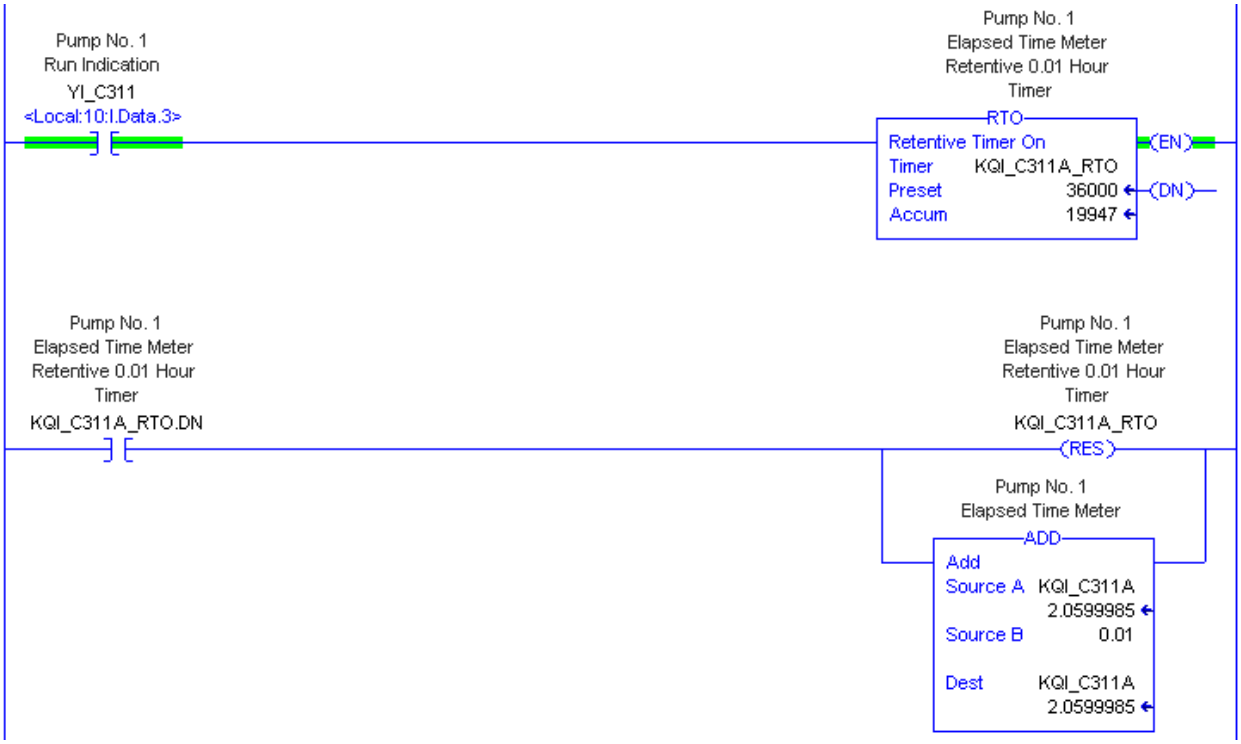
10. Last Start Time: All motors with a run indication shall have a Last Start Time. The Last Start Time indicates the last time the motor was started. The Last Start Time shall use the following logic:



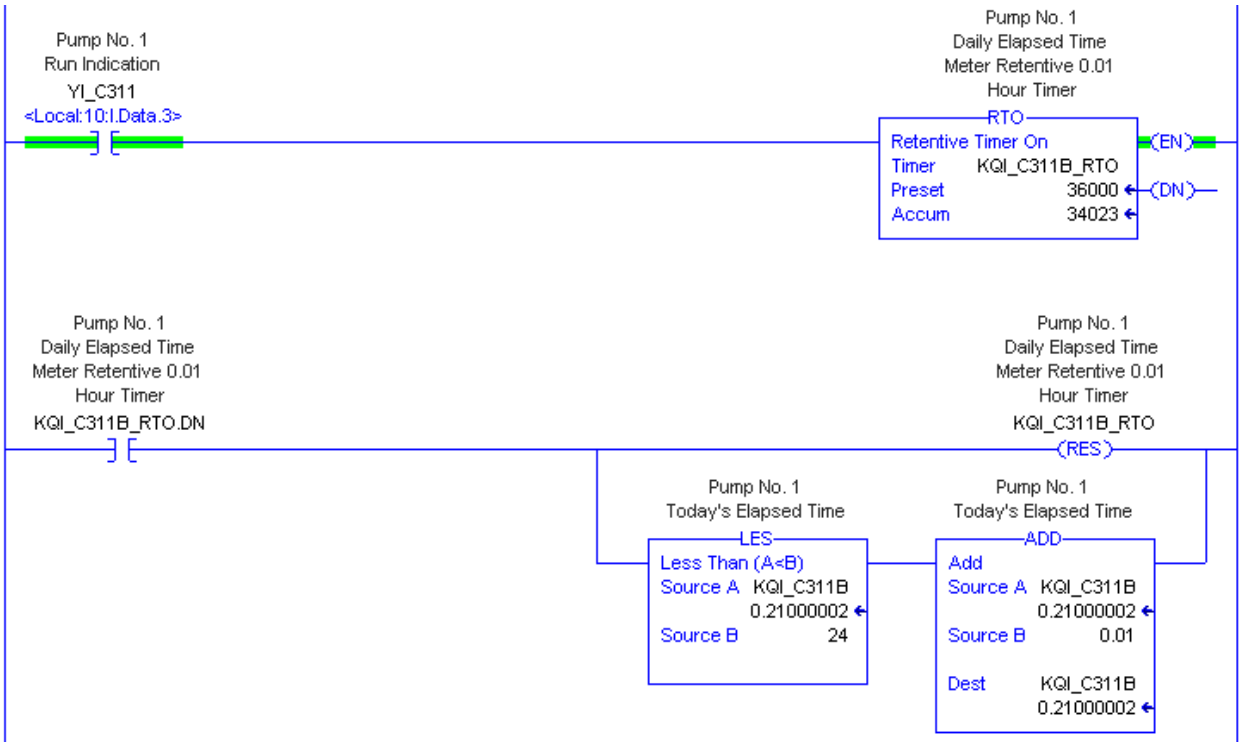
11. Last Stop Time: All motors with a run indication shall have a Last Stop Time. The Last Stop Time indicates the last time the motor was started. The Last Start Time shall use the following logic:



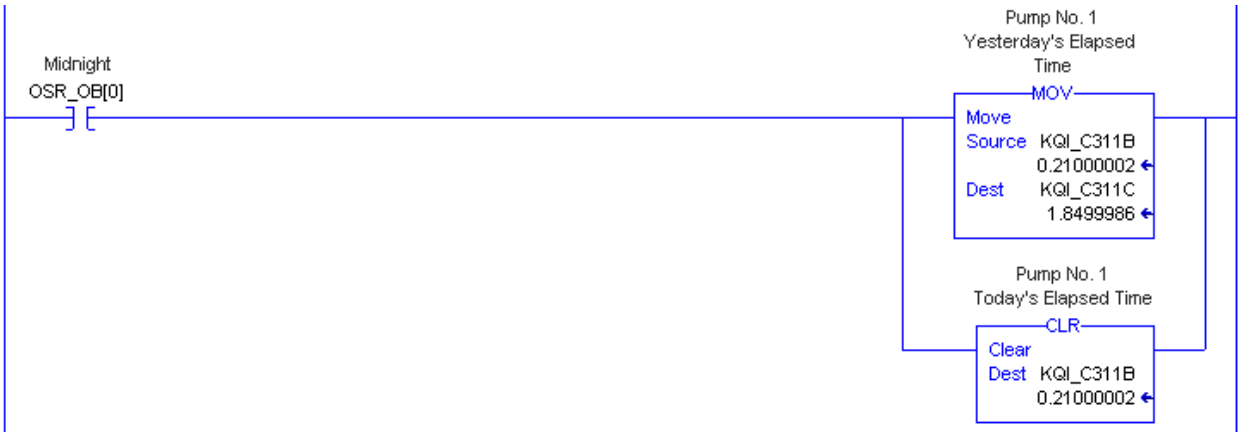
12. Run Hours: All motors shall have a run time accumulator that keeps track of the amount of hours the motor has run. All Run Hour Accumulators shall use the following logic:



13. Today's Run Hours: All motors shall have a run time accumulator that keeps track of the current days run hours. The Today's Run Hours Accumulator shall use the following logic:



14. Yesterday's Run Hours: All motors shall have a yesterday's run hours tag. This tag is given the amount of Today's Run Hours at midnight and Today's Run Hours is reset to 0. The following logic shall be used for Yesterday's Run Hours:



15. Lead Lag Alternations: There are several methods of lead and lag motor alternation. The actual method used will be determined by the Process Engineer and included in Section 17300 Control Strategies. If for any reason a motor is not available to run it is taken out of the alternations and the next motor would take its position. Automatic alternations will follow a general 1-2-3, 2-3-1, 3-1-2 order for a system of three motors, 1-2-3-4, 2-3-4-1, 3-4-1-2, 4-1-2-3 order for a four motor system etc. The following are general alternation methods that will be used throughout the plant:

    a. Manual Alternation: In Manual Alternation operators and plant staff will select what motors fill the position of lead and lag motors.

    b. Timed Alternation: A Timed Alternation is an automatic alternation that switches the position of lead and lag motors at a user specified time each day or after a user specified amount of time. This alternation shall be bumpless if motors are running during the alternation.

    c. Run Status Alternation: A Run Status Alternation is an automatic alternation that switches the position of the lead and lag motors once all motors have stopped running or all motors start running. This alternation shall be bumpless if motors are running during alternation.

16 Motor Control: Motor control will be determined by the Loop Descriptions in Section 17300 Control Strategies.

17. Valve Control: Valve control will be determined by the Loop Descriptions in Section 17300 Control Strategies.

I. PLC Monitoring: PLC status monitoring will include communication monitoring and card monitoring. Each PLC will have an individual alarm for each card in the PLC. This alarm will indicate a failure status for the card. A heartbeat will be set up that will be monitored by the HMI or other PLC in order to ensure a communication link.

3.2 COMMISSIONING, TESTING AND INSTRUCTION

A. See Section 17000 Instrumentation for details on commissioning, testing, and instruction.

– END OF SECTION –

Attachment K-2

Water Treatment Facility

Please note that the WTP specifications are not provided at this time because design of the facility has been suspended until the NPDES permit is finalized.

Midnite Mine Superfund Site
100 Percent Design

Appendix L – Remedial Action Health and Safety Plan

June 2015

Prepared for:

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APPROVALS

This Midnite Mine Superfund Site Remedial Action Health and Safety Plan (HASP) has been reviewed and approved by the following:

Name	Title	Date
_____	DMC/Newmont Site Construction Manager	_____
_____	DMC/Newmont Site Safety Manager	_____
_____	DMC/Newmont Radiation Safety Officer	_____

Changes to the HASP as described in this document, must be reviewed and approved by the above individuals.

One controlled hard copy of this HASP will be maintained at the Midnite Mine administrative and safety office(s), and one must be accessible at the Midnite Mine work site at all times during work.

TABLE OF CONTENTS

L1.0 INTRODUCTION 1

L1.1 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITIES 3

L1.1.1 Competent Person 3

L1.1.2 Contractor/Subcontractor Safety and Health Plan 3

L1.2 MULTIPLE EMPLOYER PROJECTS 5

L1.2.1 Differing Opinions 5

L1.3 UNSAFE CONDITIONS 5

L1.4 JOB SAFETY ANALYSIS AND STANDARD OPERATION PROCEDURES 6

L1.5 PROJECT ORGANIZATION 6

L2.0 GENERAL HEALTH AND SAFETY REQUIREMENTS 10

L2.1 SITE SAFETY MEETINGS 11

L2.2 ACCIDENT/INCIDENT REPORTING 12

L2.3 PROHIBITED ACTIVITIES 12

L2.4 VISITOR CLEARANCE 13

L2.5 MEDICAL SURVEILLANCE 13

L2.6 GENERAL PERSONAL PROTECTIVE EQUIPMENT 14

L2.6.1 Levels of PPE 14

L2.6.2 Respiratory Protection 15

L2.6.3 PPE Policies 16

L2.7 PERSONAL HYGIENE 16

L2.8 DECONTAMINATION 16

L2.9 EMERGENCY RESPONSE 17

L2.9.1 Lines of Authority 17

L2.9.2 Emergency Information 18

L2.9.3 Evacuation Procedures 18

L2.9.4 Emergency Medical Treatment 18

L2.9.5 Incident Investigation 19

L2.9.6 First Aid 19

L2.9.7 Spill Containment 20

L2.9.8 Communications 20

L2.10 TRAINING 20

L2.10.1 Required Courses and Meetings 20

L2.10.2 Worker Right to Know 20

L2.10.3 Emergency Recognition 21

L2.10.4 Physical Hazards 21

L2.10.5 Radiation Training 21

L2.11 RECORDS 21

L2.12 ADDENDA – MODIFYING THIS HASP AND CHANGE MANAGEMENT 22

L3.0 SPECIFIC HEALTH AND SAFETY REQUIREMENTS 22

L3.1 WORK ACTIVITIES 22

L3.2 APPLICATION OF STANDARDS 23

L3.3 CHEMICAL HAZARDS 23
L3.4 PHYSICAL HAZARDS 27
L3.4.1 Earthmoving Equipment Operation 27
L3.4.2 Excavating and Trenching 27
L3.4.3 Confined Space 28
L3.4.4 Ladders and Scaffolding 28
L3.4.5 Overhead and Highwall Hazards 29
L3.4.6 Power and Hand Tools 29
L3.4.7 Electrical Hazards 30
L3.4.8 Underground Utilities or Buried Materials 30
L3.4.9 Overhead Power Lines 30
L3.4.10 Steep Slopes and Tripping Hazards 30
L3.4.11 Fire and Explosion Hazards 31
L3.5 SLIPS, TRIPS, AND FALLS 31
L3.6 VEHICLE AND EARTHMOVING EQUIPMENT SAFETY 32
L3.7 EXTREME TEMPERATURES AND ADVERSE WEATHER CONDITIONS 33
L3.7.1 Cold Stress 33
L3.7.2 Heat Stress 35
L3.7.3 Adverse Weather Conditions 37
L3.8 BIOLOGICAL HAZARDS 38
L3.8.1 Animals 38
L3.8.2 Insects 39
L3.8.3 Snakes 39
L3.8.4 Poisonous Plants 39
L3.8.5 Bacteria and Viruses 39
L3.9 AIR MONITORING REQUIREMENTS AND PROTECTIVE MEASURES 39
L3.9.1 Organic Vapors 40
L3.9.2 Flammable Vapors 40
L3.9.3 Equipment, Calibration, and Maintenance 40
L3.10 NOISE MONITORING REQUIREMENTS 41
L3.11 ENGINEERING CONTROLS 41
L4.0 REFERENCES 41

LIST OF TABLES

Table L-1 – Key Personnel 6

Table L-2 – External Contacts 18

Table L-3 – Chemical and Toxicological Characteristics of Site Constituents (Metals) 24

Table L-4 – Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature 34

Table L-5 – Cold Stress Conditions 35

Table L-6 – Heat Stress Conditions 36

LIST OF FIGURES

Figure L-1 Decontamination Area and Exclusion Zone

LIST OF ATTACHMENTS

Attachment L-1 Radiation Protection Plan

Attachment L-2 Example Job Safety Analysis

Attachment L-3 Safety Compliance Form and Accident Report Form

Attachment L-4 Hospital Route Map

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AL	OSHA Action Level
ALARA	as low as is reasonably achievable
ANSI	American National Standards Institute
CERLCA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CSHP	Contractor/Subcontractor Safety and Health Plan
Company	DMC / Newmont
CQAO	Construction Quality Assurance Officer
CRSP	Colorado Rockfall Simulation Program
CSZ	construction support zone
CY	cubic yard
dBA	A-weighted decibel
DMC	Dawn Mining Company, LLC
EPCRA	Emergency Planning and Community Right-to-Know Act
EPA	U.S. Environmental Protection Agency
HASP	Health and Safety Plan
HAZCOM	Hazard Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high density polyethylene
IDLH	Immediately Dangerous to Life or Health
JSA	Job Safety Analysis
m	meter
mg/m^3	milligram per cubic meter
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MWH	MWH Americas, Inc.
Newmont	Newmont USA Limited
NIOSH	National Institute for Occupational Safety and Health
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limits
PPE	Personal protective equipment
RA	Remedial Action
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design

RI	Remedial Investigation
RPP	Radiation Protection Plan
SDS	Safety Data Sheet (formerly Material Safety Data Sheet)
Site	Midnite Mine Superfund Site
SOP	standard operating procedure
TLV	threshold limit values
TWA	time-weighted average
USC	United States Code
USDHHS	U.S. Department of Health and Human Services
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act
WTP	Water Treatment Plant

L1.0 INTRODUCTION

The Midnite Mine Superfund Site (Site) is an inactive, open-pit hard rock uranium mine that is being remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The Site is located in Washington State, approximately 40 air miles northwest of Spokane, Washington. The Site includes inactive open pits, disposal areas (waste rock/protore), and media impacted by mine-related contamination. Contaminants at the Site include radionuclides and heavy metals mobilized as a result of mining activities and environmental processes, such as acid rock drainage, radioactive decay, and particulate transport.

This Health and Safety Plan (HASP) describes the minimum health, safety and emergency response requirements for performing Remedial Action (RA) activities at the Site.

This HASP has been prepared on behalf of Dawn Mining Company LLC (DMC) and Newmont USA Limited (Newmont), and is applicable to all DMC/Newmont employees, contractors, and subcontractors involved with the RA. It establishes general safety requirements, and procedures for the protection of personnel and to prevent and minimize personal injuries, illnesses and physical damage to equipment, supplies, and property.

The work covered by this HASP will be conducted by DMC/Newmont (Company), its contractors and their subcontractors. Company personnel, contractors, subcontractors, suppliers, visitors, and all personnel engaged in work at the Site shall comply with all provisions of this HASP. This HASP shall not be modified without written approval of DMC/Newmont.

DMC/Newmont cannot anticipate all the hazards inherent to all contractor and subcontractor work activities. Therefore, each contractor and subcontractor will be required to read and evaluate this HASP to ensure that it adequately addresses the hazards presented to their employees. This HASP presents the minimum requirements for all contractors and subcontractors. Addenda may be attached to this HASP to ensure that additional potential risks are controlled for Site activities, and are addressed in contractor-prepared safety plans (see Section L1.1.2).

Since there is a potential for exposure to radiation above background levels, the Radiation Protection Plan (RPP), included as Attachment L-1 to this HASP, describes radiation hazards, safety requirements, training and policies, and the requirement that radiation doses be kept as

low as is reasonably achievable (ALARA). Specific radiation safety procedures applicable to the RA are covered in the RPP.

This HASP was prepared using the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (USDHHS, 1985). This site-specific HASP presents safety and health procedures designed to minimize potential risks of harm to personnel working on the Site. These procedures were developed in accordance with the list of regulatory guidelines, presented below, as applicable and appropriate. Individual contractor activity may be regulated under the Occupational Safety and Health Administration (OSHA) General Industry Standard, Mine Safety and Health Administration (MSHA), U.S. Nuclear Regulatory Commission (NRC), and/or Construction Standards to ensure a consistent and conservative risk management. Specific hazards in this HASP may specify the more stringent or prescriptive of the standards. The majority of operations conducted during the RA are primarily regulated by OSHA and/or the NRC. Since this is an inactive mine site formerly regulated by MSHA, Newmont/DMC and its contractors/subcontractors may utilize applicable MSHA best practices for managing specific mine hazards. These operations include but are not limited to:

- Ground Control for Rockfalls & Highwalls (30 CFR Part 56 Subpart B)
- Ground Control for Berms (30 CFR Part 56 Subpart B)
- Loading, Hauling, Dumping & Traffic Safety (30 CFR Part 56 Subpart H)
- Machinery (30 CFR Part 56 Subpart M)

This HASP was developed with the intent that regardless of the activity, all activities are compliant with the following regulatory and consensus standards:

- Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR), Part 1910 (General Industry Standards)
- Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR), Part 1926 (Construction Standards)
- NRC Standards for Protection against Radiation included in 10 CFR 20
- American National Standards Institute (ANSI), N14.1 Nuclear Materials - Uranium Hexafluoride - Packaging for Transport and N14.5 Radioactive Materials - Leakage Tests on Packages for Shipment
- Washington Industrial Safety and Health Act (WISHA), to include but not limited to:

- Washington Administrative Code (WAC), Parts 296-24, 296-45, 296-62, 296-155, 296-200, 296-800, 296-809, 296-817, 296-843, and 296-876

L1.1 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITIES

Any Site Contractor or Subcontractor shall ensure compliance with all applicable Federal, State, and local laws, rules, regulations, and guidelines governing safety, health and sanitation, including but not limited to the Contractor/Subcontractor Safety and Health Plan described below, the Occupational Safety and Health Act, 29 CFR 1910, 29 CFR 1926, 10 CFR 20, 296 WAC 296-155, and the Drug-Free Workplace Act (Public Law 100-690 Title V, subtitle D, 41 USC 701 et seq.). The Contractor/Subcontractor shall provide all safeguards, safety devices, and protective equipment, and shall take any other actions necessary to protect the life, safety and health of persons working at or visiting the project Site, the public, and the property in connection with the performance of the work covered by the Contract. The Contractor/Subcontractor shall take every reasonable precaution to minimize any dangers or hazards to their employees. In the case of conflicting requirements, the more stringent of the requirements shall apply. The Contractors/Subcontractors will be held accountable for the safety performance of their employees including lower tier subcontractors.

L1.1.1 Competent Person

Prior to start of work, the Contractor/Subcontractor shall designate at least one competent person for each of the operations being completed. The appropriate competent person(s) shall be present on the project Site at all times during construction activities. A competent person is an individual who, by way of training, experience, or combination thereof, is knowledgeable of applicable standards, is capable of identifying existing and predictable workplace hazards relating to the specific operation, is designated by the employer, and has authority to take appropriate actions.

L1.1.2 Contractor/Subcontractor Safety and Health Plan

Prior to the start of any work, the Contractor/Subcontractor shall prepare a Contractor/Subcontractor Safety and Health Plan (CSHP), which shall be specific to the project. The CSHP shall include:

1) A hazard assessment for each work site activity and job classification required in the activity area.

2) Direction as to whether engineering, administrative, personal protection measures, training, or a combination thereof, shall be implemented to address the hazards

identified above. Measures shall include but are not limited to fall protection, hearing protection, respiratory protection, confined space protection, excavation protection, and measures to address any other work zone activities.

3) Provisions for regular informal safety meetings. The Contractor/Subcontractor Project Safety Officer or designated representative shall conduct safety meetings with their employees at the frequency specified in the CSHP, once per week at a minimum, but preferably at the start of each shift. The Contractor/Subcontractor shall encourage participation by all personnel working at the project Site. For tasks/projects involving multiple Contractors/Subcontractors, combined safety meetings are allowed and encouraged. Participants at these meetings shall discuss specific work activities for that shift, safe work practices, results of safety inspections, required personal protective equipment, and all other necessary safety precautions.

4) Provisions for more formal safety meetings to discuss accidents, incidents, safety goals, and results of safety inspections. The Contractor/Subcontractor shall notify the Company personnel of the time, date, and location of these meetings, and shall encourage participation by all persons working at the project Site.

5) Procedures for assuring compliance by their subcontractors, suppliers, and authorized visitors to the project. In addition, the CSHP shall specify the measures that will be taken to discourage unauthorized personnel from entering the Site.

6) Measures that will be taken in cases where workers are suspected of drug or alcohol impairment.

7) Provisions for regular safety inspections. The Contractor/Subcontractor shall conduct regular safety inspections at the frequency specified in the CSHP. The Subcontractor shall provide documentation to the Construction Quality Assurance Officer (CQAO) of the date of these inspections, the findings, and the measures taken to address the findings.

8) The disciplinary measures that shall be taken to correct violations of the CSHP.

9) The notification, investigation, and implementation procedures that the Contractor/Subcontractor shall follow in the case of a safety stand down.

The Contractor/Subcontractor shall submit the CSHP to the Company for the project records, and shall provide updates to the CSHP as necessary. An up-to-date copy of the CSHP shall be at the project site in the Contractor's/Subcontractor's possession at all times.

L1.2 MULTIPLE EMPLOYER PROJECTS

Under OSHA, each employer is required to provide a safe and healthy working environment for employees. When several employers are working simultaneously on the project, the activities of one employer could expose personnel of another company to a hazard.

Where an employer creates unsafe conditions, the exposing employer shall be responsible for exercising reasonable diligence to discover the condition, and for taking steps to protect their personnel. When the exposing employer has authority to correct the hazard, it shall do so. Where the exposing employer lacks the authority to correct the hazard, the employer shall ask the creating and/or controlling employer to correct the hazard; inform its personnel of the hazard; and take reasonable alternative protective measures. In extreme circumstances (e.g., imminent danger situations), the exposing employer shall remove their personnel from the area to avoid the hazard.

Each Contractor/Subcontractor will be held accountable for compliance with 296 WAC 296-155, 29 CFR 1926 and/or 1910, and 10 CFR 20. All Contractors/Subcontractors must protect their employees from hazards, regardless of who created them.

L1.2.1 Differing Opinions

When a dispute or difference of opinion occurs between Company and Contractor/ Subcontractor personnel concerning any interpretation of the safety practices as found in this plan or the Contractor's/Subcontractor's CSHP, the most stringent plan shall be the controlling plan. The subcontractor shall not start or continue with work until the safety practices and procedures in dispute are resolved to the satisfaction of all applicable senior management personnel.

L1.3 UNSAFE CONDITIONS

The Contractor/Subcontractor shall immediately correct any unsafe conditions that are brought to its attention. When unsafe conditions are not corrected to the satisfaction of the Company or Contractor/Subcontractor management personnel, or the Contractor/Subcontractor fails to correct the unsafe conditions and/or repeatedly fails to comply with the safety and health requirements as found in 296 WAC 296-155, 29 CFR 1926 or 1910, or 10 CFR 20, specific work

activities will stop. All Company, Contractor, or Subcontractor personnel have the authority and responsibility to stop work associated with unsafe or unhealthy workplace conditions or acts. The work stoppage will be in place until the corrective steps to eliminate the unsafe conditions or acts are taken.

L1.4 JOB SAFETY ANALYSIS AND STANDARD OPERATION PROCEDURES

Each CSHP will include Standard Operating Procedures (SOPs) for routine RA work activities and a Job Safety Analysis (JSA) for any non-routine RA task (or combination of tasks) that present health or safety risks. Each SOP and JSA will detail the task, identify the task-specific hazards and the measures to eliminate or control those hazards. To support the development of JSAs that are fit-for-purpose, an example JSA is included in Attachment L-2. If established standard operating procedures (SOPs) provide safe work practices and protective measures, they may be referred to by reference in a JSA (must be attached to the JSA), but they do not replace a JSA. The JSA contains site-specific information that will not be included in the contractor's SOP(s).

L1.5 PROJECT ORGANIZATION

Key health and safety personnel are listed in Table L-1. The authorities, responsibilities and qualifications for key personnel are discussed below. Contractors/Subcontractors are required to provide a Project Safety Officer responsible for the health and safety of their personnel, subcontractors, vendors, and visitors.

Table L-1 – Key Personnel

Personnel	Name	Affiliation	Phone (Work)	Phone (Other)
Site Construction Manager	TBD	DMC/Newmont		
Site Safety Manager	TBD	DMC/Newmont		
Radiation Safety Officer	TBD	DMC/Newmont		
Contractor Superintendent	TBD	Contractor		
Contractor Site Safety Officer	TBD for each project	Contractor		

L1.5.1 Company Site Construction Manager

The Company Site Construction Manager has overall responsibility for project worker safety and to assure that RA work activities comply with the health and safety requirements and guidelines of this HASP, including the RPP in Attachment L-1. The Company Site Construction Manager is responsible for ensuring the necessary resources (qualified personnel, equipment, supplies,

etc.) are being provided to the project. The Company Site Construction Manager also is responsible for procuring Contractors/Subcontractors that are qualified to perform in accordance with this HASP. The Company Site Construction Manager directs the Company Site Safety Manager, Company Radiation Safety Officer, and all Contractor/Subcontractor safety personnel.

L1.5.2 Company Site Safety Manager

The Company Site Safety Manager reports to the Company Site Construction Manager and has responsibility for the implementation of the industrial safety provisions of the HASP and conformance with all applicable worker safety and health regulations, as appropriate. The Company Site Safety Manager is the primary contact for matters relating to health and safety. The Company Site Safety Manager must approve any changes to the HASP that could affect worker health and safety requirements. The Company Site Safety Manager is responsible for resolving any health and safety issues that arise out of the work. The Company Site Safety Manager coordinates with the Company Radiation Safety Officer (described below) to ensure that both this HASP and the RPP included in Attachment L-1 are effectively implemented. The Company Site Safety Manager coordinates with the Contractor Project Safety Officer (described below) to ensure the CSHP is being effectively implemented, and that tasks/projects involving multiple Contractors/Subcontractors are coordinated. The responsibilities of the Company Site Safety Manager are:

- Direct health and safety related activities, such as coordinating combined safety meetings among multiple Contractors/Subcontractors.
- Report all safety and health related incidents or accidents immediately to the Company Site Construction Manager.
- Assist in all aspects of implementing the HASP.
- Conduct industrial hygiene monitoring and interpreting results.
- Maintain health and safety equipment.
- Implement emergency procedures as required.
- Evaluate the effectiveness of the HASP and reporting deficiencies as needed.
- Enforce the buddy system, where necessary, so that workers are observed by at least one other worker in the work group. The purpose of the buddy system is to maintain communication between workers and provide rapid assistance in the event of an emergency.

- Maintain a health and safety log as outlined in Section L2.11 of this HASP.
- Maintain records of HASP compliance agreements for all staff and contractors.
- Conduct safety meetings as required.
- Define limited access zones (based on potential hazards) on a task by task basis.
- Implement radiation protection procedures as directed by the Company Radiation Safety Officer or his/her designee.
- Act as Emergency Coordinator in the event of an emergency.

The Company Site Safety Manager has authority to:

- Suspend work or otherwise limit exposure to personnel if health and safety conditions appear to be unsuitable or inadequate
- Upgrade and downgrade levels of protection based on air monitoring data

L1.5.3 Company Radiation Safety Officer

The Company Radiation Safety Officer reports to the Company Site Construction Manager and is the individual responsible for oversight of the activities related to radiation safety. The Company Radiation Safety Officer coordinates with the Company Site Safety Manager to ensure that both this HASP and the RPP included in Attachment L-1 are effectively implemented. The responsibilities for the Company Radiation Safety Officer are described in the RPP included in Attachment L-1.

L1.5.4 Contractor Superintendent

The Contractor Superintendent has the overall responsibility for ensuring that all contractor/subcontractor personnel comply with the health and safety requirements and guidelines of this HASP, as well as the CSHP. The Contractor Superintendent is responsible for ensuring the necessary contractor/subcontractor resources (qualified personnel, equipment, supplies, etc.) are being provided to the project. The Contractor Superintendent reports to the Company Site Construction Manager and directs the Contractor Site Safety Officer.

L1.5.5 Contractor Safety Officer

First-tier Contractors are required to provide a Site Safety Officer responsible for the health and safety of their personnel, subcontractors, vendors and visitors. The Contractor Site Safety Officer reports to the Contractor Superintendent.

The Contractor Site Safety Officer is responsible for:

- Coordinating with the Contractor Superintendent, Company Site Safety Manager, Company Radiation Safety Officer on health and safety matters
- Providing SOPs/JSAs that list requirements for specific tasks and types of equipment for each activity
- Conducting regular safety meetings
- Performing regular safety inspections at the frequency specified in the CSHP
- Coordinating changes to the HASP with the Company Site Safety Manager relating to specific work activities
- Correcting work practices or conditions that may result in injury or exposure to hazardous substances

The Contractor Site Safety Officer has authority to:

- Suspend field activities if the health and safety of personnel become endangered.
- Suspend personnel or subcontractors from field activities for infractions of the health and safety plan, pending an evaluation by the Company Site Construction Manager.

L1.5.6 Field Personnel Responsibilities

Management of safety by the Company Site Safety Manager, Company Radiation Safety Officer, or Contractor Site Safety Officer does not relieve any employee of his or her responsibility to perform work according to safe work practices. The employee must know who to contact for safety questions and concerns, where the Work Plans are kept, who to contact for first-aid, and the names, locations and telephone numbers of emergency medical services. All written and oral safety rules must be observed recognizing particular job-associated hazards. The employee is responsible for observing the following general safe work practices:

1) A job shall not be started until proper instructions have been received and understood.
2) Any hazardous conditions, unsafe equipment, or unsafe working practice shall be reported to the supervisor immediately.
3) All injuries or accidents shall be reported immediately to the supervisor.

4) Moving equipment shall not be operated unless the operator has been instructed and properly trained in its use.

5) Speed limits, traffic signs, “clean/dirty” road designations and parking regulations must be observed within the Midnite Mine Site and in travel to and from the Site on public roads.

6) Safety devices and safety guards must be in place before operating any equipment.

7) Hand tools and special tools must be kept clean and in good repair.

8) The correct tool must be used for the particular job in the proper manner.

9) Proper protective equipment must be used for particular job conditions.

10) Loose clothing must not be worn as it may be caught in moving equipment causing injury. Long hair must be bound to prevent entanglement with equipment.

11) Good housekeeping must be practiced at all times.

12) The rules of personal hygiene shall be observed to avoid infection and contamination with toxic chemicals and radioactive material.

13) Practical jokes, rowdiness, and “horseplay” are strictly forbidden.

14) Reporting to the work site under the influence of alcohol or drugs, or bringing them on the premises, is forbidden.

15) Under no circumstances shall safety be sacrificed.

16) No job shall be considered finished until the safety of the next person to use the equipment has been assured.

17) All site radiation safety procedures and work rules must be followed.

18) Failure to adhere to safety and health procedures and rules can result in removal from the site.

19) All site personnel have the authority and responsibility to suspend field activities if the health and safety of personnel become endangered.

L2.0 GENERAL HEALTH AND SAFETY REQUIREMENTS

Personal protective equipment (PPE) is used to shield, isolate or otherwise protect individuals from chemical or physical hazards that may be encountered while performing work at and in the

vicinity of the Site. Level D PPE as specified in Section L2.6 is anticipated for most Site activities unless an upgrade is needed based on air sampling/monitoring results.

The primary respiratory concern is airborne dust generated during earth-moving operations. Should airborne dust levels be visible, engineering controls (e.g., watering) shall be promptly implemented to reduce dust concentrations. Engineering and administrative controls will be instituted as needed to correct workplace conditions. However, the Company Site Safety Manager, Company Radiation Safety Officer, or Contractor Site Safety Officer may require respiratory protection in accordance with all necessary safety and health precautions or requirements providing a respirator protection plan is in place and the individual(s) has been properly trained, medically cleared, and fit tested.

It is anticipated that activities related to the RA construction will require provisions to be as low as reasonably achievable as to radiation doses. However, monitoring of workers will be performed as described in the RPP (Attachment L-1). In the event that monitoring results indicate a need for reducing doses, engineering controls or PPE requirements will be instituted.

L2.1 SITE SAFETY MEETINGS

All field personnel shall attend a Site orientation meeting before commencing field work. This meeting shall be scheduled and conducted by the Company Site Safety Manager or Contractor Site Safety Officer depending on the nature of work or the personnel involved. The requirements of this HASP will be reviewed at this meeting, and discussion will include at least the following:

- Contaminants and exposure pathways of concern
- Physical hazards
- Radiation hazards
- Task specific procedures
- PPE
- Air monitoring procedures
- Decontamination requirements and procedures
- Emergency procedures
- Evacuation routes

At the close of the meeting, all field employees shall sign a safety compliance form stating that they have read and understand this HASP and agree to comply with its provisions. A copy of the compliance form is presented in Attachment L-3.

Subsequent safety meetings will be conducted on regular basis at the beginning of a shift and may be task specific. The Company Site Safety Manager or Contractor Site Safety Officer will determine when work procedures have changed and when additional meetings are necessary to introduce further safety requirements.

L2.2 ACCIDENT/INCIDENT REPORTING

If an accident or incident results in physical injury, illness, chemical exposure or property damage, the CQAO, Company Site Safety Manager, Contractor Site Safety Officer and/or Contractor Superintendent shall report the incident in writing to the Company Construction Manager. The Company Construction Manager will convey the accident/illness information to the Supervising Contractor for inclusion in the Weekly Construction Report to EPA. Emergency response is discussed in Section L2.9. Near-miss, personal injury, or property damage incidents shall be reported to Site safety personnel.

L2.3 PROHIBITED ACTIVITIES

Personnel shall not do the following:

- Work alone on the Site with power equipment
- Smoke, eat, drink, or chew gum or tobacco on the Site except in designated areas

Utilizing the buddy system during activities involving power equipment will permit personnel to attend to coworkers or seek assistance should an accident or other emergency situation arise. The buddy system will also reduce the likelihood of accidents as coworkers observe each other performing work activities. Smoking, eating, drinking, or chewing gum or tobacco increases the risk of ingestion of Site contaminants.

Potable drinking water supplies will be supplied and maintained for workers. No employee shall perform work in any area where hazardous conditions exist that could endanger the employee's safety unless visual and/or verbal contact is maintained. At the discretion of the Company Site Safety Manager or Contractor Site Safety Officer, the buddy system may be waived for low hazard tasks.

L2.4 VISITOR CLEARANCE

Due to potential hazards presented at the Site, the Company will, to the extent it is able, exclude all persons other than those associated with the Company and its Contractors/Subcontractors from the Site, unless authorized by Company management personnel and accompanied by a Company representative or other authorized person. The Company will deny entry to those persons who do not meet the training requirements of Section L2.10 of this HASP.

Any non-authorized person observed on the Site by a Company representative or other authorized person will be 1) informed that there are potential hazards at the Site, 2) asked to leave the Site, and 3) told to contact the Company Site Construction Manager for further information regarding access to the Site.

L2.5 MEDICAL SURVEILLANCE

Medical surveillance related to potential radionuclide exposures are addressed in the RPP (Attachment L-1).

Personnel assigned to work in the Site Exclusion Zone, where personal air monitoring/sampling will be conducted to identify workplace contaminates above contaminant-specific Permissible Exposure Limits, shall be protected through the use of engineering controls, administrative controls, and respiratory protection. All respiratory protection will be conducted in accordance and compliance with a Respirator Protection Plan. Site personnel shall be medically cleared to conduct Hazardous Waste Operations and Emergency Response (HAZWOPER) remediation activities in accordance with OSHA 29 CFR 1910.120/29CFR1926.65. Fit-for-Duty paperwork documenting these medical surveillance requirements shall be maintained on-Site for all personnel assigned to work in the Exclusion Zone. Medical surveillance shall be current within the previous 12-24 months.

OSHA regulates medical surveillance/monitoring for specific compounds in several substance specific standards:

- Lead (29 CFR 1910.1025/1926.62)
- Cadmium (29 CFR 1910.1027/1926.1127)
- Arsenic (29 CFR 1910.1018)

Periodic air monitoring/sampling for potential health contaminates such as lead, cadmium, and arsenic will be conducted in order to be certain the OSHA Action Levels triggering specific

medical surveillance for these compounds are not exceeded. Detailed discussions of chemical hazards, Site action levels, and air monitoring procedures are presented in Sections L3.3 and L3.9, respectively.

Contractors and their subcontractors may also have task-specific medical surveillance requirements (e.g. medical surveillance related to crane operators). All CSHPs shall detail all medical surveillance necessary to protect their workers and comply with OSHA regulatory requirements.

L2.6 GENERAL PERSONAL PROTECTIVE EQUIPMENT

L2.6.1 Levels of PPE

This section outlines the PPE protection levels described in OSHA 29CFR1910.120 Appendix B. It is anticipated that RA activities will require Level D PPE as described below. The recommended PPE for specific RA tasks will be identified the SOPs and JSAs included in the CSHP (see Section L1.4). Provisions for Level C PPE are included below in the event they are deemed necessary by the Company Site Safety Manager, Company Radiation Safety Officer, or Contractor Site Safety Officer. If Level C PPE is deemed necessary, this HASP will be modified to reflect both the increased risk and the need for greater personal protection, exposure monitoring, decontamination procedures, and medical surveillance.

Level C

Level C PPE will be required when an action level for upgrade from Level D is met or exceeded and/or specific concentrations of airborne contaminants meet or exceed their respective OSHA permissible exposure limits (PELs) or the American Conference of Governmental Industrial Hygienists threshold limit values (ACGIH TLV's).

The following constitute Level C equipment

- Positive or negative pressure full-face or half-mask air purifying respiratory protection approved by National Institute for Occupational Safety and Health (NIOSH)
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls)
- Boots, outer, chemical-resistant steel toe and shank

- Boot-covers, outer, chemical-resistant (disposable (optional, depends on activity)
- Hard hat (optional, may be required for some activities)
- Face shield (optional depending on activity)
- High-visibility traffic vest (depending on hazards)

Level D

Level D PPE includes work attire affording minimal protection: used for nuisance contamination only.

The following constitute Level D equipment:

- Coveralls (in areas where required by the RPP) or durable pants and long or short-sleeved shirt (no tank tops)
- Gloves (depends on activity and as directed by relevant SOPs/JSAs)
- Boots/shoes, chemical-resistant steel toe and shank, if necessary
- Safety glasses or chemical splash goggles (depends on activity and as directed by relevant SOPs/JSAs)
- Hard hat (depends on activity and as directed by relevant SOPs/JSAs)
- Face shield (depends on activity and as directed by relevant SOPs/JSAs)
- High-visibility traffic vest (depending on hazards)

L2.6.2 Respiratory Protection

Contractors and their subcontractors performing or working near dust-generating activities in the Exclusion Zone shall have a written respirator program that meets or exceeds the requirements of 29 CFR 1910.134. This includes but is not limited to medical clearance, respirator training, respirator fit testing, respirator care and maintenance, etc. Respirator use may not be necessary for most Site operations, but Exclusion Zone personnel need to be trained and ready to upgrade to Level C PPE or stop work in the event an OSHA PEL or ACGIH TLV is met or exceeded. Site PELs and Action Levels are presented and discussed further in Section L3.3.

Some Site personnel may require a respiratory protection program depending on their work activities. For example, some activities (e.g. welding or cutting, work with possible asbestos-containing materials) may require respiratory protection independent of any unique site-related

hazards. Asbestos may be present in individual historic buildings on the Site. Asbestos shall only be sampled or removed by certified, trained, qualified personnel in accordance with Washington State asbestos requirements. If asbestos is confirmed, signs shall be posted and unauthorized persons shall be restricted from the area. If asbestos removal is necessary these actions will be included as part of the CSHP with Company oversight personnel directing contractor/subcontractor work from outside the designated asbestos exclusion zone.

If monitoring indicates a need for respiratory protection due to airborne dusts, the selection of respirators, as well as any decisions regarding upgrading or downgrading of respiratory protection, will be made by a certified industrial hygienist or other qualified professional. Based on the anticipated loading, contaminant properties, and the respirator/cartridge selected, a filter change-out schedule will be developed.

L2.6.3 PPE Policies

PPE shall be provided, used, and maintained in a sanitary and reliable condition wherever actual or potential hazards cannot be eliminated through the use of engineering controls or safe work practices. Users of PPE shall inspect the equipment prior to use and after any occurrence that could affect the integrity of the equipment. Damaged PPE shall be discarded and not used. Users shall not modify, tamper with, or repair PPE beyond routine maintenance.

L2.7 PERSONAL HYGIENE

Designated shower and laundry facilities will be provided as support for site remediation to provide personal hygiene and to limit movement of contaminants from the site. The Contractor/Subcontractor will review the shower/laundry facility design and include appropriate shower/laundry procedures in the CSHP.

L2.8 DECONTAMINATION

Decontamination facilities will be established in the Construction Support Zone (CSZ) for people and equipment adjacent to the Exclusion Zone (see Figure L-1). Decontamination procedures are included in RPP-SOP06 – Decontamination Procedures, which is included in the RPP. The procedures described in RPP-SOP06 are applicable to both trace metal and radiation constituents. The general decontamination approach shall include the following:

- Wet methods to remove visual contamination from equipment, boots, outer gloves, etc.
- Removal of outer boots, gloves, coveralls, etc.

- Wash face and hands with soap and water
- Radiological scan of personnel and equipment (see RPP-SOP06)

Decontamination of equipment, such as light (pick-up trucks) and earth-moving (mine) equipment, shall take place at the Equipment Decontamination Facility. Physical contamination with mine dust and debris is the primary concern. It is anticipated that decontamination will be performed with water (e.g., pressure washing) and wastewater will be treated at the WTP.

Decontamination of personnel shall be conducted at the Personnel Decontamination Facility adjacent to the Exclusion Zone. These facilities shall include a clean side and a dirty side. Personnel shall enter the facilities at the beginning of the work shift on the clean side and don the required Site attire. They shall then enter the dirty side for their necessary PPE (hard hats, work boots, etc.) and enter the Exclusion Zone to begin the day's work. Upon exit from the Exclusion Zone, the procedure shall be reversed and personnel shall follow each step of the SOP/JSA in removing contaminated clothing and PPE. Full body showers may be required if radiation testing is elevated.

The Exclusion Zone footprint will change and become smaller as RA activities progress on-Site. When these changes take place a new Exclusion Zone map will be created and displayed on-Site. Workers on-Site will be made aware of any Exclusion Zone area changes. Figure L-1 presents the location of the Decontamination Facility and Exclusion Zone footprint at the start of the RA.

L2.9 EMERGENCY RESPONSE

Local emergency response agencies will be informed of the project by the Company Site Construction Manager or his/her designated representative and provided the document titled *Midnite Mine Superfund Site Health and Safety Information for Emergency Responders* (MWH, 2012). The Company Site Construction Manager or his/her designated representative will coordinate with the local response agencies on a routine basis as established amongst the parties to provide project status updates, and to ensure that potential staff changes do not affect emergency preparedness.

L2.9.1 Lines of Authority

At least one employee, either at the Site or on call at all times during project hours, will be available to respond to emergency situations. This Emergency Coordinator typically will be the Company Site Construction Manager, Company Site Safety Manager, or Company Radiation

Safety Officer, or their qualified authorized representative, which has the responsibility of coordinating all emergency response measures, and will be thoroughly familiar with all aspects of this HASP, the location of all records, and the work area layout. The Company Site Construction Manager, Company Site Safety Manager, or Company Radiation Safety Officer contact information is included on Table L-1.

L2.9.2 Emergency Information

The following list provides telephone numbers for external contacts (Table L-2). Internal contacts are listed on Table L-1. Both internal and external contacts will be posted in an area accessible to all employees:

Table L-2 – External Contacts

Agency	Contact Information
Spokane Tribal Police Department & Ambulance	911 or 509-258-4400
Stevens County Sheriff Dispatch	509-684-2555
Washington Poison Control Center	800-222-1222
EPA Emergency Response Unit, Region 10	206-553-1200
National Response Center	800-424-8802
RCRA, Superfund & EPCRA Hotline	800-424-9346
U.S. EPA Environmental Response Team	732-321-6660

L2.9.3 Evacuation Procedures

Due to the nature of the contaminants at the Site, chemical releases requiring evacuation are not anticipated. Therefore, evacuation routes have not been established. However, all evacuation procedures will be identified to all employees during the Site Orientation Meeting. Site personnel will be directed to immediately contact the Emergency Coordinator after reaching a safe location. The Company Site Safety Manager is responsible for updating personnel on any changes to entry and exit routes. Identified meeting places will be provided for each specific work area and a facility safety monitor will be assigned to each of the meeting places.

L2.9.4 Emergency Medical Treatment

If any site personnel are injured, become ill or emergency medical treatment is needed, contact shall be made with the site safety and/or emergency services personnel on the Company radio or cellular phone and either site ambulance or other necessary emergency equipment and

personnel will be dispatched, or necessary emergency services personnel in Wellpinit or Spokane will be notified, if appropriate. Should offsite emergency medical services be required provide the dispatcher with the following information:

Site location:

Midnite Mine (Midnite Mine East Road exits the pavement to the north between mile markers 16 and 17 on McCoy Lake Road (Ford Wellpinit Road). The road is marked with a sign – "MM East")

Spokane Tribe Reservation, Stevens County, Washington

Personnel may be transported to Sacred Heart Medical Center in Spokane or other facility if they develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards. A map showing the route to the hospital from the Site is included in Attachment L-4 to this HASP. Symptoms of exposure and emergency medical treatment information are addressed in Safety Data Sheets (SDSs), formerly known as Material Safety Data Sheets (MSDSs), that will be available to all workers at an appropriate location on the Site.

All accidents and injuries that occur at the Site will be reported to the Company Site Safety Manager or Contractor Site Safety Officer immediately (see Section L2.2). All injuries will be reported regardless of the apparent severity. Likewise, all possible overexposures will be reported even though adverse health effects or symptoms may not be initially apparent. An accident report form (Attachment L-3) will be completed for all accidents and injuries. Any equipment damage incidents exceeding $500 of damage will be reported.

L2.9.5 Incident Investigation

The Company Site Safety Manager or Contractor Site Safety Officer will investigate all incidents, including near misses, to determine root cause and necessary corrective action to be taken to prevent like accidents from occurring. These written reports will be maintained in a project file and made available to authorized personnel. Additionally, each CSHP will include requirements to report incidents to the Company Site Safety Manager or Contractor Site Safety Officer, and include provisions for proper OSHA recording and reporting.

L2.9.6 First Aid

Various Company and Contractor/Subcontractor employees working on Site will have current CPR and first aid training and these employees will be identified as new tasks are initiated. First aid kits will be required at each active work area.

L2.9.7 Spill Containment

The RA predominantly involves the movement of dry material (soils and mining wastes) within the Site boundaries; therefore, the potential for a major spill of a hazardous substance that would present a risk to workers is low. While a spill containment program, as specified in 29CFR1910.120(j)(1)(viii), is not required for the planned RA earthworks activities, contractors using hazardous substances are required to maintain a spill containment program, and the spill containment procedures will be a component of their CSHP. Likewise, general spill containment procedures and protocols for the RA earthworks activities is included in the Remedial Action Work Plan (RAWP).

L2.9.8 Communications

Communications will occur via two-way radios or cellular telephones equipped with receiver boosters. At a minimum, the RA Contractor will be required to provide reliable communication services on-Site.

L2.10 TRAINING

L2.10.1 Required Courses and Meetings

Employees engaged in field activities within the Exclusion Zone or Decontamination Areas must have successfully completed OSHA HAZWOPER initial training in compliance with 29 CFR 1910.120. Annual 8-hour HAZWOPER refresher training shall be completed by each employee. Annual refresher training will be completed within 365 days of the last completed refresher training course. Site managers and supervisors shall successfully complete an 8-hour supervisor's course in addition to other training received. Attendance at the initial Site Safety Meeting and other as-needed Site Safety Meetings shall also be required of all personnel working on Site. Additional training such as radiation safety, excavation safety, confined space entry, work from heights, etc. will be required for specific persons or activities as may be required by SOPs/JSAs.

L2.10.2 Worker Right to Know

As part of the training required under 29 CFR 1910.120 and the Hazard Communication (HAZCOM) standard in 29 CFR 1910.1200, workers shall be familiarized with MSDSs/SDSs and instructed on the terms and concepts that relate to MSDSs/SDSs. Contractors and subcontractors will provide the Company Site Safety Manager with a written HAZCOM plan together with all the MSDSs/SDSs for the hazardous products they are using. These plans will

meet or exceed the requirements outlined in Company Right to Know Plan. As part of the Site Safety Meetings, the Company Site Safety Manager shall review hazardous materials that will be used and the precautions that will be taken when working with these materials. MSDSs/SDSs shall be kept in a binder at the Site for reference by workers.

L2.10.3 Emergency Recognition

During the initial Site Orientation Meeting, all employees will be trained to recognize and respond to on-Site emergencies, and to anticipate and avoid hazards discussed in this HASP. Site Action Levels will be discussed during the Site Orientation Meeting so that personnel will understand air monitoring results and the level of hazards they represent.

L2.10.4 Physical Hazards

Possible physical hazards will be identified and discussed at the Site Orientation Meeting by the Company Site Safety Manager or authorized Company representative. Potential hazards are discussed further in Sections L3.4 and L.3.5.

L2.10.5 Radiation Training

The radiation training requirements are described in Section 2.4 of the RPP (Attachment L-1).

L2.11 RECORDS

The Company Site Safety Manager or Contractor Site Safety Officer shall be responsible for maintaining records relevant to the HASP. The records will be available at all times. A log book of the following information shall be kept:

- Daily work activities
- Air quality monitoring
- Make and model of equipment used
- Calibrations
- Maintenance
- Dates, time, and a list of attendees at safety meetings
- All incidents and accidents

Verification of compliance with applicable training programs will be maintained by the responsible contractor.

L2.12 ADDENDA – MODIFYING THIS HASP AND CHANGE MANAGEMENT

Addenda to the HASP may be implemented based on newly acquired information or unforeseen situations which may arise. The addenda will state any changes, deletions, or additions to the HASP. Addenda shall be approved and signed by the Company Site Safety Manager before taking effect. All affected workers and contractors will be briefed on addenda content, associated risks, and protective measures.

L3.0 SPECIFIC HEALTH AND SAFETY REQUIREMENTS

L3.1 WORK ACTIVITIES

The work that will be conducted at and in the vicinity of the Site consists of construction and associated operations, maintenance, and monitoring. Work will include excavating or handling materials that may have elevated concentrations of trace metals and naturally occurring radionuclides. Work may be conducted in areas where trace metal or radiologically contaminated water is flowing or ponded.

Anticipated construction related-tasks include earthmoving equipment operation (excavation, loading, hauling, spreading, compacting, grading), HDPE liner and geotextile deployment, rock crushing and screening operations, electrical equipment operation, pipe installation, rock and gravel placement, loading and unloading trucks, mechanical and electrical equipment maintenance (i.e., welding, electrical, lubricant, etc.).

Planned RA activities include:

- Excavation of approximately 18 million cubic yards (CY) of mine wastes and mine-affected soils and sediments
- Consolidation of the excavated materials in the open pits
- Preparation of the open pits prior to waste consolidation, including scaling the pit walls to reduce rock-fall hazards
- Demolition of existing site facilities and buildings
- Construction of a new water treatment plant (WTP)
- Construction of temporary and permanent water storage impoundments
- Construction of temporary and permanent water conveyance pipelines and channels

- Operation and maintenance of constructed facilities
- Site-wide monitoring of soil, sediment, groundwater and surface water

L3.2 APPLICATION OF STANDARDS

The work will entail activities that may be covered under OSHA General Industry Standards (29 CFR 1910), OSHA Construction Standards (29 CFR 1926), and/or NRC Standards. For consistent application of the most comprehensive or protective standard, the applied standard for work at the Site may be specified for specific activities, as set forth in the following subsections.

L3.3 CHEMICAL HAZARDS

The Midnite Mine Remedial Investigation (RI) Report (EPA, 2005) contains sample data for trace metal content in Site surface materials and sediments. The trace metal content of surface materials and sediments is location dependent and exposure potential depends how and where work is conducted. Section L3.9 includes air monitoring procedures for trace metals during the RA. The trace metals determined present at the Site include: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Uranium, Vanadium, and Zinc. The toxicity and concentrations of these substances varies. Table L-3 summarizes the information. The greatest risk of exposure to these substances is from inhalation or ingestion of airborne dust that contains these substances.

Table L-3 – Chemical and Toxicological Characteristics of Site Constituents (Metals)

Constituent	CAS[1] Number	OSHA PEL (TWA)[2]	IDLH[3]	Routes of Entry	Health Effects
Aluminium	7429-90-5	15 mg/m^3	Not Determined	Inhalation, contact	Irritation: eyes, skin, respiratory system
Antimony	7440-36-0	0.5 mg/m^3	50 mg/m^3	Inhalation, ingestion,skin and/or eye contact	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly: Eyes, skin, respiratory system, cardiovascular system.
Arsenic	7440-38-2	AL = 0.005 mg/m^3 PEL = 0.010 mg/m^3	5 mg/m^3	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]: Liver, kidneys, skin, lungs, lymphatic system.
Barium	10022-31-8	0.5 mg/m^3	50 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia: eyes, skin, respiratory system, heart, central nervous system
Beryllium	7440-41-7	0.002 mg/m^3	4 mg/m^3	Inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]: eyes, skin, respiratory system.
Cadmium	7440-43-9	0.005 mg/m^3	carcinogen; (9 mg/m^3 [as Cd])	Inhalation, absorption	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain, headache, chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia, emphysema, chronic bronchitis, respiratory system, kidneys, prostrate, blood, prostatic & lung cancer

Table L-3 – Chemical and Toxicological Characteristics of Site Constituents (Metals), continued

Constituent	CAS[1] Number	OSHA PEL (TWA)[2]	IDLH[3]	Routes of Entry	Health Effects
Chromium	7440-47-3	1.0 mg/m3	250 mg/m^3 (as Cr)	Inhalation, ingestion, contact	Irritation of the eyes or skin, and lung fibrosis
Cobalt	7440-48-4	0.10 mg/m^3	20 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma: Skin, respiratory system.
Copper	7440-50-8	1.0 mg/m^3	100 mg/m^3	Inhalation, ingestion, contact	Irritation of the eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis
Lead	7439-92-1	AL = 0.03 mg/m- PEL = 0.05 mg/m^3	100 mg/m^3	Inhalation, ingestion, contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension
Manganese	7439-96-5	5 mg/m^3 (15-minute Ceiling)	500 mg/m^3	Inhalation, ingestion	Asthenia, insomnina, mental confusion, metal fume fever, dry throat, cough, chest tightness, dyspena, rales, flu-like fever, low back pain, vomitting, kidney damage
Mercury	7439-97-6	0.1 mg/m^3	10 mg/m^3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria: eyes, skin, respiratory system, central nervous system, kidneys.
Nickel	7440-02-0	1.0 mg/m^3	10 mg/m^3	Inhalation, ingestion, contact	Sensitization dermatitis, allergic asthma, and pneumonitis. Potential occupational carcinogen
Selenium	7782-49-2	0.2 mg/m^3	1 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage: eyes, skin, respiratory system, liver, kidneys, blood, spleen.

Table L-3 – Chemical and Toxicological Characteristics of Site Constituents (Metals), continued

Constituent	CAS[1] Number	OSHA PEL (TWA)[2]	IDLH[3]	Routes of Entry	Health Effects
Silver	7440-22-4	0.01 mg/m^3	10 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance: nasal septum, skin, eyes
Thallium	7440-28-0	0.1 mg/m^3	15 mg/m^3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs: eyes, respiratory system, central nervous system, liver, kidneys, gastrointestinal tract, body hair.
Uranium	7440-61-1	Sol = 0.05 mg/m^3 Insol = 0.25 mg/m^3	10 mg/m^3 (as U)	Inhalation, ingestion, skin and/or eye contact	Dermatitis; kidney damage; blood changes; [potential occupational carcinogen]; in animals: lung, lymph node damage; [potential occupational carcinogen] Potential for cancer is a result of alpha-emitting properties & radioactive decay products (e.g., radon): Skin, kidneys, bone marrow, lymphatic system.
Vanadium	1314-62-1	0.5 mg/m^3 (Ceiling) respirable fraction	35 mg/m^3 (as V)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea (breathing difficulty): eyes, skin, respiratory system.
Zinc	1314–13–2	15 mg/m^3 as zinc oxide dust	500 mg/m^3 (as zinc oxide)	Inhalation, ingestion, contact	Coughing, substernal pain, upper respiratory tract irritation, rales, chills, nausea and vomiting.

1 Chemical Abstract Number

2 Permissible exposure limit time-weighted average

3 IDLH = Immediately Dangerous to Life or Health

L3.4 PHYSICAL HAZARDS

Physical hazards that may be present on this Site include:

L3.4.1 Earthmoving Equipment Operation

Activities will include the use of earthmoving equipment (equipment). Personnel operating equipment will be trained in accordance with 29 CFR 1926 Subparts H, O, and W. As work plans are developed, SOPs/JSAs will be completed for all activities involving equipment and job-specific protective measures will be established. Certification records will be maintained for all site operators.

In general:

- Daily and routine equipment inspections must be performed by a competent, trained personnel prior to use. Inspections must be done in accordance with the manufacturer's recommendations.
- No one shall approach a moving piece of equipment without first obtaining eye contact and a positive signal to approach from the operator.
- Ground personnel shall wear a highly visible safety vest or equivalent type of attire and stay out of the swing radius of the moving equipment. Ask operator about blind spots, if unsure.
- Never stand beneath a suspended load.
- Backup alarms must be functional, whenever activated confirm no one is the backing path of the equipment.

L3.4.2 Excavating and Trenching

Construction and RA activities will include excavation, which at times may be extensive. All Exclusion Zone personnel will keep back at least 2 feet from excavation/trench edge and will avoid movement between the excavation/trench and any equipment or spoils positioned within 10 feet of the excavation/trench. If work or entry into an excavation/trench greater than 3 feet in depth becomes necessary, entry will not be allowed until a relevant JSA is developed and affected employees are trained on safe work practices, egress methods, and emergency procedures by a competent person. If a contractor or subcontractor has work involving excavations/trenches, the work with be conducted in accordance with 29 CFR 1926 Subpart P and an excavation plan or JSA will be developed and followed that includes, but is not limited to:

- Designation of a competent person able to classify soils, identify hazards and develop soil stabilization methods and personal protective measures
- Utility clearance (both overhead and underground)
- Atmospheric assessment and any necessary protective measures
- Vehicle management/safety
- Highwall/sidewall stabilization method
- Equipment and spoils management
- Means and method of egress
- Elevated work requiring fall protection

In addition to highwalls associated with past mining activities, some work activities may involve work on elevated walking/working surfaces. All work, where a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level, shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems. Workers will be informed on the existing systems as part of site orientation, and systems in place for specific areas/activities will be included in the relevant JSA(s). Any contractor or subcontractor who creates an elevated walking/working surface shall prevent exposure to the fall hazard for all other site personnel and protect their workers from fall as specified in 29 CFR 1926 Subpart M.

L3.4.3 Confined Space

If work or entry into a confined space becomes necessary entry will not be allowed until a confined space entry program is in place, a relevant JSA is developed and affected employees are trained on safe work practices, egress methods, and emergency procedures by a competent person. Work involving confined spaces will be conducted in accordance with 29 CFR 1910.146 and the final entry permit issued by DMC/Newmont.

L3.4.4 Ladders and Scaffolding

All ladders employed on site and their use will comply with 29 CFR 1926 Subpart X. SOPs/JSAs for activities using portable ladders will include the requirement to inspect the ladder(s) prior to use. Contractors and subcontractors using scaffolds will have an SOP detailing their proper erection, use, inspection, and disassembly. The competent person for scaffold erection, pre-shift inspection, and dismantling shall be designated in writing. JSAs for activities using

scaffolds shall detail the safe work practices specific to the scaffold type and include the requirement for pre-shift/pre-use inspection.

L3.4.5 Overhead and Highwall Hazards

RA construction activities will involve consolidating wastes in open pits that present rockfall hazards from exposed highwalls, particularly when working in Pit 3 and Pit 4. The Remedial Design (RD) used Colorado Rockfall Simulation Program (CRSP) modeling to incorporate rockfall mitigation measures into the planned construction activities. A specialty rockfall-mitigation contractor (Rock Solid Solutions) also performed a Site visit during October 2013 to assess the potential hazards associated with the planned RA construction activities and provided the following observations and recommendations:

- Rockfall is a hazard in Pits 3 and 4 at the Midnite Mine and can be very unpredictable. Analyses indicate that, once rockfall is initiated a significantly high percentage of rockfall will make it down to the remedial work areas in the pit bottom.
- Physical and hydraulic scaling of (and/or identification of) larger rockfall sources (larger than 3-feet in size) will be conducted prior to dewatering the pit lakes.
- Rockfall catch berm/ditch designs 10-feet deep and 15-feet wide horizontally will be used along with work sequencing as identified in the design will be used.
- A portable rockfall barrier will be used in areas where personnel need to work outside of construction equipment prior to construction of rockfall catch berms (i.e. sump drilling/blasting, sump excavation, drainage system construction, and liner placement) or in areas where rockfall catch berms cannot be constructed due to site space constraints.

All contractors working in the pits or near other exposed highwalls will identify relevant hazards and develop mitigation/injury prevention measures. The identified hazards and protective measures will be presented during site orientation. All personnel on site are required to follow demarcations, barricades, and signage that protect against highwall and rockfall hazards.

L3.4.6 Power and Hand Tools

All hand and power tools and similar equipment shall be maintained in a safe condition. When power tools are designed with guards, they will be maintained with guards in place. Any electrical cord or pneumatic hose damaged during operation will be replaced as specified by the manufacturer, damaged tools will be removed from service and tagged out for further use until all necessary repairs are made. Wherever power or hand tools are used, their safe use, care,

and limitations will be addressed in relevant JSAs. All contractors using power and hand tools will integrate procedures and policies compliant with 29 CFR 1926 Subpart I into their CSHP and JSAs.

L3.4.7 Electrical Hazards

All equipment used on the Site and methods of use, as well as all electrical wiring will comply with 29 CFR 1926 Subpart K. Only qualified personnel will access electrical switchboards and panelboards. Contractors and subcontractors using temporary switchboards and/or panelboards will provide methods for compliance with 29 CFR 1926.404 and 29 CFR 1926.405 as part of their HASP, and include provisions for routine inspections of the systems. All electrical service installations shall be assessed and appropriately managed for possible arc flash hazards.

L3.4.8 Underground Utilities or Buried Materials

Ground disturbance (digging, drilling, excavation, etc.) outside the mine waste disturbance requires an underground utilities and buried materials clearance. Clearance processes must be included in both the work plan and the JSA, including the process to confirm completion prior to work start.

L3.4.9 Overhead Power Lines

Overhead power lines may be present on the Site. Additionally, as work progresses the existence and locations of overhead power lines may change. For any work with vehicle/equipment over 8 feet in height and for any construction, the work plan and all supporting JSAs must include provisions for the identification, demarcation, and clearance of power lines as prescribed in 26 CFR 1926 Subparts L, N, and V.

L3.4.10 Steep Slopes and Tripping Hazards

The Site is situated in mountainous and wooded terrain. Proper footwear and clothing will protect against minor abrasions (Level D PPE is required on site), but will not protect against slips, trips, or falls. Walking routes should be selected to avoid steep slopes. Work in remote and/or rugged terrain should not be conducted alone (refer to Section L2.3). Other potential slip, trip, fall hazards include slippery liners, temporary pipes located on the land surface, and ditches.

L3.4.11 Fire and Explosion Hazards

The Site is located in a forested area and much of the RA construction will be conducted during the driest time of the year (summer and fall). As a result, the potential for fire is significant. Smoking is only allowed in designated areas. All construction equipment will be equipped with spark arrestors. Sources of fires include lightening, welding or cutting activities, hot vehicle components (e.g., exhaust pipe) contacting dry grass, and sparks caused by construction equipment striking rocks. All JSAs will include fire prevention and response actions if appropriate. Liquefied propane storage at the WTP and other fuel storage associated with the RAs present explosion hazards.

Site personnel should only attempt to extinguish small fires that do not present an immediate hazard. Small fires should be extinguished using fire extinguishers (which should be located in all site vehicles and construction equipment), dust suppression water, or by smothering with loose soil. All persons authorized to use fire extinguishers shall have documented training as required by OSHA 29 CFR 1910.157. The following procedures should be followed if a fire cannot be safely extinguished:

- Move flammable and combustible items out of the path of the fire.
- Immediately notify others to evacuate to a safe area.
- Call 911 or 509-258-4400 (Tribal Law Enforcement/Public Safety) first and then report the fire to the Company Site Safety Manager, Company Radiation Safety Officer, or Contractor Site Safety Officer.

In the event of an uncontrolled fire or wildfire, site personnel will evacuate to the designated assembly point (i.e., Construction Support Zone or other location established during a Safety Meeting) and follow the procedures outlined in the Contingency Plan included in the Remedial Action Work Plan. The Company Site Safety Manager or Company Radiation Safety Officer will notify the Spokane Tribe of Indians – Fire Management at 509-258-4566.

L3.5 SLIPS, TRIPS, AND FALLS

Slips, trips and falls cause a high percentage of injuries and recordable accidents at construction and reclamation sites. Rocky, uneven, steep, and often wet terrain may be encountered during the removal project.

The risks of such accidents can be minimized by wearing proper footwear for the task and being aware of the physical conditions at the site. When walking from one location to another at a

removal site, the worker must check the footing, muddy or slick conditions, steep slopes, uneven surfaces, and other potential hazards.

L3.6 VEHICLE AND EARTHMOVING EQUIPMENT SAFETY

Vehicles and earthmoving equipment will be present during RA activities. Safety requirements for specific tasks and types of equipment are described in JSAs and in Contractor/Subcontractor-specific health and safety plans. The following section describes general safety requirements for such equipment.

High temperature and equipment engines may create a fire hazard. All vehicles and construction equipment will be equipped with a fire extinguisher. Platforms, footwalks, steps, and ladders used for equipment access can present slipping and/or falling hazards. Anyone entering or climbing on equipment shall always maintain three points of contact.

Equipment backing up and swing loads pose serious hazard to ground personnel. All construction equipment shall have functional back-up alarms. Eye contact must be made with the operator before approaching moving equipment. The operator must stop the equipment and lower the bucket or other attachment before the worker approaches to reduce the potential hazard. Site personnel not directly involved with the work activity and observers must remain outside the swing radius of the operating equipment. Care must be taken wherever maintenance takes place to be sure that the equipment is braked and locked so that it cannot be accidentally moved or operated.

All site vehicles and equipment shall be properly chocked when parked and left unattended.

Hard hats and steel-toed boots are required in areas where earthmoving and construction equipment is in operation.

Equipment working in RA area will follow MSHA vehicle general rules. These rules include:

- Use the honking system for moving vehicles and equipment
    - 1 honk - starting engine
    - 2 honks - moving forward
    - 3 honks – moving reverse
- Chock wheels at all times that the vehicle is unattended
- Use of high visibility flags on all motor vehicles

L3.7 EXTREME TEMPERATURES AND ADVERSE WEATHER CONDITIONS

Extreme temperatures and adverse weather conditions are most likely to be a concern during RA construction activities. However, such conditions could impact routine plant operations in the summer and winter.

L3.7.1 Cold Stress

This section describes situations where cold stress is likely to occur and discusses procedures for the prevention and treatment of cold-related injuries and illnesses. Cold conditions may present health risks to employees during field activities. The three primary factors that influence the risk potential for cold stress are moisture, temperature and wind velocity. Other factors that increase susceptibility to cold stress, include age (very young or old), smoking, alcohol consumption, fatigue, and wet clothing. Hypothermia can occur at temperatures above freezing if the individual has on wet or damp clothing or is immersed in cold water. The combined effect of temperature and wind can be evaluated using a wind chill index as shown in Table L-4.

Bare flesh and body extremities that have high surface area-to-volume ratios such as fingers, toes and ears are most susceptible to wind chill or extremely low ambient temperatures. Because cold stress can create the potential for serious injury or death, employees must be familiar with the signs and symptoms and various treatments for each form of cold stress. Table L-5 provides information on frostbite and hypothermia, the two most common forms of cold-related injuries.

Table L-4 – Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect).	LITTLE DANGER in less than 1 hour with dry skin; maximum danger from false sense of security				INCREASING DANGER from freezing of exposed flesh within 1 minute			GREAT DANGER that flesh may freeze within 30 seconds				

Source: Modified from American Conference of Governmental Industrial Hygienists. 1997. "Threshold Limit Values for Chemical Substances and Physical Agents."

Table L-5 – Cold Stress Conditions

Condition	Causes	Signs and Symptoms	Treatment
Frostbite	Freezing of body tissue, usually the nose, ears, chin, cheeks, fingers, or toes	Pain in affected area that later goes away Area feels cold and numb Incipient frostbite (frostnip) – skin is blanched or whitened and feels hard on the surface Moderate frostbite – large blisters Deep frostbite – tissues are cold, pale and hard	Move affected worker to a warm area Immerse affected body part in warm (100 to 105 °F) water – not hot! Handle affected area gently; do not rub After warming, bandage loosely and seek immediate medical treatment
Hypothermia	Exposure to freezing or rapidly dropping temperatures	Shivering, dizziness, numbness, weakness, impaired judgment, and impaired vision Apathy, listlessness, or sleepiness Loss of consciousness Decreased pulse and breathing rates Death	Immediately move affected person to warm area Remove all wet clothing and redress with loose, dry clothes Provide warm, sweet drinks or soup (only if conscious) Seek immediate medical treatment

When working in cold environments, specific steps should be taken to lessen the chances of cold-related injuries. These include the following:

- Protecting exposed skin surfaces with appropriate clothing (such as face masks, hand wear, and footwear) that insulates, stays dry, and blocks wind.
- Shielding the work area with windbreaks to reduce the cooling effects of the wind.
- Providing equipment for keeping workers' hands warm by including warm air jets and radiant heaters in addition to insulated gloves.
- Using adequate insulating clothing to maintain a body core temperature of above 36 °C/96.8 °F.
- Providing extra insulating clothing on site.
- Reducing the duration of exposure to cold.
- Changing wet or damp clothing as soon as possible.

L3.7.2 Heat Stress

This section describes situations where heat stress is likely to occur and provides procedures for the prevention and treatment of heat-related injuries and illnesses. Wearing PPE, especially during warm weather, puts employees at considerable risk of developing heat-related illness.

Health effects from heat stress may range from transient heat fatigue or rashes to serious illness or death.

Many factors contribute to heat stress, including PPE, ambient temperature and humidity, workload, and the physical condition of the employee, as well as predisposing medical conditions. However, the primary factors are elevated ambient temperatures in combination with fluid loss. Because heat stress is one of the more common health concerns that may be encountered during field activities, employees must be familiar with the signs, symptoms, and various treatment methods of each form of heat stress. Heat stroke is the most serious heat-related illness – it is a threat to life and has a 20 percent mortality rate. Direct exposure to sun, poor air circulation, poor physical condition, and advanced age directly affect the tendency to heat stroke. Table L-6 lists the most serious heat conditions, their causes, signs and symptoms, and treatment.

Table L-6 – Heat Stress Conditions

Condition	Causes	Signs and Symptoms	Treatment
Heat cramps	Fluid loss and electrolyte imbalance from dehydration	Painful muscle cramps, especially in legs and abdomen Faintness Profuse perspiration	Move affected worker to a cool location Provide sips of liquid such as Gatorade® Stretch cramped muscles Transport affected worker to hospital if condition worsens
Heat Exhaustion	Blood transport to skin to dissipate excessive body heat, resulting in blood pooling in the skin with inadequate return to the heart	Weak pulse Rapid and shallow breathing General weakness Pale, clammy skin Profuse perspiration Dizziness Unconsciousness	Move affected worker to cool area Remove as much clothing as possible Provide sips of liquid such as Gatorade® (only if conscious) Fan the person but do not overcool or chill Treat for shock Transport to hospital if condition worsens
Heat Stroke	Life threatening condition from profound disturbance of body's heat-regulating mechanism	Dry, hot and flushed skin Constricted pupils Early loss of consciousness Rapid pulse Deep breathing at first, and then shallow breathing Muscle twitching leading to convulsions Body temperature reaching 105 or 106 °F or higher	Immediately transport victim to medical plant Move victim to cool area Remove as much clothing as possible Reduce body heat promptly by dousing with water or wrapping in wet cloth Place ice packs under arms, around neck, at ankles, and wherever blood vessels are close to skin surface Protect patient during convulsions

When working in hot environments, specific steps should be taken to lessen the chances of heat-related illnesses. These include the following:

- Ensuring that all employees drink plenty of fluids (Gatorade® or its equivalent) – note eating and drinking should only occur in designated areas (see Section L2.3)
- Ensuring that frequent breaks are scheduled so overheating does not occur
- Revising work schedules, when necessary, to take advantage of the cooler parts of the day

L3.7.3 Adverse Weather Conditions

The primary concern with regard to adverse weather is electrical storms. The following are general procedures for avoiding lightning-related injuries:

- The Company Site Safety Manager and Contractor Site Safety Officer will monitor the daily weather forecast and communicate the chance of electrical storms during safety meetings (see Section L1.1.2).
- Outdoor work will be halted during electrical storms (i.e., when thunder is heard) and workers will seek shelter either in enclosed vehicles or Site buildings as appropriate. (Work will not resume until 30 minutes passes after the last time thunder is heard.)

When inside the building, additional safety precautions include:

- Keep as many walls as possible between you and the outside. Stay away from doors, windows, and fireplaces.
- Stay away from anything that will conduct electricity such as radiators, stoves, sinks, and metal pipes.
- Use battery operated appliances only. Avoid handling electrical appliances and regular telephones (cordless phones and cell phones do not increase the risk of a lightning strike).

If sheltering in an enclosed vehicle, additional safety precautions include:

- Do not park near trees or tall objects that could fall over during a storm.
- Roll up the windows and sit with your hands in your lap and wait out the storm.
- Don't touch any part of the metal frame or any wired device in the vehicle (including the steering wheel or plugged-in cell phone).
- Be aware of downed power lines that may be touching the vehicle.

If unable to find shelter in a building or an enclosed vehicle:

- Stay away from single objects that are tall (trees, flagpoles or posts), water, and other objects that conduct electricity (tractors, metal fences, lawn mowers, golf clubs). Taking shelter in a stand of similarly sized trees is safer than taking shelter under a single tree.
- Take shelter in low-lying areas such as valleys or ditches, but watch for flooding.
- If with a group of people in the open, spread out several yards apart from one another.
- If caught in a level field far from shelter, crouch down on the balls of your feet immediately, with feet together, place your arms around your knees and bend forward. Be the smallest target possible, and at the same time, minimize your contact with the ground. Don't lie flat.

If someone has been struck by lightning:

- Lightning victims are safe to touch. Call for help and administer first aid.

L3.8 BIOLOGICAL HAZARDS

Biological hazards are likely to be encountered during environmental sampling activities and occasionally during routine Site operations. Biological hazards include:

- Animals (rodents, coyotes, deer, etc.)
- Insects
- Snakes
- Poisonous plants
- Bacteria and viruses

L3.8.1 Animals

Workers will be instructed to avoid approaching wild animals such as squirrels, bats, coyotes, bear, wolves, mountain lions, deer, elk, moose, etc. or unfamiliar domestic animals. Small mammals may carry rabies and other viruses. Animal bites must be reported to the Company Site Safety Manager or Contractor Site Safety Officer immediately. The Company Site Safety Manager or Contractor Site Safety Officer will contact the Spokane Tribe of Indians – Department of Natural Resources if any large wildlife are seen on-Site. Workers should seek shelter in a nearby vehicle or building when potentially dangerous wildlife is observed (e.g., bear, mountain lion) and remain in a safe location until the wildlife have left the area.

L3.8.2 Insects

Workers will wear insect repellant while in areas where insects are likely to be a problem. Any worker with a particular allergy to bee stings or other insect bites will be required to obtain instructions and proper medication from his or her personal physician and must make that condition known to the Site Company Site Safety Manager.

Black widow spiders are prevalent at the Site. Workers need to be especially careful in turning over rocks. Black widow spiders tend to get into clothing, as a result the unwary person could be bitten. Workers should carefully check clothing and shoes before donning them and frequently during the work period to be sure there are no unwanted creatures clinging to them. All spider bites will be reported to the Company Site Safety Manager or Contractor Site Safety Officer immediately, and documented accordingly.

L3.8.3 Snakes

Snake bites can occur when snakes are inadvertently disturbed when stepping on or near them or when turning over rocks. Workers will be instructed to look before placing their hands in an area where snakes may be present, e.g., rock crevices, and to be aware when walking through vegetated areas. Snake bites must be reported to the Company Site Safety Manager or Contractor Site Safety Officer immediately and medical evaluation obtained.

L3.8.4 Poisonous Plants

Workers shall be aware of poisonous plants (e.g., poison ivy) that may be indigenous to the area where environmental sampling will take place. Long-sleeved shirts and long pants should be worn when sampling in areas where such plants have been observed or are known to be present. Ivy-wipes or similar products should be on-hand for on-Site exposures.

L3.8.5 Bacteria and Viruses

Proper personal hygiene will prevent most work-related infections. Care should be taken in structures where rodents may be or have been present. Rodent feces and urine may contain the hanta virus. The CSHP will include JSAs specific to inspecting and demolishing existing Site structures that may present hanta virus risks.

L3.9 AIR MONITORING REQUIREMENTS AND PROTECTIVE MEASURES

Radiation/Radon Surveys. Radiation/radon monitoring requirements are discussed in the RPP included in Attachment L-1.

Airborne Particulate. As described previously in Section L3.3, contaminants of concern at the Site include trace metals that have been detected in mine waste, ore stockpiles, and mine-affected sediments. Baseline workplace personal air monitoring will be conducted at the initiation of RA activities (i.e., Phase 1, Phase 2, Phase 3) to determine what trace metals present potential human health hazards with the particular work task being performed. These monitoring data will be used to screen and eliminate trace metal constituents which do not present potential human health hazards or risks. Periodic personal air monitoring will be conducted based on the baseline results and changing work-place conditions to evaluate compliance with the applicable regulatory or voluntary limits. These personal air monitoring concentrations will be compared with applicable OSHA Permissible Exposure Limits (PEL), OSHA Action Levels (AL), ACGIH Threshold Limit Values (TLV) or ACGIH Short-term Exposure Limits for the specific trace metal. Real-time dust monitoring will be routinely conducted to demonstrate compliance with OSHA and ACGIH total particulate limits. All baseline and periodic personal air monitoring and evaluation will be conducted by or under the supervision of a trained and certified industrial hygienist or health professional. This individual will determine what protective measures or administrative controls will be necessary while baseline personal air monitoring is being conducted.

L3.9.1 Organic Vapors

Organic vapors other than those associated with vehicle fuels are not anticipated to be present at the Site. The CSHP SOPs/JSAs should consider monitoring air quality that may be unique to working in the pits (e.g., accumulation of organic vapors in the pit bottoms).

L3.9.2 Flammable Vapors

Flammable vapors other than those associated with vehicle fuels are not anticipated to be present at the Site. The CSHP SOPs/JSAs should consider monitoring air quality that may be unique to working in the pits (e.g., accumulation of flammable vapors in the pit bottoms).

L3.9.3 Equipment, Calibration, and Maintenance

The real-time dust monitors are portable, battery-operated units used for monitoring personal exposures. These units read instantaneous and average dust concentrations ranging from 0.01 to 100 mg/m^3. The units are factory calibrated and will be returned for factory calibration per the manufacturer's recommendation (typically semi-annually). The units will be zeroed prior to each use.

L3.10 NOISE MONITORING REQUIREMENTS

Noise levels may exceed those levels that require hearing protection (85 dBA averaged over an 8 hour day). If noise levels approach or exceed this level for extended periods of time, hearing protection and noise monitoring may be required. Contractors and subcontractors will be responsible for providing hearing conservation programs for their employees.

L3.11 ENGINEERING CONTROLS

Dust suppression techniques, primarily watering, ventilation or filtration, shall be used to the maximum extent practicable. Motorized equipment will have mufflers and noise suppression devices as required.

L4.0 REFERENCES

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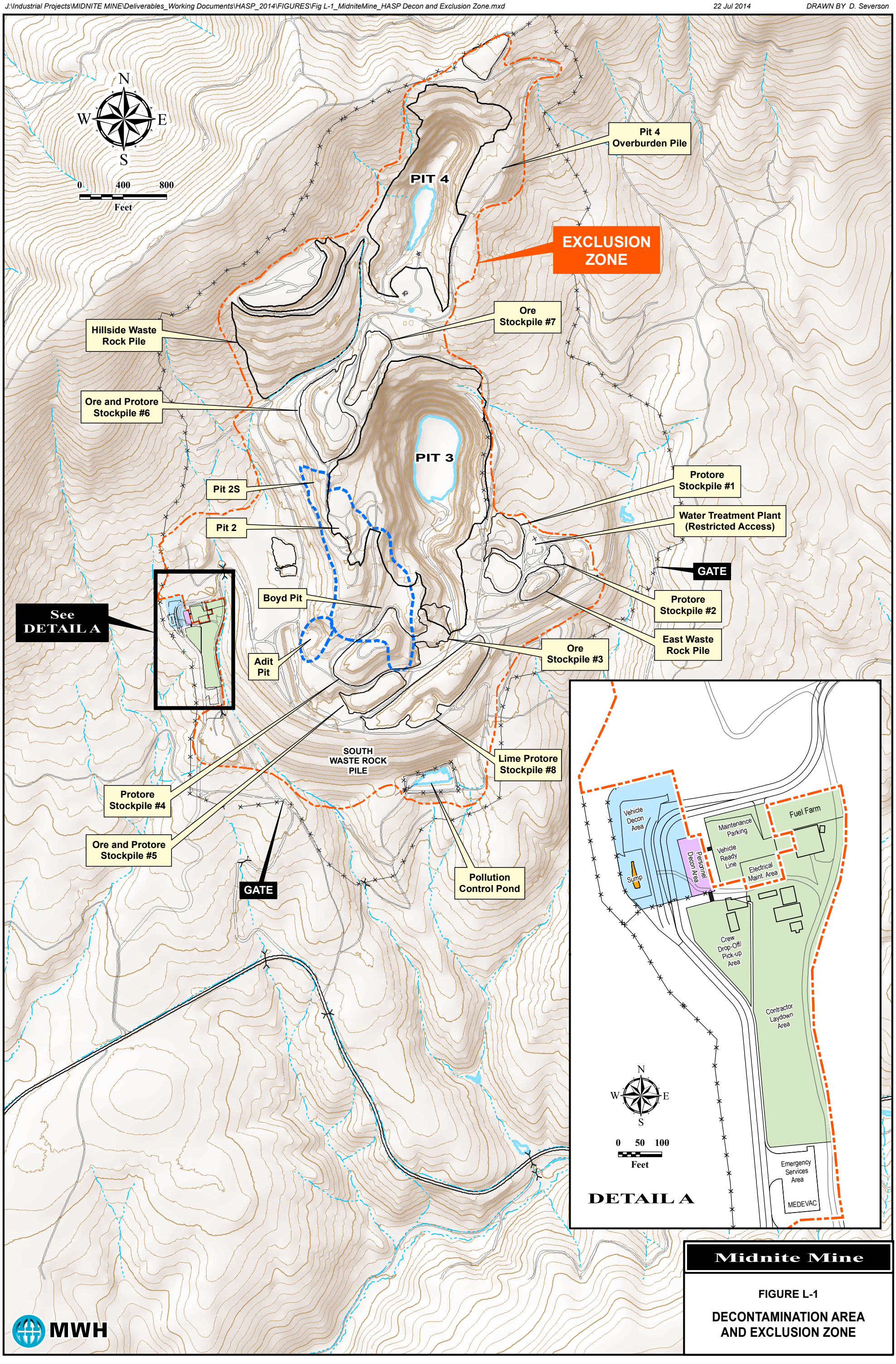
U.S. Department of Health and Human Services (USDHHS), 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. Publication No. 85-115. October.

U.S. Environmental Protection Agency (EPA), 2005. Midnite Mine Remedial Investigation Report. Prepared for the U.S. EPA by URS Corporation. September.

J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\HASP_2014\FIGURES\Fig L-1_MidniteMine_HASP Decon and Exclusion Zone.mxd 22 Jul 2014 DRAWN BY D. Severson



Midnite Mine

FIGURE L-1

DECONTAMINATION AREA
AND EXCLUSION ZONE

Attachment L-1

Radiation Protection Plan

Midnite Mine Superfund Site – Radiation Protection Plan For Remedial Action

100 Percent Design
REVISED JUNE 2015

Prepared for:

Dawn Mining Company

P.O. Box 250
Ford, Washington 99013

And

Newmont USA Limited

6363 S. Fiddler's Green Circle
Greenwood Village, Colorado 80111

Prepared by:

Environmental Resources Group (ERG)
Albuquerque, NM

APPROVALS

The Midnite Mine Radiation Protection Plan has been reviewed and approved by the following:

Name	Title	Date
_____	**Company Site Construction Manager**	_____
_____	**Company Site Safety Manager**	_____
_____	**Company Radiation Safety Officer**	_____

Changes to the Midnite Mine Radiation Protection Plan must be reviewed and approved by each above identified individual.

TABLE OF CONTENTS

APPROVALS ..... **II**

1.0 INTRODUCTION **3**
- 1.1 Radionuclides of Concern 4
- 1.2 Project Organization 7
- 1.3 As Low as Reasonably Achievable (ALARA) Policy 10
- 1.4 Applicable Standards 10

2.0 RADIATION PROTECTION PLAN **11**
- 2.2 Worker Responsibility 13
- 2.3 Standard Operating Procedures 13
- 2.4 Minimum Training and Experience Requirements for Management Personnel 13
- 2.5 Radiation Safety Training Program 14

3.0 REGULATORY STANDARDS AND GUIDES **15**
- 3.1 Worker Dose Limits 15
- 3.2 Release of Equipment and Land for Uncontrolled Use 16

4.0 RADIATION SURVEYS **16**
- 4.1 External Exposure and Exposure Rate Monitoring 16
- 4.2 Particulate Air Monitoring (For Long Lived Alpha Emitters - Uranium, Thorium, Radium) 16
- 4.3 Radon and Progeny Monitoring 17
- 4.2 Personal Contamination Surveys 17
- 4.3 Equipment Contamination Surveys 18
- 4.4 Instrument Calibration 18

5.0 RESPIRATORY PROTECTION PROGRAM **18**

6.0 CONTROL OF RADIOACTIVE MATERIALS AND RADIATION EXPOSURE **19**

7.0 SEALED SOURCES **19**

8.0 FEMALE EMPLOYEES OF CHILD BEARING AGE AND PRENATAL RADIATION EXPOSURE **19**

9.0 RADIATION PROTECTION WORK RULES – APPLICABLE TO ALL EMPLOYEES AND CONTRACTORS **20**

10.0 PERSONAL PROTECTIVE EQUIPMENT **20**

11.0 CONTAMINATION CONTROL **21**

12.0 PERSONAL DOSIMETRY PROGRAMS **21**
- 12.1 Personal Dosimeters (Direct Radiation Exposure Monitoring) 21
- 12.2 Declared Pregnant Workers (DPW) Dosimetry 21
- 12.3 Bioassay 22
- 12.4 Calculation of Total Effective Dose Equivalent (TEDE) 22

13.0 RADIATION WORK PERMIT (RWP) **22**
14.0 RECORDS **22**
15.0 BIBLIOGRAPHY **22**

LIST OF TABLES

Table 3-1 Surface Contamination Limits for Unrestricted Release 16

LIST OF FIGURES

Figure 1-1 Midnite Mine Site Layout 4
Figure 1-2 The Uranium Series[1] 5
Figure 1-3 Estimated radium-226 concentrations* 6
Figure 1-4 Gamma exposure rates* 7

LIST OF ATTACHMENTS

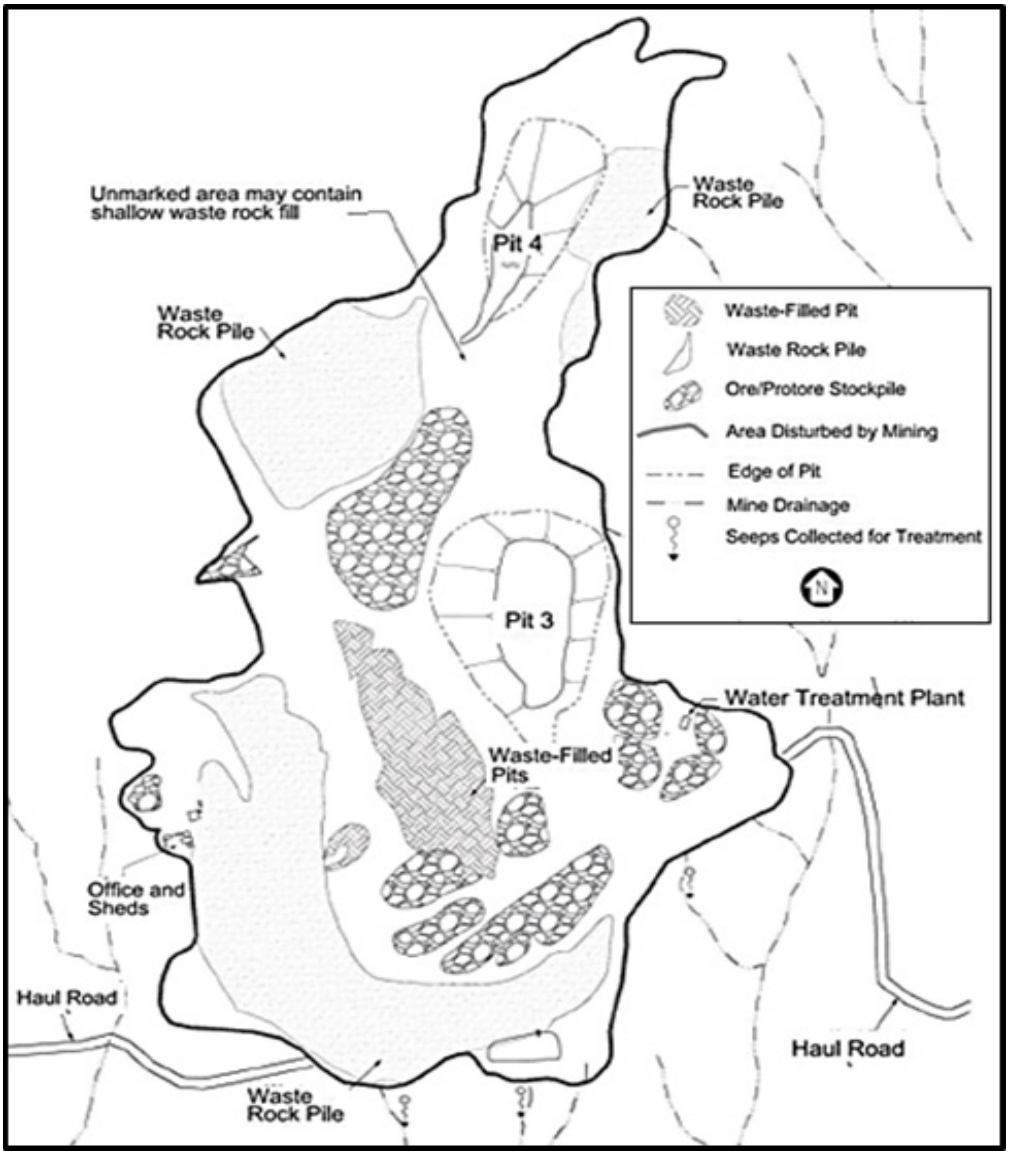
Attachment A: Radiation Protection Plan Standard Operating Procedures
Attachment B: Toxicological Profile for Uranium and Uranium Decay Products
Attachment C: RAD7 Radon Detector User Manual

1.0 INTRODUCTION

This Radiation Protection Plan (RPP) describes the radiation safety requirements, training, and policies specific to the radiation hazards that may be encountered while performing Remedial Action (RA) activities at the Midnite Mine Superfund Site (Site) approximately 45 miles northwest of Spokane, Washington. This plan has been prepared on behalf of Dawn Mining Company (DMC) and Newmont USA Limited (Newmont), and is applicable to all DMC/Newmont employees, contractors, and subcontractors involved with RA construction activities and visitors. This plan is supported by the Standard Operating Procedures (SOPs) included in Attachment A that provide the detail for field implementation of the radiation protection program defined by this RPP. A separate RPP exists for work in the water treatment plant (WTP) and is not directly applicable for the RA, although there are some identical requirements and/or similar operational procedures described in both RPPs. Workers who have responsibilities in both the WTP and the RA will be provided the necessary training for both RPPs prior to beginning work in the specific area and will use the corresponding RPP for their work.

DMC/Newmont (hereafter referred to as Company) personnel, contractors and subcontractors, and all personnel engaged in RA construction activities at the Site shall comply with all provisions of the Midnite Mine Health and Safety Plan (RA HASP) and this RPP. A general layout of the Midnite Mine Site is presented in Figure 1-1.

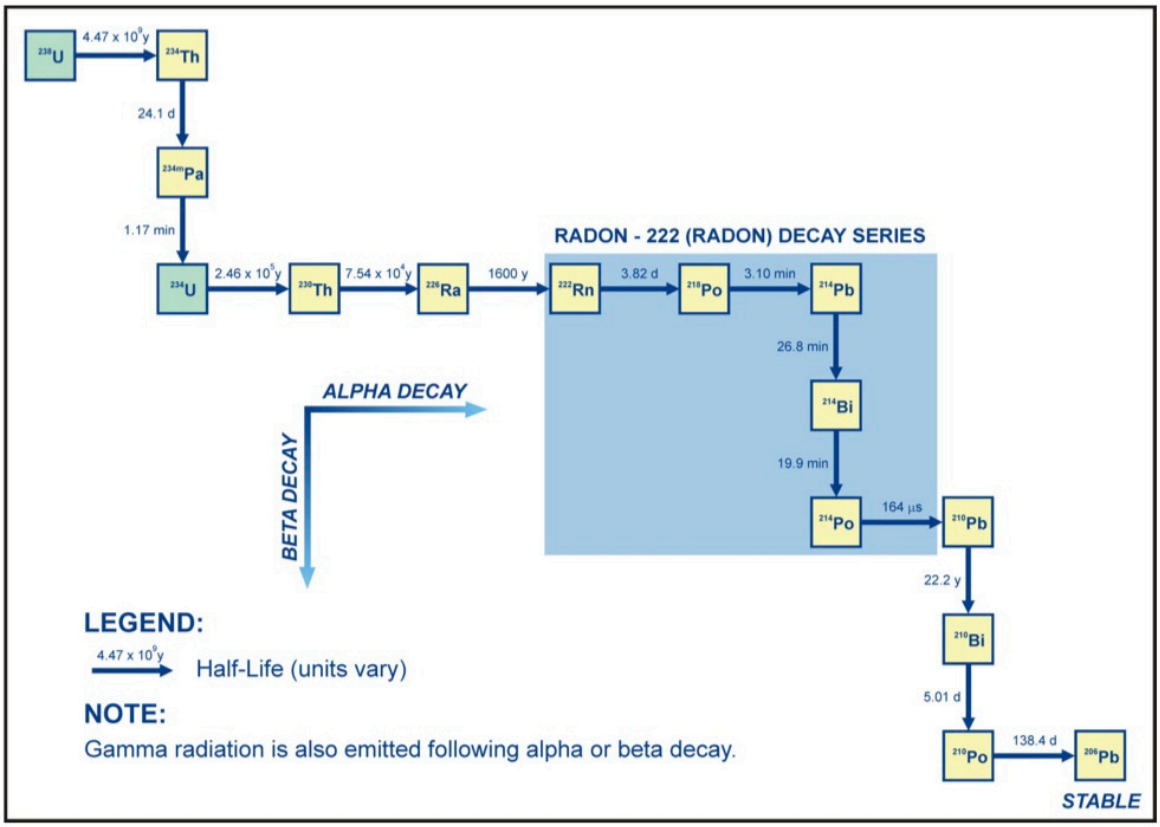
Figure 1-1 Midnite Mine Site Layout



1.1 Radionuclides of Concern

The radionuclides of concern at the Midnite Mine are limited to uranium isotopes and their decay products. The uranium decay series is presented in Figure 1-2. The uranium decay series characteristics and additional information regarding the toxicological properties of uranium and its decay products are included in Attachment B to this RPP.

Figure 1-2 The Uranium Series[1]

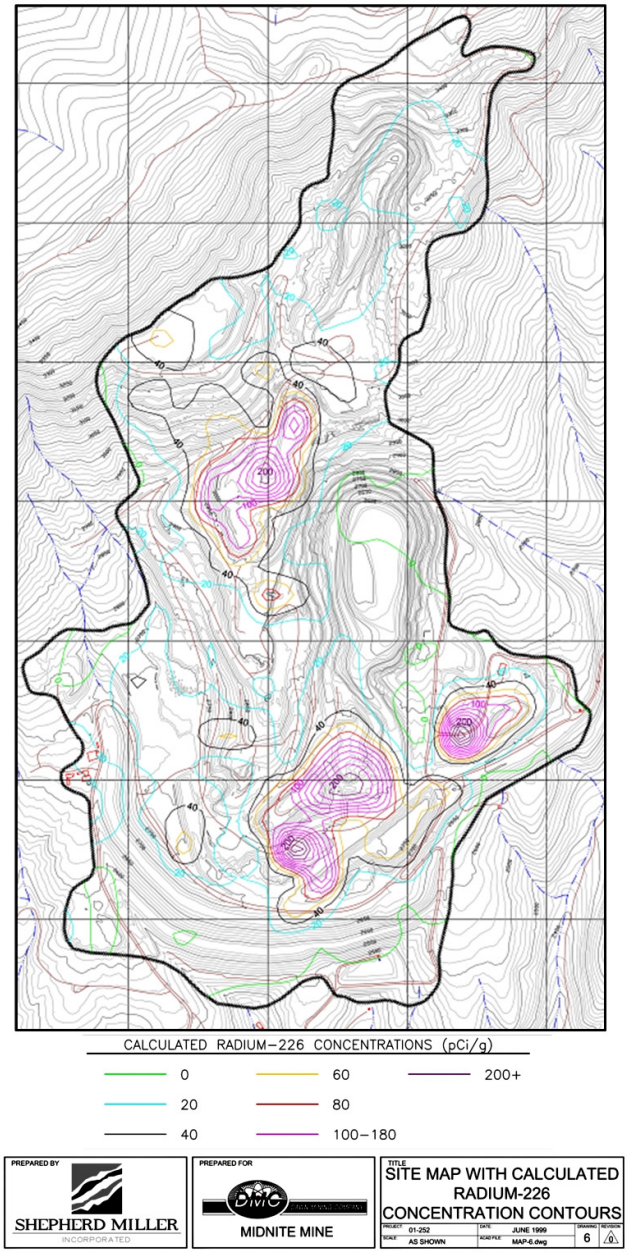


1 Figure 1-2 represents the Uranium decay series which represents > 97% of the radioactivity in natural uranium. The other naturally occurring uranium decay series, referred to as the "Actinium Series' begins with uranium 235 but this series is much less important for purposes of this project due to the very low percentage of uranium 235 in natural uranium (0.7%).

Where radiological protection is concerned, there are three different areas at the project, which have been identified as having varying levels of uranium and uranium progeny concentrations in the soil and ore/waste rock. A graded approach to personnel radiological monitoring will be used as is appropriate for the varying types of radiological hazards that may be encountered. The potential for such hazards will depend on the nature of the work being performed and the radiological composition of materials involved. Concentrations of uranium in the materials that will require removal, transport and ultimate consolidation in the engineered waste repositories is known to vary from less than 0.01% to as much as 2% by weight. However, the radiological constituent of greatest concern in terms of potential radiation doses to workers is the uranium decay product radium-226, and the primary worker dose pathway is external exposure associated with gamma radiation from several of the uranium and radium decay products. The estimated spatial distributions of Ra-226 and associated gamma exposure rates across the Site are shown in Figures 1-3 and 1-4.

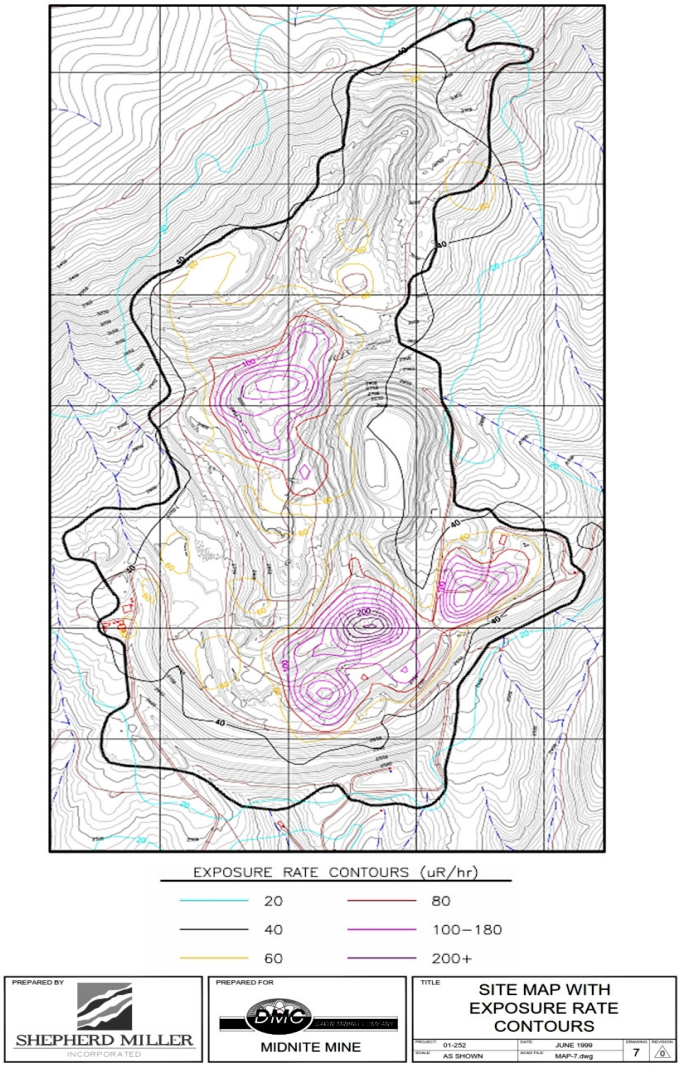
Control and monitoring for internal exposure to dusts containing radioactivity resultant from general construction activities, material movement and associated potential for radioactive material contamination is also addressed by this RPP and associated Standard Operating Procedures. However, these exposure pathways (inhalation / ingestion) are expected to be of secondary importance relative to external exposure associated with gamma radiation.

Figure 1-3 Estimated radium-226 concentrations*



*Adapted from SMI, 1999

Figure 1-4 Gamma exposure rates*



*Adapted from SMI, 1999

1.2 Project Organization

The roles and responsibilities for the key health and safety personnel are presented in Section 1.5 of the RA HASP. Additional information regarding the roles, responsibilities, and qualifications specific to the radiation protection organization (e.g., Company Radiation Safety Officer and Company Radiation Safety Technician are summarized in this section (See also RPP -SOP1 - *Responsibilities and Administrative Controls*, which provides detail on the roles and responsibilities and minimum qualifications of project organizational functions important to radiation protection. The functions within the project organization with direct responsibility and

authority for execution of the Radiation Protection Program are discussed below and in Section 2.

The Company Site Construction Manager is responsible for:

- Ensuring adequate resources are provided (personnel, equipment, etc.) for the compliant implementation of this RPP.
- Ensuring that the mine and RPP ALARA Policy is in place and is consistently administrated and applied.
- Ensuring that mine radiation safety/health performance objectives are maintained in accordance to with the RPP.
- Ensuring adequate technical services are available to support the RPP.

The Company Site Safety Manager is responsible for:

- Ensuring that the ALARA Policy is communicated to all employees and that Radiation Protection Program policies are implemented.
- Ensuring that audit recommendations and responses are resolved and completed in a timely fashion.
- Suspending any and all Site operations, if necessary, to maintain safe conditions or ensure compliance with requirements of this RPP and applicable regulations.
- Approving all project Standard Operating Procedures and Quality Assurance documents to ensure consistency, safety, and overall efficiency of site operations and work flow.

The Company Radiation Safety Officer is responsible for:

- Developing the project Radiation Protection Program, radiological training programs and evaluating compliance with radiation protection policies and ALARA principles.
- Participating in modification/design reviews for facilities and equipment that can affect potential radiation exposures.
- Developing plans, procedures, and methods for maintaining radiation exposures of Company personnel, contractors and visitors associated with RA construction activities ALARA.
- Preparing and/or approving Radiation Work Permits on an as needed basis.
- Identifying locations, operations, and conditions that have the potential for causing exposures to radiation above limits.
- Reviewing, commenting on, and recommending changes in operational procedures to maintain occupational exposures ALARA.

- Performing and/or reviewing results of audits and approving audit responses and corrective actions as necessary.

- Overall generation, review, approval, technical verification, and implementation of Midnite Mine Radiation Standard Operating Procedures.

- Developing procedures for overall radiological health and safety.

- Maintaining records related to the RPP including radiological monitoring and assessment of worker radiation exposure.

- Suspending any and all Site operations, if necessary, to maintain safe conditions or ensure compliance with requirements of this RPP and applicable regulations.

Company Radiation Safety Technicians are responsible for:

- Monitoring work in progress for compliance with the RPP, associated SOPs and provisions of the ALARA policy.

- Conduct of routine radiological surveys including air monitoring, exposure rate and contamination assessments.

- Informing remedial action workers of potential radiological and non-radiological hazardous conditions.

Company and Contractor/Subcontractor Remedial Action Workers are responsible for:

- Complying with all radiation protection program requirements and safety rules, and applicable RPP-SOPs.

- Complying with the project ALARA policy and requirements.

- Incorporating good ALARA work practices into job functions and work performance.

- Bringing ALARA concerns to the attention of the Company Radiation Safety Officer and/or the Radiation Safety Technician.

- Using assigned coveralls and other work related clothing that will remain on site for laundering and re-issue.

Company personnel and subcontractors are responsible for complying with all radiation protection and safety rules, including the requirements of any Job Safety Analysis (JSA) associated with the Midnite Mine RA construction activities. Workers are responsible for incorporating ALARA work practices into job functions and work performance and for bringing ALARA concerns to the attention of the Company Radiation Safety Officer and the Company Site Safety Manager. Additional information related to management of the Radiation Protection Plan and ALARA principles is included in Sections 1.3, 2.0 and 3.0.

1.3 As Low as Reasonably Achievable (ALARA) Policy

This section presents the Company ALARA Policy that shall be communicated to all workers including Company employees and contractors. Procedures and engineering controls must be based upon sound radiation protection principles including taking all reasonable measures to keep occupational exposures, environmental effluents and potential exposures to members of the public ALARA. This commitment to ALARA is articulated in this Radiation Protection Plan. Standard Operating Procedures (SOPs) related to radiation safety are provided as Attachment A.

All Midnite Mine RA construction activities shall be performed in a manner such that exposures to ionizing radiation and radioactive materials above background are maintained As Low as is Reasonably Achievable (ALARA). “Reasonable” means that the economic and social factors, benefits, and risks are considered in trying to reduce worker dose, in accordance with the requirements of this plan and applicable federal regulations. The Company has developed, documented, and implemented this RPP for the Midnite Mine commensurate with the scope and extent of radiation-related construction activities to be undertaken during the RA. This RPP implements the ALARA philosophy through its use, including use of its associated procedures (See Appendix A, e.g.) and engineering controls based upon sound radiation protection principles to achieve occupational exposures and potential exposures to members of the public that are ALARA. The Company and its contractors are committed to providing resources, in the form of personnel, training, engineering controls, preparation and planning, design, equipment, monitoring devices, and administrative controls to achieve ALARA doses at its facilities.

Each employee and contractor is expected to be knowledgeable of work activities and to abide by all ALARA requirements including those described in this plan and specified in SOPs, JSAs or other safety-related instructional documents. In addition to the responsibility for his/her/their own exposure minimization, each employee is responsible for minimizing exposures to other workers and members of the public by following all applicable work rules and identifying and reporting conditions or actions that could impact radiation safety. The Company management encourages employee suggestions to incorporate the ALARA policy into work practices.

1.4 Applicable Standards

The Midnite Mine is governed by OSHA regulations regarding general safety. OSHA radiation exposure limits for workers, specified in 29 CFR 1910.1096, are very similar to (although less current *) than the requirements of 10 CFR 20 that must be applied to facilities licensed by the U.S. Nuclear Regulatory Commission or virtually identical regulations of the State of Washington Department of Health. Since the occupational dose limits in 10 CFR 20 are based on more current nationally and internationally accepted models and technical basis, the 10 CFR 20 exposure limits and related requirements are applied to the Midnite Mine in a graded approach as applicable, since they represent the current industry standard. Additional information regarding applicable radiation protection standards and criteria are included in Section 3.0 of this RPP.

* OSHA radiation protection requirements are based on metabolic and dosimetric models and data that predate those currently used by NRC by many years. They have not been updated since originally prepared over 35 years ago.

2.0 RADIATION PROTECTION PLAN

The objective of the Midnite Mine Radiation Protection Plan is to provide a safe work environment for employees and to minimize the impact of RA construction activities on the health and safety of workers, the public, and the environment. The RPP and its associated Standard Operating Procedures are part of the health and safety program and applies the principles of ALARA to control radiation exposures and other related health, safety and environmental impacts.

The Radiation Protection Plan for the Midnite Mine includes control and monitoring of exposure to uranium and its associated radioactive decay products. It consists of the following elements:

- Identifying radiation standards and guides to provide definition of applicable methods for the monitoring, control and documentation of radiation exposures.
- Designating work areas and appropriate engineering and process controls to minimize exposure to radioactive materials.
- Designing and implementing monitoring programs to measure, control and document exposures of workers to radiation above background. This includes techniques involving assignment of personal dosimeters to workers for measuring external exposure and air sampling and contamination surveys to assess potential for internal exposure of radionuclides via inhalation and / or ingestion.
- Training requirements for workers to ensure that personnel are properly informed of radiation risks, proper work procedures, procedures for minimizing exposure to radiation, and applicable regulations and guidance (USNRC Regulatory Guides, USNRC 10 CFR 20, 29 CFR 1910.120 and 29 CFR 1910.1096).
- Midnite Mine RPP Standard Operating Procedures (RPP-SOPs) designed to ensure that radiation safety objectives and requirements are met (See Attachment A).
- Implementing regular ALARA audits of the RPP that include reviews of radiation exposures to workers, the public, and new or proposed operations and projects on the Site to ensure the principles of ALARA are being properly applied and administered.

The worker radiation monitoring program will at a minimum include the following:

- Radiation dosimetry program, consisting of external exposure rate surveys and personal dosimeters to measure external radiation doses as required by 29 CFR 1910.1096 / USNRC 10 CFR 20 or as deemed advisable by the Company Radiation Safety Officer.
- Air particulates sampling to estimate potential for intake of radioactive materials and associated assessment of potential internal exposure, and to gather information for improving source control.
- Initial monitoring of ambient radon gas in air and airborne radon decay products at the bottom of the mine pits and near waste rock piles to assess potential worker exposures to radon and the need for continued radon monitoring throughout the duration of the RA construction project.
- Contamination surveys of personnel, areas and equipment to ensure potential for internal exposure and spread of contamination are minimized.
- Baseline urine bioassays for all employees and contractors prior to working within controlled areas at the site, an attempt will be made to obtain a final urine bioassay sample for these personnel upon termination of employment at the site, and as deemed appropriate by the Company Radiation Safety Officer under certain conditions, interim bioassay sampling to measure potential intakes of uranium during RA construction activities.

- Documenting and retaining records of radiation exposures and monitoring activities.

Authorities of management positions with responsibilities for the radiation protection and monitoring program follows.

2.1.1 Authorities and Responsibilities of Organizational Functions Important to Radiation Protection

2.1.2 Management

Company management is committed to the implementation and enforcement of this RPP and associated ALARA principles. The Company management regularly communicates with workers and supports decisions made by the Company Site Construction Manager, Company Site Safety Manager, and Company Radiation Safety Officer. Annual internal audits are conducted to ensure that the programs and procedures designed to maintain radiation exposures ALARA are in place and are properly implemented. Additional information on organizational roles, responsibilities and qualifications of staff are provided in RPP-SOP1.

2.1.3 Company Site General Manager

The Site Construction Manager has overall responsibility and the authority for the effective application of the RPP. The Site Construction Manager is responsible for ensuring the necessary resources (qualified personnel, equipment, supplies, etc.) are being provided to the Company Radiation Safety Officer and Company Site Safety Manager for execution of the RPP and must “take ownership” of the RPP.

2.1.4 Company Site Safety Manager

The Company Site Safety Manager is responsible for the site daily operations implementation and compliance with the RPP. The Company Site Safety Manager is expected to participate in radiation safety related reviews of processes and activities, ALARA audits and to ensure all subordinate personal recognize the importance of compliance to this RPP. The Company Site Safety Manager has the responsibility and authority to suspend any and all Site operations, if necessary, to maintain safe conditions or ensure compliance with requirements of this RPP and applicable regulations.

2.1.5 Radiation Safety Officer and Radiation Safety Technician

The RPP is managed by the Company Radiation Safety Officer and implemented, as necessary, with the assistance of one or more Company Radiation Safety Technicians. The Company Radiation Safety Officer and/or Company Radiation Safety Technician each have the authority and the responsibility to modify and stop operations if, in his/her judgment, the operation is not being carried out in a radiologically safe manner.

The Company Radiation Safety Officer has primary responsibility for the technical adequacy and correctness of the radiation protection and ALARA program and has continuing responsibility for surveillance and supervisory action in the enforcement of the program. Specific authorities of the Company Radiation Safety Officer include but are not limited to:

- *Development and administration of the radiation protection and ALARA program;*
- *Sufficient authority to enforce regulations and administrative policies that affect any*

aspect of the radiological protection program;

- *Review and approve plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the protection program against uranium and its daughters;*

- *Designate equipment and laboratory facilities adequate to monitor relative attainment of the ALARA objective;*

- *Oversight and administration of formal radiation safety training to all employees and contractor personnel.*

2.2 Worker Responsibility

Each Site worker (Company employee or contractor) and visitor is responsible for adhering to all rules, notices, and operating procedures including those related to radiation safety as well as promptly reporting any equipment malfunctions, deviations from the SOPs and/or this RPP, or other conditions that might affect radiation safety. General reporting procedures initially involve reporting to an immediate supervisor. Additionally, workers are encouraged to suggest improvements to the Radiation Protection Plan including practical and reasonable methods that could further reduce radiation exposures consistent with ALARA principles. These responsibilities are emphasized in worker training, and are regularly reinforced by the Company Site Construction Manager, Company Site Safety Manager, Company Radiation Safety Officer, and Company management.

2.3 Standard Operating Procedures

Radiation safety related Standard Operating Procedures (SOPs) have been developed for radiation monitoring, sampling and analysis; radiological exposure and dose assessment (dosimetry); instrument use and calibration, and training. Collectively, these SOPs define specific details of the methods, procedures and protocols that will be used to implement the radiation protection and ALARA concepts, objectives and requirements as presented in this RPP. These procedures are contained in Attachment A to this RPP.

2.4 Minimum Training and Experience Requirements for Management Personnel

The minimum training and experience requirements for key management staff with responsibility for radiation safety are summarized in this section.

2.4.1 Company Radiation Safety Officer

- Bachelor's degree in the physical sciences, industrial hygiene, health physics or engineering from an accredited college or university or an equivalent combination of training and relevant experience in radiation protection. Two years of relevant experience are generally considered equivalent to 1 year of academic study.

- At least 1 year of work experience relevant to radiation protection in uranium facilities in applied health physics, radiation protection, industrial hygiene or similar work. This experience will involve actually working with radiation detection and measurement equipment, not strictly administrative work.

- The Company Radiation Safety Officer shall receive a minimum of 40 hours of health physics training every 2 years. The training requirement can be fulfilled by attending a single 40 hour class, attending a total of 40 hours of meetings and classes related to radiation protection at professional symposia, universities, uranium facilities or teaching 40 hours of radiation protection classes.

2.4.2 Company Radiation Safety Technician

- At least two years of experience in radiation safety including use of instrumentation for conduct of radiological surveys.

- Minimum of 40 hours of formal radiation safety training.

- Minimum of 8 hours of refresher training every two years (may be on-the-job training provided by the Company Radiation Safety Officer).

2.4.3 Remedial Action Workers (See Section 2.5,*Training*)

- Minimum of 4 hours of General Employee Radiation Training (GERT-See Section 2.5).
- Minimum of 8 hours of Remedial Action Worker Training.
- Supervisory training as applicable.

2.4.4 All Other Employees and Contractors

- Minimum of 4 hours of GERT.
- Instruction for female employees of child-bearing age on prenatal exposure and pregnancy declaration.

2.5 Radiation Safety Training Program

The Radiation Safety Training Programs are addressed in detail in RPP-SOP11. These training requirements apply to all personnel at the Midnite Mine Site who will receive training commensurate with the level of potential exposure to radioactive materials. Employees who work in “Controlled Areas (CA - close proximity to and/or with radioactive materials) will receive the more comprehensive remedial action worker training (RWT). Other Site employees (e.g., administrative staff) who are not regularly working in active CAs will receive “general employee radiation training (GERT)”. Visitors who will be escorted will receive an orientation from the Company Radiation Safety Officer, Company Radiation safety Technician, or designee. Contractors who will be on-site are provided with training specific for the radiation hazards in areas they will occupy and the activities in which they will be engaged, e.g., full remedial action worker training if applicable. The extent of the radiation training required will be determined by the Company Radiation Safety Officer, but at a minimum will include the GERT program.

Female workers of child bearing age who will work in areas with elevated potential for exposure to radiation will receive additional training in the potential effects of radiation on the fetus in accordance with the guidance contained in USNRC Regulatory Guide 8.13, *Instruction Concerning Prenatal Radiation Exposure.*

Records and documentation pertaining to radiation safety training are maintained by the Company Radiation Safety Officer.

3.0 REGULATORY STANDARDS AND GUIDES

Radiation protection standards are provided in 29 CFR1910.1096 and in 10 CFR 20 or Agreement State administrative codes. Licensed facilities are required to comply with NRC or agreement state regulations (note that the Midnite Mine RA project is not "licensed" under the US Atomic Energy Act). OSHA radiation protection standards are similar to those of the USNRC but are based on much older metabolic and dosimetry models and associated technical basis and apply to non-licensed facilities. Since these workers are not trained in accordance with NRC requirements for licensed facilities, acceptable risk and dose limits should be reduced accordingly although application of "public exposure limits" for this worker population would not be appropriate (e.g., 100 mrem/yr above background per 10 CFR 20.1301). Accordingly, consistent with the relatively low levels of radiation exposure and risk expected to be associated with this project, and in order to maintain worker exposures ALARA, more conservative limits applicable to the RA construction activities (relative to licensed facilities) have been established for this RPP. This graded approach recognizes that workers will be potentially exposed to levels of radioactivity and radiation greater than the background to which the public is exposed, yet these workers will be educated in potential radiological health risks, will be trained in radiation protection principles and procedures, and will receive the benefits associated with employment at the site.

3.1 Worker Dose Limits

As indicated above, the fundamental annual worker exposure limits established by both OSHA and NRC are similar. OSHA occupational dose limits are given in 29 CFR 1910.1096. NRC's limits are defined in 10 CFR 20.1201. The annual dose limits applicable for this project are 500 mrem Total Effective Dose Equivalent (TEDE) above background (10 % of the OSHA and NRC limits for trained "radiation workers") and for declared pregnant workers, 500 mrem above background to the fetus for the period of gestation. The TEDE includes doses received from both external exposure (e.g., gamma exposure to the whole body) as well as from internal exposure (primarily from inhalation of radionuclides in air). Methods for calculating and assigning TEDE are described in RPP – SOP10, *Dose Calculations.*

NRC also applies a 10 mg per week intake limit for soluble uranium based on chemical toxicity. If airborne uranium concentrations are maintained below the applicable Derived Air Concentration (e.g., see RPP-SOP3, Internal Exposure Monitoring), the mass intake limit cannot be exceeded. However, the uranium species (compounds) expected to be encountered in the Midnite Mine environment (ore residues and precipitates as highly reduced mineral oxides. e.g., UO_2) are expected to be relatively insoluble and this limit is not expected to be applicable.

An additional administrative dose limit will be applied at the Midnite Mine Site. This annual administrative limit will be 50 % of the fundamental TEDE limit as stated above (250 mrem/yr). The purpose of this administrative limit is to provide a conservative "trigger level", at which the Company Radiation Safety Officer will re-evaluate applicable procedures under the RPP to determine if additional measures can be taken to reduce exposures consistent with the project's ALARA policy. Annual worker TEDE values in excess of 250 mrem above background should be justified and must be approved by the Company Radiation Safety Officer.

3.2 Release of Equipment and Land for Uncontrolled Use

Appropriate criteria that will be applied at this project for release from the site of equipment and materials for uncontrolled use is provided in the NRC's *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material* (NRC, 1993). The limits are given in Table 3-1. RPP-SOP4 and RPP-SOP6 describe the procedures for the survey and decontamination of materials and equipment above these limits to allow for uncontrolled release if desirable.

Table 3-1: Surface Contamination Limits for Unrestricted Release

Element	Removable Surface Activity (dpm/100 cm^2)	Ave. Total Surface Activity (dpm/100 cm^2)	Max. Total Surface Activity (dpm/100 cm^2)
U-nat and its decay products	1,000 (total alpha)	5,000 (total alpha)	15,000 (total alpha)
Beta/gamma Emitters	1,000	5,000	15,000

4.0 RADIATION SURVEYS

Radiation surveys and monitoring will be conducted according to the procedures described in RPP-SOP2 through 7. Results of surveys will be documented, reviewed, and approved by the Company Radiation Safety Officer. Surveys and monitoring are conducted as described in the following sections.

4.1 External Exposure and Exposure Rate Monitoring

All full time employees that work within Controlled Areas will be provided personal dosimeters (TLDs or OSLs - see RPP-SOP7, *External Dosimetry*) to provide a permanent record of external exposure to gamma radiation. Additionally, routine exposure rate surveys will be performed with appropriate hand held instrumentation (See RPP-SOP4, *Survey Meter / Contamination Surveys)* to monitor general exposure rates as material is moved about and radiological conditions may change. Results of these surveys will be documented and evaluated by the Company Radiation Safety Officer and/or Company Radiation Safety Technician to determine whether additional radiation safety measures may be required in accordance with the ALARA policy. Additionally, AS-SOP6 in Appendix S of the Midnite Mine Basis of Design Report addresses the conduct of gamma surveys of soil and waste rock materials associated with the remedial action program.

4.2 Particulate Air Monitoring (For Long Lived Alpha Emitters - Uranium, Thorium, Radium)

Both general area and breathing zone / lapel type (BZ) samples will be collected as necessary using a graded approach, based on the judgment of the Company Radiation Safety Officer. In general work areas, it is expected that routine area grab sampling will be adequate to monitor and document radionuclide concentrations in air. However, during excavation of the sediments from Pits 3 and 4, continuous BZ sampling of workers with the highest potential for inhalation exposure shall be conducted until such time as operational data indicates it is not necessary. Similarly, pending operational experience, BZ sampling in other active areas should be performed for workers having job functions with the highest potential for intake. BZ air sampling will be performed with a properly calibrated personal sampling pump as per RPP-SOP5, *Air Sampling*. Air samples will be collected and analyzed for gross alpha activity by the Company

Radiation Safety Technician in accordance with RPP-SOP2, *Scalers / Detectors* and RPP-SOP5. The counting equipment will be calibrated with National Institute of Standards and Technology (NIST) traceable standards. If air particulate results by gross alpha counting exceed 10% of the DAC (6E-11 µCi/ml) for ore dust (RG 8.30; RPP-SOP5), work in the affected area will be suspended pending evaluation by the Company Radiation Safety Officer of the adequacy of dust suppression measures, need for a radiation work permit (RWP), need for bioassay samples from potentially exposed workers, and potential use of respiratory protection before work can continue in the affected area (see also sections 5.0 and 13.0).

In addition to sampling general work areas, air particulate samples will be taken at appropriate locations around the site in accordance with the Air Quality Monitoring Plan (AQMP).

4.3 Radon and Progeny Monitoring

In general, radon monitoring is not expected to be necessary for outdoor work at the Midnite Mine because the radon emanating from the surface materials is dispersed before the decay products (the major contributors to dose) build up and in general radon exposures are expected to be low. Nonetheless, radon-222 and short lived decay product (radon progeny) concentrations will be measured during initial project phases near/on ore piles and at the bottom of the pits. If it is consistently demonstrated that exposure is not above 10 % of the DAC in these areas, this monitoring can be reduced or discontinued at the discretion of the Company Radiation Safety Officer.

Long-term average Radon-222 gas concentrations in air will be measured with Alpha Track Detectors (ATDs) as described in RPP-SOP5. Alternatively, at the discretion of the Company Radiation Safety Officer, shorter-term radon-222 measurements will be performed with a Durridge RAD7 Radon detector in accordance with the operating procedures provided in the instrument's User Manual included in Attachment C. Capable of measuring concentrations as low as 0.1 pCi/L, the Durridge RAD7 can measure radon-222 in short-term samples (e.g. 5 – 120 minutes) for temporal comparability to radon progeny grab sample measurements, and can also be programmed for real-time continuous radon monitoring over longer periods (e.g. a record of radon-222 concentrations over several days to evaluate diurnal fluctuations). In the event that the RAD7 is selected for use, general measurement procedures are provided in the User Manual, and specific SOPs will be developed once site-specific measurement objectives have been determined through initial testing and evaluation. Radon progeny measurements will be conducted using the standard Kusnetz Method, or equivalent, as described in Attachment 5-3 of RPP-SOP5.

4.4 Personal Contamination Surveys

Personnel working inside Midnite Mine controlled areas will survey their shoes, hands, clothing and any other areas of the body that may have become contaminated before leaving the controlled area and the Site and document same on a form provided at the survey stations. (Note that workers will be provided coveralls and related work clothing that will remain and be laundered on site – see also Section 2.2, Worker Responsibility). Personnel will be trained (See RPP-SOP11) in use of the alpha survey meter and/or the pancake GM probe, or equivalent, for personal and equipment surveys and proper documentation of survey results. The procedure for conduct of these surveys is presented in RPP-SOP4, *Survey Meter / Contamination Surveys*. The goal for personal contamination is levels indistinguishable from background. Personal contamination action levels are indicated on the Personnel Exit Survey Log Sheet. In general, personnel are required to decontaminate themselves and/or their personnel effects (or seek assistance from a Company Radiation Safety Technician if the action level is exceeded and

decontamination measures prove ineffective). Personal decontamination procedures are provided in RPP-SOP6, *Decontamination*.

Repeated personnel contamination is an indication of improper hygiene or training. Repeated personnel contamination will be investigated by the Company Radiation Safety Officer with corrective actions taken (e.g. retraining personnel).

4.5 Equipment Contamination Surveys

Equipment and vehicles released for uncontrolled use after having been used within controlled areas of the Midnite Mine will be surveyed for contamination according to the procedures for contamination surveys described in RPP-SOP4. If total (fixed + removable) activity measurements indicate contamination levels above the limit for removable contamination, swipe tests need to be performed as per RPP-SOP4. Decontamination procedures to be employed in the event the level of contamination exceeds the release limits are provided in Section 3.3 (Table 3-1) are also provided in RPP-SOP6.

4.6 Instrument Calibration

All portable survey instruments (detectors, rate meters and scalers) used at the Site will be calibrated annually, or as recommended by the manufacturer, by a qualified calibration facility. Instrument function check and QC measurements will be performed daily prior to use in the lab or the field as described in RPP-SOPs 2 and 4. Daily QC check readings that fall outside established control limits will be noted and corrected through service, repair, or recalibration as necessary.

Calibration records will be maintained by the Company Radiation Safety Officer. Flow rates for personal and area air samplers will be checked and recorded prior to each use and the equipment will be calibrated as described in RPP - SOP5. Breathing zone/lapel and high volume air samplers will be calibrated according to the manufacturer's directions or applicable regulatory requirements.

5.0 RESPIRATORY PROTECTION PROGRAM

It is unlikely that respiratory protection from airborne radionuclides will be routinely necessary during RA construction activities at the Midnite Mine due to mandatory dust suppression measures and typically very low concentrations of radioactivity when dusts are controlled to below visible levels. Engineering, administrative and/or workplace process controls (such as dust suppression during excavation of mine materials, and stationing workers upwind of active excavation areas wherever possible) will be the primary means of controlling exposures to airborne radionuclide concentrations and associated potential for inhalation exposures. The circumstance with the highest potential to require use of respiratory equipment is expected to be extraction of the uranium sludge from the bottom of the pits. General Area and Breathing Zone (BZ) air sampling during initial excavation of this material will determine if respirators are required. At the discretion of the Company Radiation Safety Officer, respiratory protection may be required if there is a potential for employee exposures to airborne radioactive material concentrations in excess of 10 % of the 6 E-11 µCi/mL DAC for ore dust as specified in USNRC 10 CFR 20, Appendix B (i.e. air concentrations > 6 E-12 µCi/mL).

In the event that respiratory protection is required for these or any other Site activities within controlled areas, the respiratory protection program will be conducted in accordance with 29

CFR 1910.134 or US NRC 10 CFR 20, Subpart H and RPP-SOP8, *Respiratory Protection*. Since a period of time is required to properly medically qualify and train workers for respiratory use, a small, select group of workers will be specifically trained and medically qualified at the beginning of the project in the event that the need is identified for specific, ad-hoc project tasks in the future.

6.0 CONTROL OF RADIOACTIVE MATERIALS AND RADIATION EXPOSURE

The radioactive materials present in the Midnite Mine impacted area are limited to uranium and its decay products in waste rock, low grade uranium ore, uranium sludge at the bottom of the pit and contaminated pit water. Processes and procedures to control access to controlled areas and radioactive materials are described in RPP-SOP9, *Access Control*. Where necessary, access control, security and dust control measures designed to keep radiation doses ALARA will be used. Additionally, worker coveralls, PPE and related work clothing will remain on site at all times for laundering and subsequent re-issue. As practical, clothing / PPE will be surveyed for contamination prior to reissue and re washed if necessary. The contamination limits presented in Table 3-1 are applicable to clothing and PPE.

Since the primary pathway of exposure to workers is from gamma radiation from uranium decay products (primarily Pb-214 and Bi-214, which are short-lived decay products of Ra-226), minimizing time spent in close proximity to large quantities of mine materials and maximizing distance from these materials as is practicable given the work to be accomplished, is the most direct way of maintaining exposures ALARA. From a practical perspective, this means that break areas, sanitary facilities, office areas, etc. will be located as far away from large quantities of ore, waste rock and sludges as is practical and time spent in the immediate vicinity of these materials will be kept to a minimum consistent with the ability to otherwise safely accomplish project objectives. Methods for conducting exposure rate surveys are provided in RPP-SOP4, *Survey Meter / Contamination Surveys.*

7.0 SEALED SOURCES

Several small, exempt quantity instrument check sources will be required for the project. These small sealed radioactive sources will be securely kept at the project radiation safety office and will be used for routine instrument function and measurement quality control checks. The Company Radiation Safety Officer will keep an inventory of these instrument check sources.

8.0 FEMALE EMPLOYEES OF CHILD BEARING AGE AND PRENATAL RADIATION EXPOSURE

All female employees as well as female contractors who will be working at the Midnite Mine RA project will be given special training about circumstances and risks of prenatal exposure. Such instructions are based on the information provided in NRC Regulatory Guides 8.36 (1992) and 8.13 (NRC, 1999). The 10 CFR 20 dose limit for the embryo/fetus (500 mrem for the period of gestation) and associated monitoring requirements will be implemented for any “declared pregnant woman”, i.e., a woman who has declared in writing to the Company that she is pregnant along with the estimated date of conception. Any declared pregnant woman who could receive a radiation dose in excess of background from work at the Midnite Mine will be issued a personal dosimeter that will be exchanged monthly. The Company will review the monitoring

report on a monthly basis and will track the potential dose to the fetus. Additional information is provided in RPP-SOP11, *Training.*

9.0 RADIATION PROTECTION WORK RULES – APPLICABLE TO ALL EMPLOYEES AND CONTRACTORS

General radiation safety work rules, developed to keep radiation doses to workers ALARA, are as follows:

- No smoking, eating or chewing in RA controlled areas where radionuclide concentrations are elevated. To the extent feasible, breaks will be taken in areas outside the Midnite Mine controlled areas. However, if that is not reasonable or feasible, an area or vehicle isolated from large quantities of radioactive materials may be designated as a break area.

- Workers must clean hands and face before eating, drinking or smoking. Alternatively, wet wipes, wash water and cleaning materials may be kept in the vehicles used for transporting workers and equipment.

- After completing activities for the day and before eating, drinking, or smoking, workers will survey hands, feet, and other parts of the body that might have become contaminated. The locations of survey stations with appropriate survey meters will be established by the Company Radiation Safety Officer. Alpha and/or beta/gamma survey instruments may be assigned to work groups.

- Personnel must wear their assigned personal dosimeters at all times while at the Midnite Mine. Personnel will be trained in proper care of their dosimeters to ensure that the devices do not become contaminated, damaged, or lost and that they are stored properly when not in use (see RPP-SOP7). The Company Radiation Safety Officer will designate storage locations in an area with direct gamma exposure rates that are as close to background as is feasible.

Workers who violate these radiation safety work rules may be subject to disciplinary actions. This applies both to Company employees and contractors.

10.0 PERSONAL PROTECTIVE EQUIPMENT

The Company Site Safety Officer and/or Company Radiation Safety Officer will determine the required personal protective equipment (PPE) for RA construction tasks and/or conditions. As noted in Section 9.0, safety shoes, safety glasses and hard hats are required at the Midnite Mine in any area where heavy equipment, drill rigs, or trucks are operated or in other areas as designated by the Company Radiation Safety Officer, Site Safety Officer or as specified in task-specific SOPs/JSAs. It is anticipated that at a minimum, all work will be performed in Level D personal protective equipment, i.e., work clothes and gloves.

Worker coveralls, PPE and related work clothing will remain on site at all times and will be regularly laundered for subsequent re-issue. Washing facilities will be on site to accomplish this. As practical, used clothing will be surveyed for contamination prior to issue and rewashed if necessary. See also Section 6.0.

11.0 CONTAMINATION CONTROL

As noted in Section 4, personnel and equipment surveys are necessary to prevent the spread of contamination. The contamination limits for release of equipment/materials for uncontrolled use are given in Table 3-1. A description of survey and decontamination methods is provided in RPP-SOP4 and RPP-SOP6. The goal for personnel contamination levels are always background.

12.0 PERSONAL DOSIMETRY PROGRAMS

All employees at the Midnite mine RA (company/contractor) working in controlled areas will be assigned personal monitoring devices to measure and document external radiation exposure using thermoluminescent dosimeters (TLDs) or optically stimulated luminescent dosimeters (OSLs). Additional monitoring, including air sampling, contamination assessments, bioassay etc. to assess potential for internal exposure may be required for specific job functions and/or under unusual circumstances as described elsewhere in this RPP and at the discretion of the Company Radiation Safety Officer.

12.1 Personal Dosimeters (Direct Radiation Exposure Monitoring)

Direct (external) radiation doses are measured using personal dosimeters (TLDS or OSLs) Dosimeters will be worn on the outer clothing between the waist and the neck. Dosimeters are to be stored at a location designated by the Company Radiation Safety Officer when not in use on the Site. Lost dosimeters must be reported immediately to the Company Radiation Safety Officer. The Company Radiation Safety Technician r will issue a replacement badge as soon as practicable. The Company Radiation Safety Officer will calculate the “missed dose” by pro-rating the dose recorded on the replacement badge or extrapolating from measured co-worker doses. Additional detail on the personnel dosimetry program is provided in RPP-SOP7, *External Dosimetry.*

The dosimeters will be obtained from a National Voluntary Laboratory Accreditation Program (NVLAP) certified vendor and exchanged quarterly or as determined by the Company Radiation Safety Officer. Exposure/dose records will be maintained by the Company Radiation Safety Officer and distributed to the monitored individual. The data collected using personal dosimeters will be evaluated periodically to determine if ALARA objectives are being achieved and if additional exposure reduction strategies are warranted.

12.2 Declared Pregnant Workers (DPW) Dosimetry

Based upon recommendations of the National Council on Radiation Protection and Measurements (NCRP, 1998) and on regulatory requirements and recommendations (See section 8.0), controls are established for the protection of the embryo/fetus during a female worker’s pregnancy. These controls ensure minimization of risk to female employees and their unborn child and to protect the rights of the female worker.

A DPW shall not be permitted to enter airborne radioactivity areas or be assigned to tasks that could lead to internal radionuclide intakes without written authorization by the Company Radiation Safety Officer. Any DPW shall be issued a personnel monitoring device (TLD or OSL). Exposures to the DPW and embryo/fetus shall be assessed by the Company Radiation Safety Officer on a monthly basis. Any woman who does not declare her pregnancy shall not be

subject to special controls or treatment with respect to work assignments involving exposure to radiation.

12.3 Bioassay

The bioassay program is described in RPP-SOP3*, Internal Exposure Monitoring*. Baseline urine bioassays will be required for all company employees, contractors and subcontractors prior to working within controlled areas at the site, and an attempt will be mad to obtain a final urine bioassay sample from these personnel upon termination of employment at the site. In addition, at the discretion of the Company Radiation Safety Officer, interim bioassay sampling may be required to evaluate potential intakes of uranium during RA construction activities (see RPP-SOP3 for further details). The bioassay program will follow recommendations in USNRC Regulatory Guide 8.22, *Bioassay at Uranium Mills*). Copies of bioassay results will be provided to subject personnel upon final review by the Radiation Safety Officer.

12.4 Calculation of Total Effective Dose Equivalent (TEDE)

The total effective dose equivalent (TEDE) will be determined annually for all remedial action workers based on personal dosimeter data and potential inhalation intakes from air sample results, and by results from bioassay, as applicable. Results approaching regulatory and/or administrative limits will be investigated to ensure proper implementation of the radiation protection and ALARA program. Detail of the requirements and methods to be used for assessing worker dose is provided in RPP-SOP10, *Dose Calculations*.

13.0 RADIATION WORK PERMIT (RWP)

RWPs will be issued at the discretion of the Company Radiation Safety Officer when unusual or unexpected radiological exposure conditions may exist. RWPs will be necessary at air particulate levels ≥ 10% of the appropriate DAC or higher. RWPs may also be required for activities that, at the discretion of the Company Radiation Safety Officer, could involve employee radiation exposure above background for which no Standard Operating Procedure exists.

14.0 RECORDS

Personnel dosimetry, and results of exposure monitoring and calculations shall be provided to applicable personnel upon request or termination, and the records will be retained by the Company for at least ten years after project termination. Estimates of the Effective Dose Equivalent (EDE) for both external and internal radiation exposure shall be performed and the TEDE (combination of EDE from external and internal exposure) shall be calculated, documented in individual exposure record files and reported (See Section 12.4). Records shall be retained, in either hard copy or electronic format.

15.0 BIBLIOGRAPHY

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U.S. Nuclear Regulatory Commission. Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure. Revision 3, June 1999.

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U.S. Nuclear Regulatory Commission. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. Division of Fuel Cycle Safety and Safeguards. April 1993.

ATTACHMENT A
RADIATION PROTECTION PLAN
STANDARD OPERATING PROCEDURES

RADIATION PROTECTION PLAN STANDARD OPERATING PROCEDURES LIST

Document	Rev.	Title or Description	Effective Date
RPP-SOP1		Responsibilities and Administrative Controls	
RPP-SOP2		Data Quality Control for RPP Survey Instruments	
RPP -SOP3		Internal Exposure Monitoring	
RPP -SOP4		Survey Meter/Contamination Surveys	
RPP -SOP5		Air Sampling	
RPP -SOP6		Decontamination Procedures	
RPP -SOP7		External Dosimetry	
RPP -SOP8		Respiratory Protection	
RPP -SOP9		Access Control	
RPP -SOP10		Dose Calculations	
RPP -SOP11		Training	

MIDNITE MINE RA RADIATION PROTECTION PROGRAM STANDARD OPERATING PROCEDURES	**RPP-SOP01** **REVISION: 2**
RESPONSIBILITIES AND ADMINISTRATIVE CONTROLS	**PAGE: 1 OF 24** **DATE: May 20, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. SITE MANAGER 3
2.2. RADIATION SAFETY TECHNICIAN 4
2.3. REMEDIAL ACTION WORKERSRADIATION WORKERS 5

3. PRECAUTIONS 5

4. EQUIPMENT AND MATERIALS 6

5. PROCEDURE 6

5.1. MINIMUM REQUIREMENTS FOR THE ORGANIZATIONAL FUNCTIONS IMPORTANT TO RADIATION PROTECTION 6
5.2. ALARA AND RELATED AUDITS OF THE RADIATION PROTECTION PROGRAM 7
5.3. WEEKLY RSO/RST INSPECTIONS 8

6. RECORDS 8

6.1. GENERATION AND REVISION OF STANDARD OPERATING PROCEDURES 8

7. REFERENCES AND BIBLIOGRAPHY 9

8. ATTACHMENTS 10

1. PURPOSE

For the purpose of this Standard Operating Procedure the Midnite Mine is assumed to refer to operations at the Midnite Mine that are under the control of DMC/Newmont for the Midnite Mine Superfund Site (Phase I RD/RA). These procedures are not necessarily applicable to any other activities. Procedures may be changed as necessary to address conditions at the Midnite Mine.

This procedure provides guidance regarding the Midnite Mine policy to keep exposures to radiation and to radioactive material As Low As is Reasonably Achievable (ALARA – see also Attachment 1-1), for the performance of radiation protection program audits and reviews, to define the corporate structure of the Midnite Mine RA project as related to radiation protection, for the generation of procedures, notification and reporting requirements, and definitions. This procedure also addresses aspects of the Quality Assurance Program related to maintaining exposures ALARA. Areas of the Quality Assurance Program discussed within this procedure are applicable to the Radiation Protection Program and Environmental Monitoring Program.

The Radiation Protection Program is defined and documented in the Radiation Protection Plan (RPP) and an associated set of Standard Operating Procedures (SOPS) as follows:

RPP-SOP01 Responsibilities and Administrative Controls
RPP-SOP02 Scalar/Detectors
RPP-SOP03 Internal Exposure Monitoring
RPP-SOP04 Survey Meter/Contamination Surveys
RPP-SOP05 Air Sampling
RPP-SOP06 Decontamination
RPP-SOP07 External Dosimetry
RPP-SOP08 Respiratory Protection
RPP-SOP09 Access Control
RPP-SOP10 Dose Calculations
RPP-SOP11 Training

2. RESPONSIBILITY

The functions within the project organization with direct responsibility and authority for execution of the Radiation Protection Program are discussed in this section.

2.1. Site Operations Manager

- Responsible for ensuring that the ALARA Policy is communicated to all employees.
- Responsible for ensuring that Radiation Protection Program policies are implemented.
- Responsible for ensuring that audit recommendations and responses are resolved and completed in a timely fashion.
- Responsible for suspending Phase I RD/RA activities, including any and all Site operations, if necessary, to maintain safe conditions or ensure compliance at Midnite Mine.

- Responsible for approving all Midnite Mine Standard Operating Procedures and Quality Assurance documents to ensure consistency, safety, and overall efficiency of site operations and work flow. Radiation Safety Officer (RSO)
- Responsible for developing the project Radiation Protection Program, radiological training programs and evaluating compliance with radiation protection policies and ALARA principles.
- Responsible for participating in modification/design reviews for facilities and equipment that can affect potential radiation exposures.
- Responsible for developing plans, procedures, and methods for maintaining radiation exposures of Dawn Mining Company personnel, contractors and visitors associated with the Phase I RD/RA activities ALARA.
- Responsible for identifying locations, operations, and conditions that have the potential for causing exposures to radiation above limits.
- Responsible for reviewing, commenting on, and recommending changes in operational procedures to maintain occupational exposures ALARA.
- Responsible for performing and/or reviewing results of audits and approving audit responses and corrective actions as necessary.
- Responsible for overall generation, review, approval, technical verification, and implementation of Midnite Mine Standard Operating Procedures.
- Responsible for reviewing procedures for overall radiological health and safety.
- Responsible for maintaining records related to the Radiation Safety Program including those related to radiological monitoring and assessment of worker radiation exposure
- Suspending any and all Site operations, if necessary, to maintain safe conditions or ensure compliance with requirements of this RPP and applicable regulations.

2.2 The Radiation Safety Officer (RSO) is responsible for:

- Developing the project Radiation Protection Program, radiological training programs and evaluating compliance with radiation protection policies and ALARA principles.
- Participating in modification/design reviews for facilities and equipment that can affect potential radiation exposures.
- Developing plans, procedures, and methods for maintaining radiation exposures of Company personnel, contractors and visitors associated with the Phase I RD/RA activities ALARA.
- Preparing and/or approving Radiation Work Permits on an as needed basis

- Identifying locations, operations, and conditions that have the potential for causing exposures to radiation above limits.

- Reviewing, commenting on, and recommending changes in operational procedures to maintain occupational exposures ALARA.

- Performing and/or reviewing results of audits and approving audit responses and corrective actions as necessary.

- Overall generation, review, approval, technical verification, and implementation of Midnite Mine Standard Operating Procedures.

- Developing procedures for overall radiological health and safety.

- Maintaining records related to the Radiation Safety Program including those related to radiological monitoring and assessment of worker radiation exposure.

- Suspending any and all Site operations, if necessary, to maintain safe conditions or ensure compliance with requirements of this RPP and applicable regulations.

2.2. Radiation Safety Technician

- Responsible for monitoring work in progress for compliance with the RPP, associated SOPs and provisions and the ALARA policy.
- Responsible for conduct of routine radiological surveys including air monitoring, exposure rate and contamination assessments .
- Responsible for informing remedial action workers of potential radiological and non-radiological hazardous conditions.

2.3. Remedial Action Workers

- Responsible for complying with all radiation protection program requirements and safety rules, and applicable, RPP-SOPs.
- Responsible for complying with the project ALARA policy and requirements.
- Responsible for incorporating good ALARA work practices into job functions and work performance.
- Responsible for bringing ALARA concerns to the attention of the Radiation Safety Officer (RSO) and/or the Radiation Safety Technician.
- Responsible for ensuring that work completed is in accordance with Midnite Mine's Quality Assurance Program.

3. PRECAUTIONS

Proper personal protective equipment shall provided by management as required to ensure radiation exposures will be maintained ALARA and will be worn whenever entering a Controlled area. Individuals entering Controlled Areas shall be cognizant of

potential hazards within Controlled Area, and shall review and understand the requirements of RPP-SOPs and all ALARA requirements.

4. EQUIPMENT AND MATERIALS

5. PROCEDURE

5.1. Minimum requirements for the organizational functions important to radiation protection

1. Site Operations Manager
   - 4 years college degree in the arts or sciences or equivalent experience.
   - 4 years of related management experience.
2. Radiation Safety Officer
   - Bachelor's degree in the physical sciences, industrial hygiene, health physics or engineering from an accredited college or university or an equivalent combination of training and relevant experience in radiation protection. Two years of relevant experience are generally considered equivalent to 1 year of academic study.
   - At least 1 year of work experience relevant to radiation protection in uranium facilities in applied health physics, radiation protection, industrial hygiene or similar work. This experience should involve actually working with radiation detection and measurement equipment, not strictly administrative work.
   - The RSO shall receive a minimum of 40 hours of health physics training every 2 years. The training requirement can be fulfilled by attending a single 40 hour class, attending a total of 40 hours of meetings and classes related to radiation protection at uranium or thorium facilities, or teaching 40 hours of radiation protection classes.
3. Radiation Safety Technician
   - At least two years of experience in radiation safety.
   - Minimum of 40 hours of formal radiation safety training.
   - Minimum of 8 hours of refresher training every two years (may be on-the-job training provided by the RSO).
4. Auditor and Inspectors
   - Shall be competent in the area in which they are inspecting (e.g. radiation safety auditors shall have knowledge of such systems.)
5. Facility Staffing
   - Minimum staffing while operations at the Site (as described in 1.0) are being conducted shall be at least one of the following: Site Manager, Plant Manager, Radiation Safety Officer, or Radiation Safety Technician.

5.2. ALARA and Related Audits of the Radiation Protection Program

- This section provides guidance on the conduct of audits. The purpose of the audit is to determine the effectiveness of the Midnite Mine Radiation Protection Program and ALARA principles, to identify any areas of regulatory or procedural noncompliance, administrative requirements, operating and health physics procedures, and general plant safety. Documentation including audit reports, responses, corrective actions and related correspondence shall be maintained in accordance with the Midnite Mine Quality Assurance Plan. All audits shall include the use of checklist that include the item reviewed, the status of compliance, the reason for not being in compliance and recommended corrective actions as applicable.

- ALARA Audits

  An ALARA audit of the radiation safety program shall be performed at least once each calendar year. The ALARA audit shall be led by the RSO, and the audit team should include a representative from Dawn Mining Company management. ALARA audits shall include, at a minimum, a review of the following records.

  .

  - Records of external and internal exposures.

  - Safety meeting minutes, attendance records, and training program records.

  - Any daily or monthly inspection reports required by the radioactive materials licenses.

  - Radiological survey and monitoring data including external exposure rate, air monitoring and contamination survey data, as well as environmental radiological effluent and monitoring data.
  - Reviews of operating and monitoring procedures prepared and/or revised during the period.

  - Bioassay results, including any actions taken when the results exceeded action levels in Table 1 of Regulatory Guide 8.22, “Bioassay at Uranium Mills,” dated January 1987

  - Undesirable trends in personnel exposures for identifiable categories of workers and types of activities.
  - Trends in radiological effluent release data.

  - Performance of exposure monitoring and control equipment, and the utilization, maintenance, and inspection history for such equipment.

  - Summaries of the analytical results of the radiological surveys.

- Any recommendations to further reduce personnel exposures or environmental releases of radioactive material

An ALARA audit report shall be submitted to the Site Manager within 30 days after conducting the audit. Deficiencies identified through the audit will generally be addressed and corrected during the audit to the extent feasible but at least within 14 working days of completion of the audit report.

5.3. Weekly RSO/RST Inspections

The RSO or RST shall complete a documented inspection of all work areas at least weekly. Any deficiency noted during the inspection shall be corrected within 7 working days. The RSO will review and approve inspection reports. A summary of the results of the inspections shall be included in the Annual ALARA Report

6. RECORDS

6.1. Generation and Revision of Standard Operating procedures

This guidance for the generation, revision, review, and approval of procedures will help to ensure that activities affecting quality meet all regulatory requirements, are consistent in format, and are easy to understand. The RSO or QA manager (Site Manager) shall designate an author to develop a draft procedure or revision. All procedures shall be approved by the Site Manager and the RSO Document Identification for Midnite Mine Radiation Protection Procedures are described as follows: Procedures are numbered in the format RPP-SOPXX, where:

RPP	=	Radiation Protection Plan
SOP	=	Standard Operating Procedure
XX	=	Number (i.e. RPP-SOP01)

Cover page (front page) is the review and approval sign-off page for the procedure.

Attachments should be identified as “Attachment XX-YY” where:

XX	=	Procedure number (e.g., 01, 02, etc.)
YY	=	Attachment number (i.e. 01, 02, 03, etc.)

Example: The second attachment to RPP-SOP01 would be labeled as Attachment 1-2.

The format of the procedures should be as follows:

Section	Title
1.0	Purpose
2.0	Responsibility
3.0	Precautions
4.0	Equipment and Materials

5.0 Procedure
6.0 Records
7.0 References
8.0 Attachments

Purpose: Should be described in one or more simple statements.

Responsibility: Individual or group responsibilities should be designated.

Precautions: Identify any precautions necessary to minimize the possibility of injury to personnel or damage of equipment.

Equipment and Materials: Identify or list special tools, equipment or supplies necessary to perform the procedure.

Procedure: List the step-by-step sequence of events necessary to accomplish the purpose of the procedure.

Records: Identify those documents or records which are generated as a result of performing the procedure.

References: List references that were used to develop the procedure.

Attachments: List the attachments to the procedure.

7. REFERENCES AND BIBLIOGRAPHY

Washington Administrative Code

Midnite Mine Quality Assurance Plan and Procedures

ANSI N1.1-1976, “American Nuclear Standard Glossary of Terms in Nuclear Science and Technology”

ANSI N13.1-1969, “Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities”

ANSI N13.15-1985, “American National Standard for Radiation Detectors - Personnel Thermoluminescence Dosimetry Systems - Performance”

ANSI N13.30-1989D, “Performance Criteria for Radiobioassay (Draft)”

ANSI N323-1978, “Radiation Protection Instrumentation Test and Calibration”

ANSI N42.17A-1090, “Radiation Instrumentation - Performance Specifications for Health Physics Instrumentation - Portable Instrumentation for Use in Normal Environmental Conditions”

ANSI Z88.2-1980, “Practices for Respiratory Protection”

NCRP 87-1987, “Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition”

8. ATTACHMENTS

Attachment 1-1 - Midnite Mine ALARA Policy

Attachment 1-2 - Glossary

ATTACHMENT 1-1

MIDNITE MINE
ALARA POLICY

Midnite Mine operations shall be performed in a manner such that exposures to radiation and to radioactive materials are maintained As Low as is Reasonably Achievable (ALARA). social and economic factors taken into account. The basic philosophy of radiation protection is to maintain radiation exposures ALARA and below the regulatory requirements. “Reasonable” means that the costs, benefits, and risks are considered in trying to keep doses ALARA.

The Midnite Mine Radiation Protection Program embraces the ALARA philosophy through its use, to the extent practicable, of procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA. Dawn Mining Company is committed to providing resources, in the form of personnel, training, engineering controls, preparation and planning, design, equipment, monitoring devices, and controls to achieve ALARA doses at its facilities.

Each employee is expected to be knowledgeable of work activities and associated hazards, and to abide by all ALARA requirements such as those found in the project Radiation Protection Plan (RPP) and its associated Standard Operating Procedures (SOPs). In addition to the responsibility for his/her own radiation exposure minimization, each employee is responsible for application of ALARA principles to minimize exposures to other workers and members of the public. Dawn Mining Company encourages your suggestions to incorporate the ALARA policy into work practices.

_____Date_____
Radiation Safety Officer

_____Date_____
Site Manager

ATTACHMENT 1 - 2

GLOSSARY

Absorbed Dose: Energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

Access Control Point: An area established to provide control over the entry to and exit from a Radiologically Controlled Area (RCA).

Activity: Rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the Becquerel (Bq).

Administrative Changes: Administrative changes to documents are defined as editorial corrections (e.g., grammatical, typographical, etc.) or other administrative changes such as personnel title changes, changes in procedure names, or other changes that do not alter the technical or procedural content of a document.

Administrative Controls: The formal procedures or rules established and monitored by Midnite Mine management to ensure safety and controlled operation of the facility in accordance with licenses, regulations, corporate policy, and the ALARA policy.

Administrative Limit: A radiation dose limit established by Midnite Mine management for the purpose of maintaining radiation dose below regulatory limits.

Adult: An individual 18 or more years of age.

Airborne Radioactive Material or Airborne Radioactivity: Any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Airborne Radioactivity Area: A room, enclosure, or area in which airborne radioactive materials exist in concentrations in excess of the Derived Air Concentrations (DAC's) specified in 10 CFR 20 or to such a degree that an individual present in the area without respiratory protection equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the Annual Limit on Intake (ALI) or 12 DAC hours.

ALARA: Means "As Low as is Reasonably Achievable". The basic philosophy of radiation protection is to maintain radiation exposures ALARA below the regulatory requirements. "Reasonable" means the costs, benefits, and risks are considered in trying to keep doses low.

Alpha Particle: A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2.

Annual Limit on Intake (ALI): The derived regulatory limit for the amount of radioactive material that can be taken into the body of an adult worker by inhalation or ingestion in a year. An ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems or a committed dose equivalent of 50 rems to any individual organ or tissue.

Audit: An evaluation of the effectiveness of a program to determine the adequacy of and adherence to established procedures, instructions,

specifications, regulations and standards, and other applicable permitting and licensing requirements.

Atomic Number (Symbol Z): The number of protons in the nucleus of an atom.

Background: Ambient signal response recorded by measurement instruments that is independent of radioactivity contributed by the radionuclide being measured in the person or sample. (ANSI N13.30-1989D)

Background Radiation: Radiation from cosmic sources, unregulated naturally occurring radioactive materials including radon (except as a decay product of source or special nuclear material), and global fallout as it exists in the environment from the testing of nuclear explosive devices. Background radiation does not include radiation from sources of radiation subject to licensing or regulation.

Becquerel (Bq): The term used to describe one disintegration per second.

Beta Particle: Beta particles are emitted by the nucleus of an atom to attain stability. Beta particles are negatively charged, and are emitted from the nucleus of atoms with an excess of neutrons and serve to reduce the number of neutrons in the nucleus. Beta particles have a mass equal to 1/837 that of a proton. Beta particles are easily stopped by a thin sheet of metal or plastic.

Bioassay: Determination of the kind, quantity, or concentration and the location of radioactive material in the human body by direct measurement (in-vivo) or by analysis of materials excreted or removed from the human body (in-vitro). (ANSI N343-1978)

Biological Half-Life: The time required for a biological system, such as a person, to eliminate by natural processes (other than radioactive decay) one-half of any amount of a substance (primary concern is radionuclides) that has entered it.

Breathing Zone: The breathing zone is that region adjacent to a worker's mouth and nostrils from which air is drawn into the lungs while he/she is performing assigned work. (ANSI N13.1-1969)

Breathing Zone Air Sample: Air which is drawn through or into the sample media and is representative of the workers "Breathing Zone."

Calendar Quarter(s): First quarter - January 1 through March 31; Second quarter - April 1 through June 30; Third quarter - July 1 through September 30; Fourth quarter - October 1 through December 31.

Calendar Year: From January 1 through December 31.

Calibrate: To adjust and/or determine:

1. The response or reading of an instrument relative to a series of conventionally true values; or
2. The strength of a radiation source relative to a standard or conventionally true value.
   (ANSI N42.17A-1989)

Check Source: A radioactive source, not necessarily calibrated, that is used to confirm the continuing satisfactory operation of an instrument. (ANSI N323-1978)

Chi-Square Test: A statistical test to determine whether the results of a series of measurements follow the expected statistical distribution. This test determines if fluctuations in measurements are of statistical origin or are possibly caused by a malfunction in some part of the counting system.

Class (Lung Class or Inhalation Class): Classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y. Class D (days) applies to materials with a clearance half-time of less than 10 days, Class W (weeks), for clearance half-times from 10 to 100 days, and Class Y (years) for clearance half-times of greater than 100 days. [The International Commission on Radiological Protection (ICRP) has revised the inhalation classification scheme. The new lung clearance classifications, Fast (F), Moderate (M), and Slow (S) are equivalent to the previous D, W, and Y classifications respectively.]

Clean Shaven: No facial hair between an individual's face and the sealing surface of the respirator and no facial hair interfering with valve function of the respirator.

Committed Dose Equivalent ($H_{T,50}$): Means the dose equivalent to organs or tissues of reference (T) that will be received from the intake of radioactive material by an individual during the 50 year period following the intake.

Committed Effective Dose Equivalent ($H_{E,50}$): The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

Contact Dose Rate: A radiation dose rate as measured with the detector or instrument case within ½ inch of the surface being measured.

Contamination: A radioactive substance dispersed in materials or places where it is undesirable. (ANSI N1.1-1976) Radioactive contamination may be removable (loose) or fixed.

Continuous Air Sampling/Monitoring: A method of sampling used to measure airborne radioactivity levels in routinely occupied areas.

Control Badge: Dosimeters designated for the monitoring of background radiation exposure.

Corrective Action(s): Action(s) taken to improve areas of performance or to eliminate causes of adverse trends in performance identified during Audits.

Count: The numeric reading produced by a device designed to detect ionizing events. In this usage, a "count" refers to the number of detected events registered in a given period of time.

CPM (Counts Per Minute): The rate of ionizing event occurrence recorded by a radiation detection instrument designed to count ionizing events caused by radiation.

Curie (Ci): Means 3.7 E+10 radioactive disintegration's per second (dps). It is a measure of the amount of radioactive material present. One curie equals 37 billion (3.7 E+10) Becquerel.

Counting Efficiency: The net number of counts registered by the detector system per unit of time, divided by the number of disintegration's originating in the radioactive source that is being measured during the same unit of time.

Daughter Product (Decay Product): An isotope formed by the radioactive decay of another isotope.

Declared Pregnant Woman (DPW): A woman who has voluntarily informed Midnite Mine, in writing, of her pregnancy and the estimated date of conception.

Decontamination: Means the process of removing or reducing the level of contamination on an item or individual.

Decontamination Factor (DF): A ratio of the radioactive material existing on a surface prior to decontamination to that remaining after decontamination. The DF is a measure of decontamination effectiveness.

Deep Dose Equivalent (H_d): The dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2). Applies to external whole body exposure.

Derived Air Concentration (DAC): The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2000 hours at 1.2 m^3/hour (light work), results in intake of approximately one ALI.

Derived Air Concentration-hour (DAC-hour): The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours.

Detector: That portion of an instrument system sensitive to and used for the quantification of ionizing radiation. (ANSI N42.17A-1989)

Direct Contamination Survey: This method measures fixed and removable levels of surface contamination. A direct frisk is performed by scanning the survey location using a count rate meter within close proximity (app ½ inch, 1 cm for alpha contamination).

Direct Reading Dosimeter (DRD): A monitoring device consisting of a collection chamber coupled with an optical lens and calibrated scale. DRD's can be used as a device to provide individuals with an immediate estimate of their external gamma radiation exposure. This device is also known as a Self Reading Pocket Dosimeter (SRPD).

Disintegration's Per Minute (DPM): Refers to the number of nuclear transformations occurring per minute.

Document: Any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures or results (procedures are documents, a form generated because of this procedure is a record).

Dose Equivalent: Means the absorbed dose in rads or Gray in tissue multiplied by a quality factor and all other necessary modifying factors to account for the differing degrees of hazard from the various types of radiations (alpha, beta, gamma). The units for dose equivalent are the Sievert (Sv) and rem.

Dose or Radiation Dose: A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as applicable to context.

Dose Rate: The quantity of dose delivered per unit of time.

Dosimeter: Any of several types of devices used to measure radiation dose. Common types include TLD, film, and pocket dosimeters.

Dosimetry Processor: An individual or organization that processes and evaluates individual monitoring equipment in order to determine the radiation dose delivered to the equipment.

Effective Dose Equivalent (EDE): The sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighing factors (w_T) applicable to each of the body organs or tissues that are irradiated.

Embryo/Fetus: The developing human organism from conception until the time of birth.

Estimated Dose: Unofficial dose that is posted to an individual's radiation dose history. Estimated dose is normally based on results obtained from secondary dosimeters or incomplete bioassay information.

Examination: An evaluation device used to determine a trainee's competence in a given area. This is a summative device that is generally administered at the completion of a unit, course or program.

Exposure: Means being exposed to ionizing radiation or to radioactive material.

Exposure (quantitative): A measure of the amount of ionization produced by x or gamma radiation in air (see roentgen).

Exposure rate: Amount of ionization produced by x or gamma radiation in air per unit time.

External Dose: That portion of the dose equivalent received from a source of radiation outside the body.

Extremity: Means hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

Eye (Lens) Dose Equivalent (LDE): Dose equivalent due to external exposure to the lens of the eye. It is taken as the dose equivalent at a tissue depth of 0.3 cm (300 mg/cm^2).

Fixed Contamination: Contamination which is embedded, attached or otherwise not readily removed without surface destructive methods (e.g., grinding, sanding, acid baths).

Frisk: The performance of a direct survey for radioactive contamination.

Frisker: A radiation detection device used to check or "frisk" an individual or items for contamination. May be a hand-held instrument or a permanently mounted device.

Gamma Ray (Gamma Radiation): High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or uranium. Gamma rays are similar to x-rays, but are usually more energetic.

General Area Dose Rate: A radiation dose rate measured at 30 cm or more from a surface.

Half-Life: The time required for a radioactive substance to lose 50% of its activity by decay. Each radionuclide has a unique half-life.

High Radiation Area: Any accessible area where the dose to an individual can exceed 100 mrem in any one (1) hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

In-Vitro Bioassay (indirect): The estimation of radioactivity in the human body based upon:

(1) the measurement of radioactivity in excreta or other materials taken from the body; and,
(2) a biological model for the radionuclide movement in body tissues and organs. (ANSI N343-1978)

Indirect Contamination Survey: The method used to measure removable contamination. Indirect survey techniques are:

a) Smear Surveys - A smear is obtained by using an absorbent filter disk to wipe with moderate pressure across the area or item to be evaluated. A smear is usually wiped over an area of 100 cm^2.

b) Wipe Surveys - A wipe is obtained by wiping an absorbent pad or towel over a large area or the entire surface of the item being surveyed.

Individual Monitoring: The assessment of dose equivalent or committed effective dose equivalent to an individual through the use of commonly employed monitoring methods (e.g., TLD, OSL, bioassay, survey data).

Individual Monitoring Devices: Devices designed to be worn by a single individual for the assessment of dose equivalent. Examples include TLD's, OSLs, self reading pocket dosimeters chambers, and lapel air samplers.

Inspection: Examination or measurement to verify whether an item or activity conforms to specified requirements.

Instrument: A complete system designed to quantify one or more characteristics of ionizing radiation or radioactive material. (ANSI N42.17A-1989)

Intake: The amount of radioactive material taken into the body by inhalation, absorption through the skin, injection, ingestion, or through wounds. (NCRP 87 - 1987)

Intake Retention Fraction: The fraction of the intake that is retained in the body or organ at time (t) following the intake.

Internal Deposition: Radioactive material that has been taken into and deposited in the body through either inhalation, ingestion, absorption through the skin, or through wounds.

Internal Dose: That portion of the dose equivalent received from radioactive material taken into the body.

Isotopes: Nuclides having the same number of protons in their nuclei, but differing in the number of neutrons. Isotopes have the same atomic number and different mass numbers.

Laboratory Standard: An instrument, source, or other system or device calibrated by comparisons with a standard other than that of a U.S. National Standard. (ANSI N42.17A-1989)

Lapel Sampler: A portable battery operated air sample pump that is worn by an individual. The sample medium is connected to the pump via a flexible hose.

Licensed Radioactive Material: Source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the WDOH or NRC.

License: Means the radioactive materials license issued by the WDOH to a facility to possess and/or use radioactive materials. (Note: The Midnite Mine is not operated under a radioactive materials license. However, other permits may be issued to Midnite Mine by other state or federal agencies.

Licensee: The holder of a radioactive materials license.

Limits (Dose Limits): The permissible upper bounds of radiation doses.

Low-Level Radioactive Waste (LLRW): Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. Low-level waste has the same meaning as in the Low-Level Waste Policy Act: that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by product material as defined in Section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste). (WAC 246-249-010)

Man-Hours: The combined number of hours spent performing a task. For the purposes of this procedure, only the hours spent in areas where the workers are exposed to radiation are considered.

Man-Rem: The cumulative radiation dose equivalent received by personnel while performing a job or activity.

Man-Rem Estimate: An estimate of the cumulative dose that will be expended while performing a job or activity, from the start to the finish of that task, based on the expected dose rate in the work area, airborne radioactivity concentrations, the estimated time duration to complete the task, the expected scope of activities, and the historical dose information. The types of activities can also be a factor for calculating a man-rem estimate.

Mass Number (Symbol A): The mass of an atom relative to other atoms. The present basis for the scale of atomic weights is carbon the most common isotope of this element has arbitrarily been assigned an atomic weight of 12. The unit atomic mass is 1/12 the weight of the carbon-12 atom, or roughly the mass of one proton or one neutron. The atomic weight of any element is approximately equal to the total number of protons and neutrons in its nucleus.

Mean Count: The sum of all count values divided by the total number of counts taken. The mean is a statistical measure of central tendency, a value around which groups of counts tend to cluster.

Member of the Public: An individual who does not meet the definition of a worker. A worker is considered a member of the general public when not engaged in work for his or her employer.

Micro: A prefix meaning “one millionth” (1 E-06), as in microcurie.

Milli: A prefix meaning “one thousandth” (1 E-03), as in millirem, millirad, or millicurie.

Minimum Detectable Activity: The smallest activity of a radionuclide in a sample that will be detected with a beta probability of non-detectable (Type II) error while accepting an alpha probability of erroneously detecting that radionuclide in an appropriate blank sample. (Draft ANSI 13.30-1989)

Minor: An individual less than 18 years of age.

Monitoring (Radiation Monitoring): The measurement of radiation levels, concentrations, surface area concentrations, or quantities of radioactive material and the use of the results to evaluate potential exposures and doses.

Nano: A prefix meaning “one billionth” (1 E-09), as in nanocurie.

National Standard: An instrument, source, or other system or device maintained and promulgated by the U.S. National Institute of Standards and Technology (NIST formerly NBS). (ANSI N42.17A-1989)

Non-Radiation Worker: An individual who does not perform work in the controlled area of the Midnite Mine..

Nonstochastic Effect: Means health effects which vary in severity with dose and for which a threshold is believed to exist. Radiation induced cataract formation is an example of a nonstochastic effect.

Nuclide: Any one of the approximately 1800 isotopes of all the elements, whether radioactive or not. See radionuclide and isotope.

Occupational Dose: Means the radiation dose any individual receives in a controlled area (see below) and any other work-related radiation dose the person receives. Does not include medical dose, dose due to background radiation, or dose received while a member of the public.

Occupational Dose Limit: The maximum legally allowable dose to individuals during a specific time period, as defined by 10 CFR 20 and 29 CFR1910.1096.

Optically Stimulated Luminiscent (OSL) Dosimeter: Dosimeter used to measure gamma and beta radiation dose

Organ Burden: The quantity of a radionuclide present in an organ of the human body at a specified time. (ANSI N343-1978)

Overexposure: Means a radiation dose in excess of the allowed regulatory limit.

Particulate: Sometimes used to describe alpha and beta radiations, but most often used to mean dust, droplets, fumes, or mists containing radioactive material.

Pico: A prefix meaning “one trillionth” (1 E-12), as in picocurie.

Personnel Monitoring Equipment (Individual monitoring devices): Devices designed to be worn or carried by a single individual for the assessment of dose equivalent.

Planned Special Exposure: An infrequent exposure to radiation, separate from and in addition to the annual dose limits.

Practical Quantification Limit: (PQL) A level that is 3 to 5 times the detection level of a laboratory analysis (detection level is usually denoted as MDL-Minimum

Detection Level, LLD-Lowest Limit of Detection, or similar terms, or the smallest amount that can be detected above the noise in a procedure and within the stated confidence interval).

Protection Factor (PF): The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the worker. The protection factor is a measure of the degree of protection provided by a respirator to the wearer. (ANSI Z88.2 - 1980)

Protective Clothing: Clothing provided to reduce exposure and prevent the spread of contamination to personnel, clothing, or the body while performing work with radioactive materials.

Public Dose: Dose received by a member of the public from exposure to radiation and radioactive material released by Midnite Mine Site, or to another source of radiation attributable to the operations of the Midnite Mine Water Treatment either within Site controlled area or in uncontrolled areas. Public dose does not include occupational dose or doses received from background radiation, as a patient from medical practices, or voluntary participation in medical research programs.

Qualification: Certification of the fact that an individual possesses the knowledge, capabilities (e.g., physical), characteristics, or abilities gained through experience, training, or on-the-job training and can perform the required task.

Qualified Escort: An individual that meets entry requirements commensurate with the area to be entered.

Qualified Respirator User: An individual who has successfully completed all requirements for the use of a respiratory protection device.

Qualitative Respirator-Fitting Test: A person wearing a respirator is exposed to an irritant smoke, an odorous vapor, or other suitable test agent. If the respirator wearer is unable to detect penetration of the test agent into the respirator, the respirator wearer has achieved a satisfactory fit with the respirator.

Quality Factor (Q): The modifying factor that is used to derive dose equivalent from absorbed dose.

Quality Assurance Samples:

Field Duplicate Samples - samples that have been divided into two or more portions at some step in the measurement process. Each portion is then carried through the remaining steps in the measurement process. An example of a field duplicate sample is a water sample that has been collected and poured into two sets of sample containers.

Equipment Rinsate Samples - samples that are obtained by collecting de-ionized water that has contacted the decontaminated sample collection equipment (e.g. bailer, pump, filter, etc.). These samples are then sent to the laboratory for analysis of the same parameters as the sample taken with the same equipment. These samples will be used to determine if decontamination procedures have been effective. Equipment rinsate samples may also be taken from decontaminated equipment planned for dedicated use, prior to use at the dedicated location.

Field Blank Samples - samples that are collected by pouring de-ionized water directly into the sample container. The blank will be analyzed for the same parameters as the samples that were collected or are associated with that blank.

Matrix Spike Samples - The laboratory will analyze the sample for the analyte being measured in other related samples within the sample delivery group. The laboratory will then add (spike) a known quantity of a specific analyte to the sample and reanalyze the sample for the spiked analyte. The percent recovery of the spiked analyte is determined and matrix interferences are evaluated. A sufficient quantity of sample will be collected to allow the laboratory to spike the sample for each analyte to be analyzed.

Quantitative Respirator-Fitting Test: A person wears a respirator in a test atmosphere containing a test agent in the form of an aerosol, vapor, or gas. Instrumentation samples the test atmosphere and the air inside the respiratory-inlet covering of the respirator and is used to measure quantitatively the penetration of the test agent into the respiratory-inlet covering.

Rad: The special unit of radiation dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray).

Radiation (Ionizing Radiation): Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used within the context of the Radiation Protection Program does not include non-ionizing radiation such as radio or microwaves and visible, infrared, or ultraviolet light.

Radiation Area: Defined as any accessible area where the dose equivalent to an individual could exceed 5 mrem in any one hour at 30 cm from the radiation source or surface that radiation penetrates. The regulations require radiation area posting of all radiation areas.

Radiation Safety Officer (RSO): The health physicist responsible for development and oversight of radiation protection program policies at the Midnite Mine..

Radiation Worker: For the purpose of this SOP, an individual engaged in work at the Site or other activities associated with Phase I RD?RA.

Radioactive Materials Area: Any area or room which is posted for the purpose of protecting individuals against undue risks from exposure to licensed radioactive materials.

Radionuclide: Any one of the radioactive nuclides.

Record: A document that provides evidence of the quality of services performed, demonstrates that actions were performed in accordance with radiation protection procedures, or demonstrates conformance of actions to regulatory requirements.

Reference Man: A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus.

Rem: The special unit for any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 Sievert).

Removable Contamination: A radioactive substance dispersed in materials or placed where it is undesirable. Also known as loose surface contamination. (ANSI N1.1 - 1976)

Respirator: Respiratory protective equipment provided for protection against inhalation of airborne particles. Half-face respirators, full-face respirators, and supplied air respirators are used when appropriate to provide needed protection.

Respirator Sealing Tests: To ensure proper protection, the wearer of a respirator equipped with a face piece shall check the seal of the face piece prior to each entry into a hazardous atmosphere. This may be done using procedures recommended by respirator manufacturers or by negative pressure or positive pressure seal tests.

Response Time: The time interval required for the instrument reading to change from 10% to 90% of the final reading (or vice versa) following a step change in the radiation field (i.e., signal) at the detector.

Controlled Area: Means an area having access controlled by Dawn Mining Company with the intent of preventing or controlling the radiation exposure of individuals. Controlled areas are those areas within the fenced area at Midnite Mine Site that require completion of specific training prior to entry and personal and vehicle surveys on exiting.

Roentgen: Means the special unit of exposure. One roentgen equals 2.58×10^{-4} coulombs/kilogram of air.

Shall: Denotes a requirement.

Shallow Dose Equivalent (SDE): The dose equivalent at a tissue depth of 0.007cm ($7mg/cm^2$), averaged over an area of one square centimeter. It applies to external exposure of the skin of the whole body or of an extremity.

Should: Denotes a guideline - a suggested practice that is not mandatory in programs intended to comply with a standard.

Sievert (Sv): The SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in Sieverts is equal to the absorbed dose in grays multiplied by the quality factor. One Sv equals 100 rem.

Skin of the Whole Body: The skin of the whole body, exclusive of skin of the extremities. (10 CFR 20.101 (a)) (Not defined in WAC 246)

Radiation Work Permit (RWP): A document which specifies the controls required for protection of workers while performing tasks involving radioactive and/or hazardous materials. RWPs require specific training and acknowledgment of content prior to entry into areas covered by the RWP.

Smearable Contamination: Radioactive material which can easily be removed from a surface (e.g. soap and water, light brushing, wiping).

Source Material: Uranium or thorium, or any combination of uranium and thorium in any physical or chemical form; or ores which contain 0.05 percent by weight or more of uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

Stochastic Effects: Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a

linear function of dose without threshold. Hereditary effects and cancer are examples of stochastic effects.

Survey: An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive materials or other sources of radiation. When appropriate, such an evaluation can include a physical survey or calculations of the radiation level, concentrations or quantities of radioactive material present.

Thermoluminescent Dosimeter (TLD): An integrating detector where radiation energy is absorbed (trapped) and can be read out later by thermal excitation of the detector. (ANSI N13.15-1985)

Time Weighted Average (TWA): Refers to the time weighted average concentration for a normal 8 hour workday and a 40 hour work week.

Total Effective Dose Equivalent (TEDE): The sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

Total Organ Dose Equivalent (TODE): The sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose.

Uncontrolled Area: Any area to which access is not limited or controlled for purposes of protection of individuals from exposure to radiation and radioactive materials. The uncontrolled area at the Site includes the area outside the WTP fence with the radiation warning signs.

Uptake: Quantity of a radionuclide taken up by the systematic circulation (e.g., by injection into the blood, by absorption from compartments in the respiratory or gastrointestinal tracts, or by absorption through the skin or through wounds in the skin). (NCRP 87-1987)

Uranium (Natural, Depleted and Enriched):

Natural Uranium: Uranium found in nature. Natural uranium contains 0.7 weight percent U-235, 99.3 weight percent U-238, and a trace of U-234.

Depleted Uranium: Uranium in which the U-235 isotope represents less than 0.7 weight percent of the mass of the material. Depleted uranium is less radioactive than natural uranium.

Enriched Uranium: Uranium in which the U-235 isotope represents greater than 0.7 weight percent of the mass of the material. The alpha emission rate increases from 1.5 E3 dpm per mg at 0.7 weight percent enrichment to 1.4 E5 dpm per mg at 93% enrichment.

Visitor: An escorted individual who enters the Controlled Area and who is not an employee or contractor of Dawn Mining Company at the Midnite Mine.

Week: Seven consecutive days starting on Sunday.

Weighting Factor (w_T): The proportion of risk of stochastic effects resulting from irradiation of the organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly.

Whole Body (WB): Means, for purposes of whole body exposure, the head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Year: The period of time beginning on January 1 that is used to determine compliance with the regulations.

X-Ray: Penetrating electromagnetic radiation having a wavelength much shorter than that of visible light. X-rays are usually produced by a excitation of the electron field around certain nuclei. In nuclear reactions, it is customary to refer to photons originating in the electron field of the atom as X-rays.

MIDNITE MINE RA RADIATION PROTECTION PROGRAM STANDARD OPERATING PROCEDURES	**RPP-SOP02** **REVISION: 2**
LABORATORY SCALER/DETECTOR OPERATION	**PAGE: 1 OF 8** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER (RSO) 3
2.2. RADIATION SAFETY TECHNICIAN (RST) 3
2.3. INSTRUMENT USERS (OTHER THAN THE RST OR RSO) 3

3. PRECAUTIONS 3

3.1. RSO/RCT PRECAUTIONS 3

4. EQUIPMENT 4

5. PROCEDURES 4

5.1. VOLTAGE PLATEAU DETERMINATION 4
5.2. EFFICIENCY DETERMINATION 4
5.3. CHI-SQUARE TESTS 5
5.4. DAILY BACKGROUND COUNT RATE DETERMINATION AND RELIABILITY CHECKS 6
5.5. INSTRUMENT CONTROL CHARTS 6

6. RECORDS 6

7. REFERENCES AND BIBLIOGRAPHY 7

8. ATTACHMENTS 7

1. PURPOSE

This procedure describes the requirements for use of laboratory scaler/detector apparatus for Midnite Mine Site samples. Scalers/detectors are used to support Health Physics activities pertaining to environmental monitoring, surveys, release of material and equipment for unrestricted use, and contamination control.

2. RESPONSIBILITY

2.1. Radiation Safety Officer (RSO)

- Responsible for apparatus oversight and use, and to ensure that all instruments in use are appropriately calibrated.
- Responsible for implementation of the requirements of this procedure.
- Responsible for approving records/documents in accordance with the Midnite Mine Remedial Action Project Quality Assurance Plan.
- Responsible for the training of all users of the counting apparatus.

2.2. Radiation Safety Technician (RST)

- Responsible for using and maintaining calibration of instruments, and generating and maintaining records in accordance with this procedure.
- Responsible for performing routine operational checks, and for notifying the RSO when operational checks fall outside acceptable ranges.

2.3. Instrument Users (other than the RST or RSO)

- Responsible for notifying the RST or the RSO when operational checks fall outside acceptable ranges.
- Responsible for notifying the RST or RSO when elevated sample activity is detected above established limits and/or criteria.

3. PRECAUTIONS

3.1. RSO/RCT Precautions

- Every effort should be taken to prevent contamination of the detector and to maintain a low background reading, especially when potentially high activity samples are counted. When high activity samples are counted, the instrument background shall be checked after use and at the discretion of the RST, and decontamination performed, as required.

- Detectors operate using a high voltage that can be hazardous. No attempt shall be made to perform any repairs on live circuits.

- Calibration, or operability checks, as appropriate, shall be performed when changes may have occurred due to potential damage, relocation of equipment, or repairs.

- Normal radiation protection principles will be followed (time, distance, and shielding) when handling radioactive sources and samples, to keep radiation doses ALARA.

- A warm-up time of at least 10 minutes shall be allowed at initial power-up for detector/electronics stabilization prior to counting/operability checks.

- Sources of radiation (e.g., samples, standards, ambient radon and progeny) within and outside the laboratory may interfere with counting results. Routine instrument background checks are required to ensure awareness of such sources.

4. EQUIPMENT

- Scaler/detector apparatus.

- Radioactive calibration and check sources.

- Manufacturer's operation manual for the instrument being used.

- Specialty gases for operation of the detector, as required.

5. PROCEDURES

5.1. Voltage Plateau Determination

- A voltage plateau determination shall be performed at least annually in accordance with the instrument manufacturer manual to determine the optimum operational voltage setting. Voltage plateaus shall also be performed whenever instrument repairs are performed that may affect operating voltage or when indicated as necessary by source check results.

5.2. Efficiency Determination

- Calibration standards used for instrument calibration checks shall be traceable to the National Institute of Standards and Technology (NIST). Check sources need not be NIST traceable, but should emit radiation of the same type or types as emitted by those sources used in instrument calibration unless:

1) The source geometry is well understood and reproduced; and,

2) The instrument response to the radiation is well understood and is not critically dependent on instrument adjustment.

- Reproducible source to detector geometries shall be established and used for all performance test adjustments. A geometry correction factor may need to be used for calibration of alpha and beta survey instrumentation to account for source to detector geometry. A sample self-absorption correction factor of 0.5 shall be applied to the efficiency for counting alpha particles in air samples taken with fibrous filters or smears when the instrument efficiency is determined using a plated standard. That is, the measured efficiency shall be multiplied by 0.5 to obtain the practical efficiency.

- Efficiency determinations should be performed prior to use, when the detector/scaler is used for counting but at least weekly.

- Efficiency determinations shall be for the types of radiation and geometries to be measured using appropriate NIST calibration standards.

- Background radiation during calibrations checks shall be low, known, and stable and shall be accounted for during calibration checks. Temperature, humidity, and atmospheric pressure readings shall be recorded at the time of calibration, if applicable.

- Instruments that may be malfunctioning, fail response tests, or require calibration shall be tagged out-of-service until repair/calibration is performed.

5.3. Chi-Square Tests

- Chi-square (χ^2) tests shall be performed annually to determine that the equipment is operating correctly. The chi-square test should normally involve the collection of 21 individual counts for each source used.

- Calculate χ^2 as follows:

$$\chi^2 = \frac{\Sigma(x - \bar{x})^2}{\bar{x}}$$

where: x = counts for the sample source or background
o x bar = the average of the counts

- Ensure that the chi-square (χ^2) value indicated is within 2% and 98% probability (values of 9.591 to 34.170 for 21 individual counts). Upon

review, chi-square values below the 9.591 value may be acceptable, but values above the 34.170 value are never acceptable.

An acceptable range will be determined annually for the background and source counts by determining the mean from the 21 counts taken for the Chi-square Test. The acceptable range will be ± 2 standard deviations from the mean.

5.4. Daily Background Count Rate Determination and Reliability Checks

- A background count rate and reliability check using a check source shall be performed daily, prior to use, when the detector/scaler is used for counting.

- Background count rates and source checks shall be graphed on a control chart.

- If the background or source check result exceeds a difference of 2s (2 sigma) from the mean (as shown on the Instrument Control Chart), re-count the background or source, log the results, and enter the new data on the QA control chart.

- Two successive background or source check counts outside the 2s control chart range indicates possible problems with the detector/electronics. Values between ± 2s of the mean net counts generally indicate normal operation of the instrument. Values outside the mean ± 2s will occur with a frequency of less than 5 percent. Values greater than 3s from the mean will occur with a frequency of less than one percent and should be investigated. Two consecutive measurements outside 3s indicate problems with equipment and shall require adjustments and/or repairs as necessary. The scaler shall be removed from service and immediate notification shall be made to the RSO or designee prior to counting any samples.

- Calibrations shall be checked whenever a significant change or repair is made to the measurement system, or when changes are detected as a result of check source measurements.

5.5. Instrument Control Charts

- Control charts shall be maintained to indicate instrument operability and/or malfunction problems on a daily basis when instruments are in use.

6. RECORDS

Records shall be maintained by the RSO documenting the results of the following instrument performance tests:

- Efficiency Determinations

- Chi-Square Tests
- Background Determinations/Reliability Checks
- Control Charts
- Calibration information including Voltage Plateau information, if required.

7. REFERENCES AND BIBLIOGRAPHY

Midnite Mine Remedial Action Quality Assurance Plan

Midnite Mine Remedial Action Project Radiation Protection Plan

ANSI N323-1978, “Radiation Protection Instrumentation, Test and Calibration”

Knoll, G.F., “Radiation Detection and Measurement”, 1978

8. ATTACHMENTS

Attachment 2-1 - Chi Square Calculation

ATTACHMENT 2-1
CHI SQR CALCULATION

Date _____ Source Type _____ Serial No _____

Scaler type _____ Source Strength (4 □□ _____

Serial number _____

Chi sq. - Test is satisfactory if the chi sq. fall between 2 and 98 % probability

number	source count
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	

Efficiency(%) _____

Average	
Std dev (s)	
Chi sq (□□	
2% prob. □	
98% prob. □	

Daily Source Count
Target cpm

+3s	
+2s	
Avg.	
-2s	
-3s	

Checked by: _____

Reviewed by: _____

MIDNITE MINE RA RADIATION PROTECTION PROGRAM STANDARD OPERATING PROCEDURES	**RPP-SOP3** **REVISION: 3**
INTERNAL EXPOSURE MONITORING	**PAGE: 1 OF 10** **DATE: June, 2015**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. COMPANY RADIATION SAFETY OFFICER IS RESPONSIBLE FOR: 3
2.2. COMPANY RADIATION SAFETY TECHNICIAN IS RESPONSIBLE FOR: 3
2.3. ALL EMPLOYEES ARE RESPONSIBLE FOR: 4
2.4. WOMAN OF CHILD BEARING AGE 4

3. PRECAUTIONS 4

4. EQUIPMENT AND MATERIALS 4

5. PROCEDURE 4

5.1. BIOASSAY MONITORING 4
5.2. SPECIFIC INSTRUCTIONS FOR THE BIOASSAY (URINALYSIS) PROGRAM: 5
5.3. EVALUATION OF BIOASSAY RESULTS 6

6. BREATHING ZONE SAMPLES 6

6.1. BREATHING ZONE DEFINITION 6
6.2. BREATHING ZONE SAMPLES 6
6.3. USE OF LAPEL AIR SAMPLING PUMPS TO OBTAIN BZ SAMPLES: 6
6.4. EVALUATION OF BREATHING ZONE AIR SAMPLING RESULTS 7

7. SPECIAL REQUIREMENTS FOR DECLARED PREGNANT WOMEN (DPW) AND THE EMBRYO/FETUS 7

8. DETERMINING THE AMOUNT OF INTAKE 8

8.1. INTAKE CALCULATION 8
8.2. INFORMATION REQUESTED FOR INTAKE 8
8.3. DETERMINING FREQUENCY OF FOLLOW-UP BIOASSAY 8

9. RECORDS 8

9.1. AIR SAMPLING RESULTS 9
9.2. RECORDS OF EVALUATIONS 9

10. REFERENCES AND BIBLIOGRAPHY 9

11. ATTACHMENTS 9

1. PURPOSE

This procedure describes internal monitoring requirements, methods, evaluation criteria, and calculations necessary to determine intakes and doses for workers at the Midnite Mine Site.

2. RESPONSIBILITY

2.1. Company Radiation Safety Officer is responsible for:

- Internal dose assessments based on air sampling and/or bioassay (urinalysis) results.

- Oversight and for ensuring that the air sampling program provides representative samples of the work area, personnel breathing air, and the environment, as applicable, to allow for the identification and evaluation of potential intake of radioactive materials.

  - ♦ Authorizing sampling methods and instrumentation to be used for collection and analysis of samples.

- Implementation of the exposure monitoring program.

- Developing the methodology for performing dose calculations.

- Investigating doses exceeding regulatory limits, including documentation of results of investigations.

- Review and approval of personnel exposure data prior to entering such data into official worker exposure files.

2.2. Company Radiation Safety Technician is responsible for:

- Providing bioassay (urinalysis) kits to workers for collection of routine bioassay samples and special samples as required by the Company Radiation Safety Officer.

- Collecting and submitting samples to the laboratory for analysis.

- Notifying the Company Radiation Safety Officer when the bioassay results are received from the lab.

- Notifying employees and the Company Radiation Safety Officer when a repeat / followup sample is necessary.

- Issuance of breathing zone / lapel samplers to employees as directed by the Company Radiation Safety Officer.

- Informing the Company Radiation Safety Officer when airborne radioactivity levels have increased unexpectedly.

- Collection of breathing zone / lapel samplers and associated air filters at the end of work shifts and in accordance with this procedure.

2.3. All Employees are responsible for:

- Notifying the Company Radiation Safety Officer when medical treatments involving radionuclides have been received.

- Supplying bioassay samples when requested in a timely manner.

- Collecting bioassay samples in accordance with instructions designed to prevent cross contamination and to ensure representativeness of results.

- Using assigned breathing zone / lapel samplers in accordance with instructions provided by the and per this procedure.

2.4. Woman of Child Bearing Age

- Responsible to declare her pregnancy and the estimated date of conception to the Company Radiation Safety Officer in writing if she desires to be considered a "Declared Pregnant Worker" for the purpose of application of radiation protection related limits and/or work restrictions.

3. PRECAUTIONS

Personnel shall ensure that they are externally free of radioactive contamination that could contaminate the sample prior to bioassay sampling.

4. EQUIPMENT AND MATERIALS

- Breathing air sampler
- Lapel sampler
- Filter papers
- Bioassay sampling kit.

5. PROCEDURE

5.1. Bioassay Monitoring

- Baseline urine bioassays will be required for all company employees and contractors or subcontractors prior to working within controlled areas at the site, and an attempt will be made to obtain a final urine bioassay from these personnel upon termination of employment at the site. These samples will be analyzed for total uranium. . General guidance for uranium bioassay programs is provided in USNRC Regulatory Guide 8.22, "Bioassay at Uranium Mills". 1988.

- Because the material to which RA workers will be exposed is ore type materials and/or precipitated sludges exposed to environmental conditions (e.g., oxidation) for many years, it is assumed for the purposes of internal dosimetry that such materials will be relatively insoluble (Solubility Class Y per USNRC 10CFR20 Appendix B).

- At the discretion of the Company Radiation Safety Officer, additional bioassay sampling may be performed if it is suspected that an employee may have received an inhalation exposure of > 10% of the ore dust DAC of 6 E-11 µCi/ml (USNRC 10CFR20, Appendix B) based on air sampling results, accident conditions, equipment failure, personal contamination, or other conditions.

- In the highly unlikely event of several consecutive high bioassay sample results for a given individual (e.g. each > 35 µg/L), an additional urine sample will be tested for indications of excess protein in the urine (albuminuria) along with a recommendation that the individual seek a medical professional for interpretation of the results and any medical advising.

- If respiratory protection equipment is required, bioassay sampling shall be performed to verify the effectiveness of the respirators. Respiratory equipment will be internally swiped to determine if leakage may have occurred (See RPP SOP8 – Respiratory Protection).

5.2. Specific Instructions for the Bioassay (urinalysis) program:

- Urine specimens for analysis of uranium compounds should usually be collected at least 36 hours, but preferably 48 to 96 hours, after the most recent occupancy in any area where there is a potential for exposure to airborne uranium. Normally, this collection will take place on the day following a weekend or time off period when the worker has not had any plant occupancy.

- Specimens should be collected prior to entering or performing any work in controlled areas. Preferably the sample should be collected after the individual has showered at home.

- Sample kits or containers will be provided by the Company Radiation Safety Technician or his designee.

- Bioassay Sample Collection:

  - ♦ Sampling should be performed in accordance with Attachment 3-1 and the sample should be returned to the Company Radiation Safety Technician.

  - ♦ The Company Radiation Safety Technician or his designee shall ensure that the sample bottle is marked with the individual's name and date, and that the container lid is tightly closed and sealed.

- ♦ The samples should then be shipped to the laboratory for analysis and accompanied by a completed Chain of Custody form.

5.3. Evaluation of Bioassay Results

- The Company Radiation Safety Officer or designee shall initiate a Dose Investigation Report (See RPP-SOP10, Attachment 10-1) if there is a positive urinalysis for uranium or if need for an evaluation of a potential unusual internal intake has otherwise been identified.

- The Dose Investigation Report serves as a cover sheet for all supporting information that may be gathered during the evaluation of an internal deposition.

- Final dose assignments (if applicable) shall be made on the Dose Investigation Report. Any assumptions made during the calculation of exposure assignments should be shown on the Internal Dose Evaluation Report or the attachments.

- The employee shall be notified by the Company Radiation Safety Officer of the results of the investigation and the associated dose assessment including implications and risks associated with the exposure.

6. Breathing Zone Samples

6.1. Breathing Zone Definition

- The breathing zone of a worker is taken to mean the air that is representative of the worker's inhaled air, i.e., in vicinity of nose and mouth. Breathing zone air samples (BZ samples) are taken:

    - To estimate personnel exposures to airborne activity associated with specific tasks.
    - To monitor tasks which present the potential to cause airborne activity.
    - When personnel wear respiratory protection devices.
    - During work activities that may cause airborne radioactivity of greater than 10 % of a Derived Air Concentration (DAC).
    - When considerable loose surface activity is expected in an area.

6.2. Breathing Zone Samples

- BZ samples may be collected using a low or high volume air sampler or a lapel air sample, provided they are representative of the breathing zone and sufficient air volume collection can be obtained to identify airborne concentrations > 10% of the DAC.

6.3. Use of Lapel Air Sampling Pumps to obtain BZ Samples:

- Attach the sample head to the worker's collar or chest area with the filter head facing forwards. Instruct the worker to use care not to touch the filter during work.
- Position the sampler head as close to the worker's breathing zone as possible without interfering with his/her ability to safely accomplish the work in progress.
- Secure the pump in a manner that does not interfere with the worker's movement.
- Start pump within a few minutes prior to worker entering the area.
- At the start of an air sample, record flow rate, date and time.
- Stop the pump within 5 to 10 minutes of the worker exiting the area.
- Remove the sample filter(s) from the filter holder(s). Use caution not to cross-contaminate the filter(s). Record the stop time and date.
- Place the filter paper in the appropriate container.
- Analyze the air sample in accordance with RPP-SOP2.

6.4. Evaluation of Breathing Zone Air Sampling Results

- The Company Radiation Safety Officer will be immediately notified in the event of any BZ sampling result in excess of 10% of the DAC for ore dust based on gross alpha counting results.

- The Company Radiation Safety Officer will perform a special dose assessment in the event of any BZ sampling result in excess of 10% of the DAC for ore dust. Respective Dose assignments (if applicable) shall be made on the Dose Investigation Report with any calculations or related assessments attached. Any assumptions made during the calculation of exposure assignments should be shown on the Internal Dose Evaluation Report or the attachments.

- The employee shall be notified by the Company Radiation Safety Officer of the results of the investigation and the associated dose assessment including implications and risks associated with the exposure.

7. Special Requirements for Declared Pregnant Women (DPW) and the Embryo/Fetus

If the DPW has ever had occupational internal exposure at Midnite Mine (positive bioassay results or known intakes), the estimated dose from any residual radionuclide body burden should be calculated.

The amount of occupational exposure, if any, received at other facilities between the dates of conception and declaration based on NRC Forms 4 and 5 (or equivalent) for the DPW should be determined. If the conception date falls in the middle of an exposure period and it cannot be determined how much dose was received before conception, assume that the dose was received at a uniform rate and prorate the dose to the embryo/fetus.

- The remaining dose permitted during the term of pregnancy should then be determined by subtracting the total effective dose equivalent to date from 500 mrem.

- If the dose to the embryo/fetus exceeds or is within 50 mrem of the dose limit at the time the pregnancy is declared, the embryo/fetus may be allowed to receive up to an additional 50 mrem maximum during the remainder of the pregnancy.

8. Determining the Amount of Intake

8.1. Intake Calculation

Intakes shall normally be calculated based upon the results of the air monitoring program, unless in the Company Radiation Safety Officer's judgment, bioassay results are considered more representative of the actual intake. NOTE: Airborne uranium at the Midnite Mine is assumed to be solubility / clearance Class Y (ICRP 30; USNRC Regulatory Guide 8.22 and USNRC NUREG 0874) unless otherwise determined by the Company Radiation Safety Officer. Use of any other solubility / clearance class will be documented by the Company Radiation Safety Officer with justification.

8.2. Information Requested for Intake

The following information regarding the suspected intake shall be collected if possible:

Time of the initial intake (use the actual event time, RWP access time, personnel estimation of time based on recollection of activities, the individual's work schedule, facility operations data, or historical air monitoring data.) When information is insufficient to determine the time of intake, it is acceptable to initially assume that the intake occurred at the mid-point of the time period since the last bioassay measurement.

The amount of time that has passed since the intake.

The inhalation class of the uranium (use Class Y unless the Company Radiation Safety Officer has justified otherwise – see above)

DAC-hours committed to the individual which may then be converted to dose (See RPP-SOP10). DAC-hours are calculated by determining the concentration of radionuclides in the air inhaled by the individual, multiplied by the amount of time, in hours, divided by the DAC in uCi/mL, resulting in DAC-hours. Use RPP-SOP10 to document dose.

8.3. Determining Frequency of Follow-up Bioassay

Follow-up to confirmed positive bioassay results regarding action levels, actions and the frequency and number of subsequent bioassays should be based on the recommendations of USNRC Regulatory Guide 8.22 and NUREG 0874.

9. RECORDS

9.1. Air Sampling Results

Records of air sampling results that have been used to assess intake and of bioassay monitoring shall be maintained by the Company Radiation Safety Officer.

9.2. Records of Evaluations

Records of evaluations, individual dose assessments and assignments and notifications to employees shall be maintained in the dosimetry files by the Company Radiation Safety Officer. When a record pertains to a specific individual, a copy of the record shall be placed into the individual's dosimetry file.

10. REFERENCES AND BIBLIOGRAPHY

U.S. NRC Regulatory Guide 8.11, "Applications of Bioassay for Uranium".

U.S. NRC Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses".

U.S. NRC Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure.

U.S. NRC Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus".

ANSI N13.30-1989 (Draft) "American National Standard for Performance Criteria for Radiobioassay".

NUREG/CR-4884, "Interpretation of Bioassay Measurements".

EPA 520/1-8-020 (Federal Guidance Report No. 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion".

U.S. NRC Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program".

U.S. NRC Regulatory Guide 8.22, "Bioassay at Uranium Mills". 1988

NUREG 0874, "Internal Dosimetry Models for Applications of Bioassay at Uranium Mills"

Midnite Mine Radiation Protection Plan.

Midnite Mine Quality Assurance Plan.

11. ATTACHMENTS

Attachment 3-1 - Bioassay Sample Instructions

ATTACHMENT 3-1
BIOASSAY SAMPLE INSTRUCTIONS

PLEASE FOLLOW THESE INSTRUCTIONS FOR BIOASSAY SAMPLING

1. WRITE YOUR NAME AND SAMPLE DATE WITH PERMANENT MARKER ON THE BOTTLE.

2. BE SURE TO WASH HANDS FIRST, SO AS NOT TO CONTAMINATE BIOASSAY SAMPLES. FILL THE BOTTLE AWAY FROM THE WTP CONTROLLED AREA.

3. FILL BOTTLE TO AT LEAST HALF FULL (250ml).

4. CLOSE THE CONTAINER TIGHTLY.

5. TAPE THE LID ON.

6. AFTER SAMPLE IS COMPLETED, DELIVER SAMPLE TO RADIATION SAFETY TECHNICIAN FOR SHIPMENT.

MIDNITE MINE RA RADIATION PROTECTION PROGRAM STANDARD OPERATING PROCEDURES	**RPP-SOP04** **REVISION: 2**
GENERAL SURVEY METER OPERATIONS AND CONTAMINATION SURVEYS	**PAGE: 1 OF 12** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER 3
2.2. RADIATION SAFETY TECHNICIAN 3
2.3. WORKER RESPONSIBILITIES 4

3. EQUIPMENT AND MATERIALS 4

4. PROCEDURE 4

4.1. GENERAL 4
4.2. ROUTINE SURVEYS 5
4.3. EXPOSURE RATE SURVEYS 6
4.4. CONTAMINATION SURVEYS 6
4.5. EQUIPMENT/VEHICLE SCREENING FOR UNCONTROLLED RELEASE 8
4.6. PORTABLE RADIATION SURVEY INSTRUMENT CALIBRATION: 8

5. PRECAUTIONS 9

5.1. GENERAL PRECAUTIONS 9

6. RECORDS 9

6.1. SURVEY RECORDS 9

7. REFERENCES AND BIBLIOGRAPHY 10

8. ATTACHMENTS 10

1. PURPOSE

This procedure provides the requirements for performance of radiological surveys, including routine exposure rate and contamination surveys, survey techniques, personnel contamination monitoring, unconditional release limits, and instrument calibration requirements.

2. RESPONSIBILITY

2.1. Radiation Safety Officer

Radiation Safety Officer (RSO) is responsible for:

- Oversight, development, and implementation of this procedure.
- Ensuring that radiological surveys provide representative radiological characterizations of work areas to allow for the identification and evaluation and minimization of potential radiological hazards.
- Ensuring that only trained and qualified personnel perform surveys and authorize the unconditional release of material and equipment.
- Communicating with management when non-routine or special surveys will be necessary prior to and/or during radiological related work.
- Authorizing survey methods and instrumentation to be used for surveys of areas, material and equipment.

2.2. Radiation Safety Technician

Radiation Safety Technician is responsible for:

- Informing the RSO when measurements of radiation, contamination or airborne radioactivity levels have are increasing.
- Conducting radiological surveys in accordance with this and related SOPs under the direction of the RSO.
- Verifying operability of selected instrumentation by ensuring that response and calibration checks have been performed prior to the use of selected instrumentation for radiological surveys.
- Preparing and submitting survey documentation to the RSO.
- Document control and record retention in accordance with the Midnite Quality Assurance and Radiation Protection Plans.

- Verifying that sufficient numbers of properly calibrated and operable instruments are available.

2.3. Worker Responsibilities

- Responsible for performing response checks and conducting personal contamination surveys in accordance with this procedure upon exiting controlled areas.

3. EQUIPMENT AND MATERIALS

Applicable survey meters, associated check sources, calibration standards and associated equipment and supplies for conduct of radiological surveys.

4. PROCEDURE

4.1. General

- Radiation surveys shall be performed based upon the radionuclides and types of radiation which workers are anticipated to encounter. For this project, the primary radiological hazards will be associated with external exposure to gamma and x-rays from uranium decay products (e.g. radium 226) and to a lesser degree internal exposure to natural uranium and its decay products associated with contamination and dusts.

- General area exposure rate surveys shall be used to assess the nominal radiation fields, to verify that radiological conditions have not changed, and to establish specific radiological controls for work to be performed.

- Contact exposure rate surveys may be used to locate and identify the maximum radiation levels to which personnel could be exposed as well as localized sources of radioactive materials which present unique radiological hazards.

- Contamination surveys shall be performed to detect and quantify radioactive contaminants known or likely to be present, and to determine whether radioactive material is embedded (fixed) in a surface or is smearable (loose-surface).These will include surveys of personnel prior to exiting controlled areas, surveys of areas to minimize potential for generating airborne radioactivity in dusts and surveys of selected equipment prior to release from controlled areas.

- Qualitative (large area) loose-surface contamination surveys will be performed to ensure that radioactive contamination has not been inadvertently spread.

- Daily, prior to use, all portable radiation detection instruments shall be checked with a source for consistency, and the results recorded on the Source Check Form (Attachment 4-1). The check shall be from at least one point using the same source as used for the reference reading. If readings vary 20% from the reference reading, the meter shall be removed from service, repaired, and re-calibrated as appropriate.

- Prior to each use of an instrument, the following checks shall be completed:
  - Physical Check (is it all there and in one piece);
  - Battery check (in the 'bat OK' section);
  - Background response check;
  - Calibration sticker check.

- The person documenting a survey shall notify the RSO and Supervisor whenever exposure rates greater than 500 uR/hr or alpha contamination levels greater than 1,000 dpm/100cm² are found.

4.2. Routine Surveys

- Surveys shall be conducted at a frequency commensurate with the hazards present and the personnel occupancies in a given area.

- Weekly, monthly or quarterly routine surveys and inspections shall be performed with the frequency based on exposure conditions an potential for conditions to change as determined by the RSO.

- Monthly surveys should be performed within the first full week of the month.

- Quarterly surveys should be performed within the first three weeks of January, April, July, and October, as applicable.

- Routine survey frequencies may be augmented under the direction of the RSO or RST when:

  - Unexpected exposure rates or contamination is found outside of the Controlled Area (e.g., inside vehicles).

  - Unexpected and/or significant increases in radiation levels, contamination levels or airborne radioactivity levels occur.

  - Maintenance activities or changes in work scope occur which may change radiological conditions (i.e., operations that may increase personnel dose rates, loose surface contamination, airborne radioactivity, etc.).

  - Changes to established survey frequencies shall require approval

from the RSO and shall be documented.

4.3. Exposure Rate Surveys

Gamma exposure rate surveys may be taken at the discretion of the RSO to determine the radiation fields present.

- Measure general area gamma exposure rates at waist level and at 30 cm (11.82 inches) or more from a source or the surface of nearby objects. Attachment 4-2 presents a recommended list of survey meters and probes. These make/models are provided as examples. These instruments or ones with similar capabilities and specifications will be used).

- Determine the source of radiation fields, when practical.

  - When necessary, ensure the survey instrument is not shielded by the body by rotating 180 degrees around the point being surveyed.

  - Measure exposure rates at the head, waist and feet level relative to the worker's position to radiation source(s).

  - Measure exposure rates overhead and underfoot where personnel may position themselves during work or inspections.

  - Observe for slight increases in instrument responses.

- Perform contact gamma exposure rate measurements with the detector within ½" of the surface to be surveyed.

- Measure the exposure rates at surfaces where radiation penetrates.

- Obtain an adequate number of measurements to provide a suitable representation of the dose rates over the entire area(s).

- Appropriate radiation surveys shall be performed:

  - In the work area(s) from which personnel have exited with unanticipated or unexpectedly high instrument responses.

  - In areas where equipment configuration changed or dose rates may have changed.

- Document the survey in accordance with Section 6.0.

4.4. Contamination Surveys

In general, routine area contamination surveys will be performed by the RST. Routine personal contamination surveys (scans) may be performed by the worker if he/she has been appropriately trained. All remedial action workers including contractor employees will be instructed in personal contamination survey

procedures during initial worker training and the annual refresher training. The RST will periodically “spot check” and observe workers surveying themselves out of the radiologically controlled area to be sure the surveys are being performed appropriately. Any detection of contamination on personnel or their effects (clothing. e.g.) shall be decontaminated (washed with water and soap if necessary) under the supervision of an RCT or the RSO.

Contamination surveys shall be performed on equipment and materials prior to being released from controlled areas to evaluate fixed and smearable activity over a surface area of 100 cm^2. The loose-surface contamination shall be quantified by wiping (smearing) approximately 100 cm^2 (approximately 16 square inches) of the surface. Wipe surveys will be conducted by the RST or RSO. Where the equipment meets the removable contamination release criteria based on a total contamination measurement, using a pancake probe or alpha survey meter, smears are not necessary.

- Conduct of Personnel Contamination Surveys:

  - Monitoring of personnel as they leave the radiation control areas or enter “clean” areas such as eating areas is necessary to prevent the spread of contamination and to reduce the possibility that individuals will inadvertently ingest radioactive materials. The goal for personal contamination is no activity detectable above background.

  - Contamination surveys will generally be performed with alpha survey meters (See examples in Attachment 4-2) because lower background levels allow easier discernment of contamination above background. However, at the direction of the RPO, beta/gamma surveys may also be conducted.

  - The monitoring will be performed by the individual with assistance and oversight as necessary by the RPO or his/her designee. Training in performing personal contamination surveys will be provided to all permanent employees as part of the employee safety training program and to contractors and temporary workers as required.

  - At the exit from a controlled area, personnel shall scan their feet, hands, and faces using the alpha detector. A minimum of 30 seconds is generally required to adequately survey each individual. Because of its low background count rate and low limits for contamination, personal alpha surveys should depend on audible detection of counts. The process should be used:

    - If residual radioactivity is not present above detectable levels (for specific instrument), the individual may exit the area. If monitoring indicates residual detectable radioactivity above background, the individual shall wash the contaminated area and repeat the radiation survey. If the routine decontamination

procedures and equipment will not remove the contamination, the individual shall contact the RCT or RSO who will consult RPP-SOP06.

- As the predominant radionuclide present at the Midnite Mine RA project is uranium and its decay products. In the interest of the ALARA philosophy, the goal ("limit") for personal contamination should be background. Detectable contamination of persons or their effects should be removed as soon as possible using simple water or water soap or mild detergent washes. If the contamination persists after two washes, contact the RCT or RSO. Do not use abrasive techniques that could damage the skin and provide a route of entry (potential for internal exposure) for the radioactive material.

4.5. Equipment/Vehicle Screening for Uncontrolled Release

- Equipment/vehicles leaving the Controlled Area shall be surveyed using a portable instrument that utilizes a standard pancake G-M probe. If levels greater than 100 counts per minute above background are detected, the vehicle shall be decontaminated (water wash) to levels below 100 counts per minute, or evaluated for loose surface contamination and fixed contamination. Alpha probes may be used at the discretion of the RSO.

- Uncontrolled release surveys shall consist of direct surveys (initially measuring both fixed and removable contamination to assess the gross residual surface contamination of the equipment being monitored. Where the equipment meets the removable contamination release criteria based on a total contamination measurement, using a pancake probe or alpha survey meter, smears are not necessary.

- If an item or material or equipment is determined to meet the uncontrolled release criteria, it shall be segregated in an area outside of the Controlled Area. If a container/area is utilized inside the Controlled Area, controls such as identifying the area with signs or labels must be in place to prevent the material from being re-contaminated, such as contaminated materials being placed in the container/area.

- Surface contamination levels of material to be released for uncontrolled use shall have gross alpha activity of less than 5,000 dpm/100cm^2 (average), 15,000 dpm/100cm^2 (maximum), and 1,000 dpm/100cm^2 (removable), as listed in Table 2 of U.S. NRC Regulatory Guide 8.30.

- Results of uncontrolled release survey(s) for surface contamination shall be documented in accordance with Section 7.0.

4.6. Portable Radiation Survey Instrument Calibration:

- When the instrument is returned from calibration, complete the source check and record the results as reference readings (Attachment 4-1).

- The instrument shall not be used if it is not operating properly or if the source response check differs from the reference reading by more than 20 percent. Instruments that fail the response or the battery check shall be tagged out of service.

- Instrument calibrations shall be performed in accordance with manufacturer's recommendations at intervals not to exceed 12 months or at shorter intervals as recommended by the manufacturer. Calibrations shall be performed using radioactive sources traceable to NIST or equivalent, as practical.

- Survey instruments shall be calibrated after repair, prior to use. However, "repair" does include battery, probe non-functioning accessory (e.g. handle), or cord replacement.

5. PRECAUTIONS

5.1. General Precautions

- Alpha surveys should be performed with the detector within 1/4 inch of the surface that is being monitored.

- Avoid contaminating the survey meter. If the individual performing the survey suspects that his/her hands are contaminated, he/she should handle the survey meter or detector with a paper towel or wipe or place the meter (not detector) in a small plastic bag. Do not handle the survey meter with a gloved hand unless the gloves are known to be clean.

6. RECORDS

6.1. Survey Records

- Surveys shall be documented in writing. The person performing the survey is responsible for the correct and accurate documentation of survey data.

- Surveys should be documented as they are being performed whenever possible in a clear and legible manner using black or blue ink.

- Indicate survey points or sample locations, as applicable, and record the associated measurements. Provide sufficient detail to adequately describe each specific area or item surveyed.

- Survey records shall include the type of survey performed (e.g., routine, weekly, RWP, etc.), name of person who performed the survey, date survey was performed, model number, serial number, and calibration due date for all instruments used to measure radiation levels or radioactive material concentrations, the specific location (area or room), component and equipment surveyed, the RWP number(s) if applicable, the results of survey measurements performed, and any remarks concerning radiological or non-radiological conditions (i.e. the presence of water, safety concerns, etc.) which may affect personnel exposure to radiation or radioactive material, as applicable.

- The person performing the survey shall sign the survey record.

- Routine personnel contamination surveys performed at the exit of controlled areas need only be document on the log used for this purpose located with the survey instrument at the exit location unless unusual evidence of contamination is detected for which the RCT or RSO must be contacted.

7. REFERENCES AND BIBLIOGRAPHY

U.S. NRC Regulatory Guide 8.30, “Health Physics Surveys in Uranium Mills”.

Midnite Mine Radiation Protection Plan.

Midnite Mine Quality Assurance Plan.

Midnite Mine Appendix S-Analytical Support and Verification Plan for Remediation of Surface Materials and Sediments Preliminary Design SOP06.

8. ATTACHMENTS

Attachment 4-1 - Example Source Check Form.

Attachment 4-2 - Recommended Radiological Survey Equipment List.

ATTACHMENT 4-1
SOURCE CHECK FORM

Meter: _____ Serial Number: _____

Calibration Due: _____ Probe Type: _____

Source A: _____ ser. # _____ Initial Reading: _____ + 20%_____ - 20%_____

Source B: _____ ser. # _____ Initial Reading: _____ + 20%_____ - 20% _____

Date	Source A	Source B	Sat./Init.

Date	Source A	Source B	Sat./Init.

MIDNITE MINE RA RADIATION PROTECTION PROGRAM STANDARD OPERATING PROCEDURES	**RPP-SOP05** **REVISION: 2**
AIR SAMPLING	**PAGE: 1 OF 10** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER 3
2.2. RADIATION SAFETY TECHNICIAN 3

3. PRECAUTIONS 4

4. EQUIPMENT AND MATERIALS 4

5. PROCEDURE 4

5.1. GENERAL 4
5.2. GENERAL AREA AIR SAMPLES 5
5.3. BREATHING ZONE (LAPEL) AIR SAMPLES 5
5.4. USE OF LAPEL AIR SAMPLERS: 6
5.5. GENERAL AIR AND ENVIRONMENTAL AIR SAMPLING 6
5.6. ALPHA TRACK RADON MONITORING 6
5.7. AIR SAMPLER CALIBRATION 7
5.8. AIR FLOW CALIBRATOR 8

6. RECORDS 8

7. REFERENCES AND BIBLIOGRAPHY 8

8. ATTACHMENTS 8

1 PURPOSE

This procedure provides the requirements for performance of general area sampling and personnel air sampling in support of Midnite Mine Site operations.

2 RESPONSIBILITY

2.1 Radiation Safety Officer

Radiation Safety Officer (RSO) is responsible for:

- Oversight, development, maintenance, and implementation of this procedure.
- Ensuring that air samples provide representative samples of the work area and personnel breathing air, are representative of potential intake (inhalation) of radioactive materials by workers and airborne releases to the environment to allow for the identification and evaluation of potential radiological hazards.
- Authorizing sampling methods and instrumentation to be used for analysis of samples.

2.2 Radiation Safety Technician

Radiation Safety Technician is responsible for:

- Informing the RSO when airborne radioactivity levels have increased unexpectedly.
- Collection of air samples in accordance with this procedure.
- Preparation and analysis of samples counted on-site.
- Ensuring source checks have been performed prior to the use of instrumentation.
- Preparing and submitting survey documentation to the RSO for approval.
- Submittal of environmental samples to off-site laboratories, as required, using required quality control measures.
- Responsible for document control and record retention in accordance with the Midnite Mine Site Quality Assurance Program Plan (QAPP) and the Radiation Protection Plan (RPP).

3 PRECAUTIONS

N/A

4 EQUIPMENT AND MATERIALS

Air sampling and sample analysis equipment including pumps, filters, scalers and probes, and materials for documenting air sampling activities and results.

5 PROCEDURE

5.1 General

- Samples for airborne radioactivity shall be collected to monitor for and evaluate conditions that may result in potential internal personnel exposures (via inhalation).

- Air samples shall be collected where it is expected that the concentrations of airborne radioactivity may be in excess of background and therefore require monitoring to document potential for internal personnel exposures.

- A grab (e.g. high volume) air sample shall be collected when a significant increase in airborne radioactivity (dust generation, e.g.) is suspected as a result of work activities.

- Air sample collection media shall be appropriate to address the radionuclides present.

- The analysis of air samples (including preliminary field screening) shall be performed in a timely and expeditious manner.

- Air samples should be collected in airflow pathways downwind of sources of airborne radioactive material.

- Collect low or high volume air samples as follows:
    1. Orient the sample head horizontally or downwards to reduce the potential for collection of particles by gravity settling.
    2. Start the sample pump and record the location, time, date and current flow rate.
    3. The quantity of air sampled for general area and breathing zone samples should allow the Lower Limit of Detection (LLD) to be less than approximately 10% of the class Y Derived Air Concentration for ore dust (i.e., 6 E-11 uCi/ml- see 10 CFR 20, Appendix B).
    4. At the completion of the sample collection, remove the sample filter(s) from the filter holder(s). Use caution not to cross-contaminate the filter(s). Record the location, stop time, date, current flow rate (for variable flow samplers), and printed name of the person who collected the sample.

5. Place the filter paper in the appropriate container. Mark the container with the following information: location, start and stop times and dates, start and end flow rates, and initials of the person who collected the sample.
6. Analyze the air sample in accordance with RPP-SOP02.
7. If a general area or job specific air sample indicates airborne radioactivity equal to, or greater than 10% DAC, follow-up with breathing zone and/or additional general area air samples, as applicable, collected to monitor airborne radioactivity concentrations as directed by the RSO.

5.2 General Area Air Samples

- General area air samples are taken to determine airborne concentrations where workers may be present and ensure airborne particulate concentrations to the public are below effluent concentration limits.

- Select sampling locations that are in the general air flow path and representative of conditions where workers are performing their jobs

- Position the sampler approximately 4 to 6 feet above the floor or ground.

- Orient the sampler head horizontally or downwards and 90° to any significant air flow direction.

- Collect a sample using high or low volume air sampling.

5.3 Breathing Zone (Lapel) Air Samples

The breathing zone of a worker is taken to mean the air that is representative of the worker's inhaled air, that is, the area around the nose and mouth..

- Breathing zone air samples are taken:
  - To estimate personnel exposures to airborne activity associated with specific tasks.
  - To monitor tasks which present the potential to cause airborne activity and therefore the potential for intake via inhalation.
  - Anytime personnel are required to wear respiratory protection devices.
  - During work activities that may cause airborne radioactivity of greater than 10% of a Derived Air Concentration (DAC).
  - When loose surface activity is expected to be excessive as determined by the RSO

.

- Position the sampler head as close to the worker's breathing zone as possible without interfering with the work in progress. Typical locations for lapel samplers are on shirt collar or having the sampling head attached to shirt in the chest area.

- Breathing zone air samples may be collected using a low or high volume air sampler or a lapel air sample, provided they are representative of the breathing zone and sufficient air volume collection is feasible.

5.4 Use of Lapel Air Samplers:

1. Attach the sample head to the worker's collar or chest area with the filter head facing horizontally. Instruct the worker to use care not to touch the filter during work.
2. Secure the pump in a manner that does not interfere with the worker's movement.
3. Start pump within a few minutes prior to worker entering the area.
4. At the start of an air sample, record flow rate, date and time.
5. Stop the pump within 5 to 10 minutes of the worker exiting the area.
6. Remove the sample filter(s) from the filter holder(s). Use caution not to cross-contaminate the filter(s). Record the stop time and date.
7. Place the filter paper in the appropriate container.
8. Analyze the air sample in accordance with RPP-SOP02.

5.5 General air and environmental Air Sampling

5.5.1 At the discretion of the RSO, air particulate, radon gas and/or radon progeny samples may need to be collected and analyzed in accordance with Environmental Air Sampling Requirements (Attachment 5-1).

5.5.2 Calibration of equipment shall be performed using radionuclide standards traceable to NIST to the extent practical.

5.5.3 Calibrations of air sample measuring equipment shall be performed at least semi-annually or at the manufacturer's recommended intervals, whichever is more frequent. The dry test meter is calibrated annually. In addition, equipment shall be recalibrated after repairs or whenever it is suspected that it is out of adjustment.

5.5.4 Laboratories performing analysis of environmental air samples shall comply with the requirements of U.S. NRC Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations)-Effluent Streams and the Environment."

5.5.5 The following information shall be recorded for each sample:

- Sample location
- Sample start and end dates
- Start and end flow rate
- Individual who performed sampling

5.6 Alpha track Radon Monitoring

5.6.1 Remove alpha track detector from the protective radon barrier casing in the field.

5.6.2 Record date, location, and detector number.

5.6.3 Allow the detector to remain in the field for the required time period.

5.6.4 Collect sample, place into the protective radon barrier casing, and record collection date, location, and detector number.

5.6.5 Ship samples to vendor for analysis.

5.7 Air Sampler Calibration

(General area high volume and lapel low volume sampling pumps)

5.7.1 Fixed Flow Samplers

5.7.1.1 Attach the air flow calibrator to the air sampler per the operating manual for the calibrator.

5.7.1.2 Record the temperature, pressure, and elevation of the sampler and calibrator.

5.7.1.3 Remove the cover for the air flow regulator and adjust the flow rate on the calibrator to read the flow rate required. Record the flow rates on Attachment 5-2 (Air Sampler Calibration Record).

5.7.1.4 This type of calibration does not allow the sampler to be used at any other flow rate.

5.7.1.5 Mark the air sampler with its flow rate and the calibration due date.

5.7.2 Variable Flow Air Samplers

5.7.2.1 Attach the air flow calibrator to the air sampler per the operating manual for the calibrator.

5.7.2.2 Remove the cover for the air flow regulator and adjust the flow rate on the calibrator to read in the center of the flow rate meter's scale. Adjust the flow rate meter to match the calibrator flow, if possible, at that flow. Lock the flow meter adjusting screw in place. Record the actual and indicated flow rates on Attachment 5-2.

5.7.2.3 Adjust the air sampler regulator to flow rates at approximately five evenly spaced increments of the flow meters range, as read on the air flow calibrator. Record the actual and indicated flow rates on Attachment 5-2.

5.7.2.4 Set the air sampler flow rate at 50 percent of meter range, or the flow that the meter is to be used.

5.7.2.5 Complete Attachment 5-2. Attach a copy of the graph from Attachment 5-2 on the air sampler.

5.8 Air flow calibrator

5.8.1 Air flow calibrator shall be calibrated to a NIST standard or equivalent annually.

6 RECORDS

- All records of air sampling and assessment of radionuclide concentrations in air shall be maintained in accordance with the Midnite Mine Quality Assurance Project Plan (QAPP) and the Radiation Protection Plan (RPP).
- Field notes shall be kept in field log books.
- Radon alpha track detectors and environmental air samples sent to an outside laboratory shall be accompanied by a Chain of Custody form as per the Midnite Mine QAPP.

7 REFERENCES AND BIBLIOGRAPHY

U.S. NRC Regulatory Guide 8.30, “Health Physics Surveys in Uranium Mills”

U.S. NRC Regulatory Guide 8.25, “Air Sampling in the Workplace”

U.S. NRC Regulatory Guide 4.14, “Radiological Effluent and Environmental Monitoring at Uranium Mills”

U.S. NRC Regulatory Guide 4.15, “Quality Assurance for Radiological Monitoring Programs (Normal Operations)-Effluent Streams and the Environment”

Midnite Mine Radiation Protection Plan and Standard Operating Procedures

Midnite Mine Quality Assurance Plan and Procedures

8 ATTACHMENTS

Attachment 5-1 - Midnite Mine Air Sampling Requirements

Attachment 5-2 - Air Sampler Calibration Record

ATTACHMENT 5-1
MIDNITE MINE ENVIRONMENTAL AIR SAMPLING REQUIREMENTS

Radon Gas and Progeny

Environmental

Continuous passive radon gas sampling based on need and at locations to be identified by the RSO (exchanged monthly). These locations may change as work progresses.

Air Particulate

Operational

Continuous general area sampling downwind of Controlled Areas will be conducted during operations when workers are present. Weekly composites will be analyzed monthly. Gross alpha measurements will be conducted per RPP-SOP02. These locations may change as work progresses.

Radon progeny sampling based on need and at work locations detremine by the RSO to monitor potential worker exposure

ATTACHMENT 5-2
AIR SAMPLER CALIBRATION RECORD

Flow Rate (liters per minute)

Actual	Indicated
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Flow Calibrator
Type:_____
Serial #:_____
Cal Due Date:_____

Air Sampler Model Number/Serial Number_____

Date:_____
Cal due date:_____
Performed by:_____

Actual flow
Indicated flow

Atmospheric conditions _____°F
_____in of Hg
and elevation 1760 ft MSL

Comments_____
_____
_____
_____

RSO Review_____

MIDNITE MINE RA **RADIATION PROTECTION PROGRAM** **STANDARD OPERATING PROCEDURES**	**RPP-SOP06** **REVISION: 2**
DECONTAMINATION PROCEDURES	**PAGE: 1 of 9** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER (RSO) 3
2.2. RADIATION SAFETY TECHNICIAN (RST) 3
2.3. REMEDIAL ACTION WORKERS 3

3. PRECAUTIONS 3

3.1. GENERAL PRECAUTIONS 3

4. EQUIPMENT AND MATERIALS 4

5. PROCEDURE 4

5.1. DECONTAMINATION (WASHING) METHODS: 4
5.2. PERSONNEL DECONTAMINATION 5
5.3. CONTAMINATED PERSONAL CLOTHING OR ARTICLES 6
5.4. DECONTAMINATION OF ENVIRONMENTAL SAMPLING EQUIPMENT 7
5.5. DECONTAMINATION OF HEAVY EQUIPMENT AND VEHICLES 7

6. RECORDS 8

6.1. PERSONNEL DECONTAMINATION 8
6.2. ITEMS OR MATERIALS RELEASED FOR UNCONTROLLED USE 8
6.3. EQUIPMENT DECONTAMINATION (NOT FOR OFF-SITE RELEASE) 8

7. REFERENCES AND BIBLIOGRAPHY 8

8. ATTACHMENTS 8

1. PURPOSE

This procedure describes the standard methods for decontamination of personnel and any tools, vehicles and other materials prior to being removed from the controlled area at Midnite Mine. The ultimate selection of decontamination methods is dependent upon As Low as is Reasonably Achievable (ALARA) principles, economic and functional considerations, and waste minimization.

2. RESPONSIBILITY

2.1. Radiation Safety Officer (RSO)

- Responsible for developing and establishing decontamination procedures and ensuring compliance with all applicable regulations and requirements.
- Responsible for oversight of all decontamination activities at the Midnite Mine Remedial Action Project.

2.2. Radiation Safety Technician (RST)

- Responsible for document maintenance and storage.
- Responsible for training remedial action workers regarding this procedure and providing assistance to them as necessary during decontamination activities.

2.3. Remedial Action Workers

- Responsible for following this procedure.
- Responsible for performing surveys in accordance with RPP-SOP04, *Survey Meter / Contamination Surveys.*

3. PRECAUTIONS

3.1. General Precautions

- All instruments shall be properly calibrated in accordance with the requirements of RPP-SOP04, “General Survey Meter Operations”.
- Decontamination methods which generate excessive amounts of waste materials shall be used only after other methods, such as vacuuming, tape presses, sweeping, etc., have been attempted or considered.
- Decontamination should normally proceed from the area of lowest to highest concentration to limit the spread of contamination as much as is practicable.

- ♦ All decontamination activities shall be performed under the health and safety guidance of the RSO.

- ♦ Materials that are to be unconditionally released shall comply with the release limits and be documented in accordance with RPP-SOP04, “General Survey Meter Operations”.

- ♦ Material that cannot be unconditionally released shall be stored at the mine site for eventual disposal.

- ♦ Decontamination solutions to decontaminate should be limited to washing with water, soap and/or a mild detergent only. Use of any other reagents or methods require input from and oversight by the RSO.

- ♦ No decontamination approach shall be used on people that can potential abrade the skin resulting in potential for internalization of the contamination.

- ♦ In the event of severe contamination that cannot be removed without use of more aggressive reagents or methods, external (including) medical assistance may be necessary at they discretion of the RSO.

4. EQUIPMENT AND MATERIALS

- Survey instrumentation (See RPP-SOP4).
- Anti-contamination clothing, including respiratory protection equipment as required.
- Decontamination of equipment and materials, as required.
- Container(s) for waste materials generated due to decontamination activities as required.

5. PROCEDURE

There are a wide variety of surfaces, equipment and areas at Midnite Mine where decontamination may be required in order to reduce contamination levels to meet regulatory release limits or to maintain working levels ALARA. Each type of surface and specific equipment or area may require a variety of decontamination techniques. The selection of the decontamination method should be based upon minimizing the exposure to personnel, the efficiency and cost of the process, and the ALARA issues associated with such process. This procedure provides examples of common methods for decontamination at Midnite Mine.

5.1. Decontamination (Washing) methods:

- Decontamination using water is effective for most contamination likely to be present at the project site. Potentially contaminated water is retained in a sump and passed through the water treatment circuit.

- Vacuum cleaning is effective on dry, porous and non-porous surfaces for the removal of loose surface dust or particles. This technique eliminates the necessity for collection and absorption of liquids. However, all dust must be filtered out of the exhaust, which in turn contaminates the vacuum equipment.

- Decontamination using water can be effective for the control of airborne radioactivity on most surfaces, but can also result in the spread of contamination if care is not taken to control runoff of solutions.

- Detergents are effective on most non-porous surfaces. This technique can be very effective on oily or damp surfaces, but is not effective with porous surfaces.

- Decontamination solvents can be effective on oily surfaces. However, if not carefully controlled, contamination can be easily spread. In addition, a “mixed” hazardous/radioactive waste can be generated.

5.2. Personnel Decontamination

In the unusual circumstances that personal contamination is not easily removed by the worker using simple warm water / soap washing methods and several repeated washings do not reduce the contamination levels to “background”, the RST or RSO must be notified to supervise further decontamination efforts.

- First aid activities shall take priority over personnel decontamination activities.

- The following are general considerations to be observed during personnel decontamination activities:

  - Decontamination of wounds (other than minor cuts or abrasions) shall be performed by medical personnel.

  - The areas of contamination on an individual should be defined through proper monitoring techniques. Special emphasis should be placed on locating any hot spots on the individual.

  - The mildest methods of decontamination should be attempted first, progressing to more harsh methods when necessary. Cleansing methods, from the least to the most harsh are listed below:

    - Flushing with water
    - Soap and warm water
    - Mild abrasive soap, soft brush, and water
    - Detergent

- Use protective clothing (i.e. gloves, etc.) as necessary when decontaminating personnel in order to prevent the spread of contamination.

- Minor wounds (cuts, abrasions, etc.) can be flushed with lukewarm water or a saline solution, after notification of the RSO or designee.

- The RST should attend to contaminated personnel until the decontamination process has been completed or otherwise terminated. After decontamination, individuals should wash hair, hands, and fingernails thoroughly.

- Avoid spreading contamination to non-contaminated areas as much as practical.

- When decontamination activities are completed, instruct the individual to perform a whole body frisk (hands, feet, and clothing). Similar equipment to that which was used for the previous whole body frisk should be used, if available, for subsequent whole body frisking. The RSO must be notified of incidents that require decontamination supervision by the RST and the results of decontamination efforts.

- Perform follow-up surveys in areas where personnel decontamination has been conducted and where contaminated personnel may have spread contamination to non-contaminated areas.

- If an individual cannot be completely decontaminated, the RSO shall be notified and will determine all necessary precautions for the individual.

- The Personnel Decontamination Record (Attachment 6-1) shall be maintained along with other records that may have been generated to document any unusual decontamination events.

- At the discretion of the RSO, the RST will collect a bioassay sample from the contaminated individual in accordance with RPP-SOP03.

5.3. Contaminated Personal Clothing or Articles

- Work clothing (coveralls, etc.) will remain on site and be laundered for subsequent re-issue. However, other personal articles found to be contaminated with radioactive material above background shall be retained.

- Decontamination of personal articles may be performed by the individual under the direction of the RST in accordance with this procedure.

- Personal clothing or items may be released when surveys indicate that radioactive material is indistinguishable from background.

- Cautionary note: Radon decay products may adhere to clothing, particularly fleece materials, and give a false positive reading on scanning out. The article of clothing may be placed in a plastic bag and retained for several hours. If radon decay products are the cause of the elevated reading, the readings should return to background within about four hours.

5.4. Decontamination of Environmental Sampling Equipment

- Physically remove any gross contamination by scraping or wiping it off, if practical. Always proceed from the area with the least contamination to the area with the highest contamination. Rinse water is discharged at the sampling site or decontamination area. Cleaning materials shall be surveyed for contamination using the appropriate survey meter (e.g., alpha survey meter or alpha/beta/gamma GM pancake probe or equivalent) and released or, if necessary, decontaminated.

- For equipment that will not be damaged by moisture, remove any remaining contamination with a brush and distilled or de-ionized water solution containing alconox detergent, or equivalent.

- Equipment that may be damaged by water should be wiped clean using clean towels and detergent water (alconox or equivalent) or using a spray bottle with a towel moistened with distilled or de-ionized water.

    - **CAUTION: Use care to ensure that equipment is not damaged.**

- Place the equipment in a clean location or use appropriate controls to ensure it will not be contaminated while drying.

- Allow equipment to air dry, if practical, or dry with a clean, lint-free towel.

5.5. Decontamination of Heavy Equipment and Vehicles

- If necessary, trucks may be decontaminated in the truck shed. Water used for decontamination must be contained in the truck shed sump and re-routed through the water treatment plant circuit.

- Personnel performing decontamination shall wear appropriate safety equipment and clothing including hand, eye, foot, hearing, and body protection, as applicable to the job, particularly when using high pressure water sprays.

- Equipment with gross contamination should be scraped off with a flat bladed scraper at the sampling or construction site. Material removed shall remain at the site or decontamination area.

- Equipment such as drill rigs, auger, drill bits, and shovels should be sprayed with water (high pressure when required) then rinsed with clean water. Care should be taken to adequately clean hard to reach places on complicated pieces of machinery.

- After cleaning and sufficient drying of equipment has been completed, perform surveys to ensure that the equipment meets the criteria for additional use or release from the controlled area, as applicable.

- Perform additional decontamination as necessary until the appropriate release criteria are met (See RPP Section 3.3 and RPP-SOP4).

- Move materials to a clean area or establish controls to ensure that the equipment will remain clean for future use.

6. RECORDS

6.1. Personnel Decontamination

Records of personnel contamination (attachment 6-1) shall be maintained in accordance with the Midnite Mine Quality Assurance Project Plan and the Radiation Protection Plan.

6.2. Items or Materials Released for Uncontrolled Use

Records of items or materials that are released for uncontrolled use shall be maintained in accordance with the Midnite Mine Quality Assurance Project Plan, the Radiation Protection Plan and RPP-SOP04. Include initial and final levels of contamination and decontamination methods used, and record on the survey form.

6.3. Equipment Decontamination (not for off-site release)

Records of equipment decontamination for items and materials not to be released from the controlled area shall be maintained in field logs and on the survey form (RPP-SOP04)

7. REFERENCES AND BIBLIOGRAPHY

Midnite Mine Quality Assurance Project Plan and Procedures

Midnite Mine Radiation Protection Plan and Procedures

8. ATTACHMENTS

Attachment 6-1, “Personnel Decontamination Record”

ATTACHMENT 6-1
PERSONNEL DECONTAMINATION RECORD

Name:_____ SSN: last four digits_____

Description of Occurrence:
_____
_____
_____

Location DPM/Frisk

Instrument Data:

Type:_____
Serial #:_____
Cal. Due Date:_____

Type:_____
Serial #:_____
Cal. Due Date:_____

Type:_____
Serial #:_____
Cal. Due Date:_____

Mark areas contaminated on the drawings above and the levels found (in DPM/Frisk).

Decontamination Method(s) Used / Final Survey Results:
_____
_____
_

Dose
Assessment:_____
_____
Individual Signature/Date:_____
RSTSig_____Date:_____RSOSig./_____Date_____
__
Bioassay required _____yes _____no

MIDNITE MINE RA **RADIATION PROTECTION PROGRAM** **STANDARD OPERATING PROCEDURES**	**RPP-SOP07** **REVISION: 2**
EXTERNAL DOSIMETRY	**PAGE: 1 OF 15** **DATE: May, 2014**

Table of Contents

1.0 PURPOSE **3**

2.0 RESPONSIBILITY **3**

2.1. RADIATION SAFETY OFFICER (RSO) 3
2.2. RADIATION SAFETY TECHNICIAN 3
2.3. ALL EMPLOYEES 3

3.0 PRECAUTIONS **4**

4.0 EQUIPMENT AND MATERIALS **4**

5.0 PROCEDURE **4**

5.1. GENERAL REQUIREMENTS FOR EXTERNAL DOSIMETRY ISSUANCE 4
5.2. INITIAL DOSIMETRY BADGE ISSUE 5
5.3. DOSIMETRY CHANGE OUT 5
5.4. TERMINATION/DEACTIVATION OF EMPLOYEES 6
5.5. EMPLOYEE DOSE RECORDS 7
5.6. LOST AND DAMAGED BADGES 7

6.0 RECORDS **7**

7.0 REFERENCES AND BIBLIOGRAPHY **8**

8.0 ATTACHMENTS **8**

1.0 PURPOSE

This procedure provides instructions for the routine issuing and use of radiation dosimetry devices, establishing and maintaining associated dose records, routine primary dosimetry exchange, and final termination of dosimetry. Regulatory and administrative exposure limits applicable to workers at the Midnite Mine RA project are presented in the project's Radiation Protection Plan Section 3.1.

2.0 RESPONSIBILITY

2.1. Radiation Safety Officer (RSO)

- Responsible for oversight of the Radiation Protection Program with respect to dose limits.
- Responsible for ensuring appropriate use of dosimetry.
- Responsible for providing the methodology for performing dose calculations including calculation of a "missed dose" when a dosimeter is lost or damaged.
- Responsible for review and approval of radiation exposure and dose data.
- Responsible for investigating if regulatory and/or administrative limits are exceeded, including documentation of such results.
- Responsible for required notifications and reports to workers and regulatory agencies.
- Responsible for maintaining dosimetry records.
- Responsible for ensuring that workers are restricted from activities that could result in additional exposure when administrative limits are exceeded.

2.2. Radiation Safety Technician

- Responsible for routine issue and change out of Personnel Dosimetry Devices.
- Responsible for reporting and replacing lost badges.
- Responsible for maintaining an appropriate inventory of dosimetry devices from the vendor.

2.3. All Employees

- Responsible for notifying the RSO when their physician has prescribed radionuclides for treatment or diagnostic purposes.
- Responsible for wearing assigned dosimetry in proper locations as required.
- Responsible for storing assigned monitoring devices in designated storage areas when not in use.
- Responsible for reporting off-scale, lost, damaged dosimetry, or unusual dosimetry readings to the RSO.

3.0 PRECAUTIONS

- Current year dose must be documented on a NRC Form 5 (See Attachment 7-1) or equivalent. This is a common form used to document exposure even if the project is not directly under NRC jurisdiction, but an equivalent alternative can be used. Documentation shall be a written signed statement from the individual, or from the individual's most recent employer. In addition, an attempt shall be made to document lifetime dose; however, a dosimeter (TLD or OSL) may be issued while awaiting lifetime dose history information requested from previous employers.
- Dosimetry devices should be adequately protected from physical abuse and harsh environments. Dosimeter holders shall not be tampered with or opened except by authorized personnel.
- Personnel radiation exposure records shall be protected from disclosure to individuals or organizations outside of Dawn Mining Company, without the written authorization of the individual. The exceptions are regulatory agencies for auditing purposes.
- Access to personnel radiation exposure history files shall be limited to health physics staff. Access by all other personnel requires specific authorization by the RSO and shall be granted only for legitimate business needs.

4.0 EQUIPMENT AND MATERIALS

- Dosimeters
  - Thermoluminescent Dosimeters (TLDs) or
  - Optically Stimulated Luminescent (OSL) dosimeters
- NRC Form 5 or equivalent (Attachment 7-1).

5.0 PROCEDURE

5.1. General Requirements for External Dosimetry Issuance

- Any individual who works at the Site for more than one week per year as a regular employee or contractor shall be subject to personal dosimetry using either a TLD or OSL dosimeters.
- The personal dosimetry badge shall be:
  - Capable of measuring the Deep Dose Equivalent (DDE) at a tissue depth of one centimeter.
  - Capable of measuring the Lens Dose Equivalent (LDE) at a tissue depth of 0.3 centimeter.
  - Capable of measuring the Shallow Dose Equivalent (SDE) at a tissue depth of 0.007 centimeter.
- External exposure monitoring is required for visitors to the Midnite Mine. Personal dosimeters will be issued and visitor training conducted by the RSO. Midnite Mine employees or contractors working anywhere on the mine site for periods greater than one week per year will be issued TLD or OSL badges and will be trained in accordance with the requirements of the Radiation Protection Plan Section 2.4 and RPP SOP 11.

- The purpose of the personnel dosimeter (TLD or OSL badge) is to determine the accumulated dose of the individual over a period of time for official dose records. All personnel dosimeters shall be processed at least quarterly. Dosimeters may be read more often at the discretion of the RSO.
- Personnel monitoring equipment shall be placed as follows:
- At the location on the body expected to be represented of whole body exposure, typically on the upper torso.
- Exposure conditions at the Midnite Mine RA project are expected to involve relatively uniform whole body dose (DDE), the dosimeter shall be worn on the front of the body between the neck and waist.

5.2. Initial Dosimetry Badge Issue

- The RSO will make arrangements thru an approved and accredited dosimeter service (e.g., by NVLAP) to establish a standing order of quarterly dosimeters assigned by name to all full time project employees including extra unassigned dosimeters (for new employees until added to dosimetry roster, for visitors, etc.).
- The RSO will inspect new dosimeters when received to ensure they have all filters and windows in place, and that shows no apparent signs of external damage.
- If not already done so by the vendor, label the dosimeter with the individual's name or identification number. Record assignments on the Dosimeter Issue Form (See Attachment 7-2) so there is a permanent record linking specific dosimeters and individuals and date of issuance.
- Ensure that the individual is trained in accordance with RPP-SOP11 (Training).
- Return the transit dosimeter to the vendor as soon as possible following receipt of each new shipment.
- Maintain the control dosimeter in a low background area.

5.3. Dosimetry Change out

- Badge Change out
  - Ensure each dosimeter to be used during the next exposure period shows no sign of external damage, such as missing filters or windows.
  - If a dosimeter is damaged, assign another badge and remove the damaged badge from service.
  - Exchange each current dosimeter in the badge rack with the corresponding replacement badge.(See Dosimeter Exchange Form Attachment 7-3).
  - If dosimeter is not in the dosimeter racks, indicating that the old dosimeter may be in use, **<u>do not</u>** place new dosimeter in the badge rack. New badges should be maintained in the possession

of the RSO/RST until the old badges are returned by the user and accounted for.

- Ensure the names and dosimeter numbers match for each badge exchanged.
- Exchange control dosimeter and dosimeters assigned for purposes other than personnel monitoring as applicable (e.g., environmental and area monitoring badges).
- Assemble all old dosimeters and inventory them against the report of current dosimeter assignments and prepare a list of missing badges.
- Attempt to recover the missing dosimeters by performing the following:
    1. Review the exposure investigation reports to account for any dosimeters that might have been lost during the past issue period.
    2. Contact any individual who did not have his dosimeters exchanged during the normal change out and attempt to retrieve the badge.

- Shipping Dosimetry to the Vendor
    - After the routine badge exchange is complete, collect all badges issued to personnel during the prior monitoring period, all unissued badges, all badges removed from service, and all badges issued other than to personnel.
    - Badges shall be surveyed for contamination by the RSO or his designee prior to being packaged for shipment to the vendor and documented accordingly. Contaminated badges shall be reported to the RSO and an attempt made to remove the radioactive contamination.

5.4. Termination/Deactivation of Employees

- The RST should be informed of an employee or contractor termination so that the dosimeter may be collected and appropriate termination bioassay samples obtained if applicable.
- For employees the termination date is the actual last day of employment. For contract personnel, the termination date is the last day the individual was on site. If the last day on site is not known, use the best information available, but the termination date should not be later than the last day the badge was actually available to the individual for use.
- End the exposure period as of the termination date.
- Ensure the individual's badge is read and the dose record is updated on NRC Form 5 or equivalent (see Attachment 7-1).
- If requested by the individual at the time of termination, prepare a preliminary dosimetry report.
- The final dose report shall be signed by the RSO.

- Give a copy of the report to the individual and place the original in the individual's exposure history file.

5.5. Employee Dose Records

- Dosimeter issue forms shall have the name, unique ID number, badge number, date of issuance, date of return, initial and final readings, and other pertinent information as applicable.
- Use NRC Form 5 or equivalent, Annual Exposure Report (Attachment 7-1) for worker exposures > 100 mrem/yr.
- Records of dose to the embryo/fetus shall be maintained with the records of the declared pregnant woman.
- Records of all personnel exposure investigations, including lost badge investigations (Attachment 7-3), shall be maintained in the individual's dosimetry file.
- Documentation of lost dosimeters shall be maintained in the dosimetry files with a copy in the individual's personal dosimetry file.
- Dose records for visitors to the site will be maintained.

5.6. Lost and Damaged badges

- In the event that a badge is lost after it has been used at the Midnite Mine, the dose received shall be estimated as described in the Missing Dosimetry Badge Form (Attachment 7-4) or other method approved by the RSO. Other methods may include but are not limited to the following:
  - ♦ Measured average exposure rate multiplied by time in area.
  - ♦ Exposure that other people doing similar work have received.
- All exposure estimates shall be recorded and maintained in the individual's dosimetry file.

6.0 RECORDS

All records shall be maintained in accordance with the Midnite Mine QAPP and Radiation Protection Plan.

The RST shall retain the following records:

- The current NVLAP certification shall be maintained on file for the external radiation dosimetry processor.
- Dosimetry Issuance, exchange and Missing Dosimeter Forms (Attachments 7-2 thru 7-4)).

Dosimetry records shall be maintained for a period of at least 10 years after the project has been completed.

The dose to the embryo/fetus shall be retained with the exposure history records of the declared pregnant woman.

7.0 REFERENCES AND BIBLIOGRAPHY

Midnite Mine Quality Assurance Plan and Procedures.

Midnite Mine Radiation Protection Plan.

U.S. NRC Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data".

U.S. NRC Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure".

U.S. NRC Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure".

U.S. NRC Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses".

U.S. NRC Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus".

NCRP Report No. 91, “Recommendations on Limits for Exposure to Ionizing Radiation”.

8.0 ATTACHMENTS

Attachment 7-1, NRC Form 5

Attachment 7-2, Dosimetry Issue Form

Attachment 7-3, Personal Dosimeter Exchange Form

Attachment 7-4, Missing Dosimetry Badge Form

ATTACHMENT 7-1

PAGE _____ OF _____

NRC FORM 5
(1-2008)
10 CFR PART 20

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO.3150-0006 **EXPIRES: 11/30/2010**

Estimated burden per response to comply with this mandatory collection request: 20 minutes. This information is used to ensure that doses to individual do not exceed regulatory limits. This information is required to record/annually report individual occupational exposure to radiation to ensure that the exposure does not exceed regulatory limits. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0006), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

OCCUPATIONAL DOSE RECORD FOR A MONITORING PERIOD

1. NAME (LAST, FIRST, MIDDLE INITIAL)	2. IDENTIFICATION NUMBER	3. ID TYPE	4. SEX ☐ MALE ☐ FEMALE	5. DATE OF BIRTH (MM/DD/YYYY)

6. MONITORING PERIOD (MM/DD/YYYY - MM/DD/YYYY)	7. LICENSEE NAME	8. LICENSE NUMBER(S)	9A. ☐ RECORD ☐ ESTIMATE	9B. ☐ ROUTINE ☐ PSE

INTAKES

10A. RADIONUCLIDE	10B. CLASS	10C. MODE	10D. INTAKE IN μCi

DOSES (in rem)

DEEP DOSE EQUIVALENT	(DDE)	11.
LENS (EYE) DOSE EQUIVALENT	(LDE)	12.
SHALLOW DOSE EQUIVALENT, WHOLE BODY	(SDE,WB)	13.
SHALLOW DOSE EQUIVALENT, MAX EXTREMITY	(SDE,ME)	14.
COMMITTED EFFECTIVE DOSE EQUIVALENT	(CEDE)	15.
COMMITTED DOSE EQUIVALENT, MAXIMALLY EXPOSED ORGAN	(CDE)	16.
TOTAL EFFECTIVE DOSE EQUIVALENT (ADD BLOCKS 11 AND 15)	**(TEDE)**	17.
TOTAL ORGAN DOSE EQUIVALENT MAX ORGAN (ADD BLOCKS 11 AND 16)	**(TODE)**	18.

19. COMMENTS

20. SIGNATURE - LICENSEE	21. DATE PREPARED

NRC FORM 5 (1-2010) PRINTED ON RECYCLED PAPER

INSTRUCTIONS AND ADDITIONAL INFORMATION PERTINENT TO THE COMPLETION OF NRC FORM 5

(All doses should be stated in rems)

1. Type or print the full name of the monitored individual in the order of last name (include "Jr," "Sr," "III," etc.), first name, middle initial (if applicable).

2. Enter the individual's identification number, including punctuation. This number should be the 9-digit social security number if at all possible. If the individual has no social security number, enter the number from another official identification such as a passport or work permit.

3. Enter the code for the type of identification used as shown below:

CODE	ID TYPE
SSN	U.S. Social Security Number
PPN	Passport Number
CSI	Canadian Social Insurance Number
WPN	Work Permit Number
PADS	PADS Identification Number
OTH	Other

4. Check the box that denotes the sex of the individual being monitored.

5. Enter the date of birth of the individual being monitored in the format MM/DD/YYYY.

6. Enter the monitoring period for which this report is filed. The format should be MM/DD/YYYY - MM/DD/YYYY.

7. Enter the name of the licensee.

8. Enter the NRC license number or numbers.

9A. Place an "X" in Record, Estimate, or No Record. Choose "Record" if the dose data listed represent a final determination of the dose received to the best of the licensee's knowledge. Choose "Estimate" only if the listed dose data are preliminary and will be superseded by a final determination resulting in a subsequent report. An example of such an instance would be dose data based on self-reading dosimeter results and the licensee intends to assign the record dose on the basis of TLD results that are not yet available.

9B. Place an "X" in either Routine or PSE. Choose "Routine" if the data represent the results of monitoring for routine exposures. Choose "PSE" if the listed dose data represents the results of monitoring of planned special exposures received during the monitoring period. If more than one PSE was received in a single year, the licensee should sum them and report the total of all PSEs.

10A. Enter the symbol for each radionuclide that resulted in an internal exposure recorded for the individual, using the format "Xx-###x," for instance, Cs-137 or Tc-99m.

10B. Enter the lung clearance class as listed in Appendix B to 10 CFR Part 20.1001-2401 (D, W, Y, V, or O for other) for all intakes by inhalation.

10C. Enter the mode of intake. For inhalation, enter "H." For absorption through the skin, enter "B." For oral ingestion, enter "G." For injection, enter "J."

10D. Enter the intake of each radionuclide in μCi.

11. Enter the deep dose equivalent (DDE) to the whole body.

12. Enter the eye dose equivalent (LDE) recorded for the lens of the eye.

13. Enter the shallow dose equivalent recorded for the skin of the whole body (SDE,WB).

14. Enter the shallow dose equivalent recorded for the skin of the extremity receiving the maximum dose (SDE,ME).

15. Enter the committed effective dose equivalent (CEDE).

16. Enter the committed dose equivalent (CDE) recorded for the maximally exposed organ.

17. Enter the total effective dose equivalent (TEDE). The TEDE is the sum of items 11 and 15.

18. Enter the total organ dose equivalent (TODE) for the maximally exposed organ. The TODE is the sum of items 11 and 16.

19. COMMENTS.
In the space provided, enter additional information that might be needed to determine compliance with limits. An example might be to enter the note that the SDE,ME was the result of exposure from a discrete hot particle. Another possibility would be to indicate that an overexposed report has been sent to NRC in reference to the exposure report.

20. Signature of the person designated to represent the licensee.

21. Enter the date this form was prepared.

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by Section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the U.S. Nuclear Regulatory Commission (NRC) on NRC Form 5. This information is maintained in a system of records designated as NRC-27 and described at 71 Federal Register 59634 (October 10, 2006), or the most recent Federal Register publication of the NRC's Systems of Records Notices that is located in NRC's Agencywide Documents Access and Management System (ADAMS).

1. **AUTHORITY:** 5 U.S.C. 7902; 29 U.S.C. 668; 42 U.S.C. 2051, 2073, 2093, 2095, 2111, 2133, 2134, and 2201(o); 10 CFR 20.2106, 20.2201-20.2204, and 20.2206; Executive Order (E.O.) 9397; E.O. 12196, as amended by E.O.s 12223, 12608; E.O. 12258; E.O. 12399; E.O. 12489; E.O. 12534; E.O. 12610; E.O. 12692.

2. **PRINCIPAL PURPOSE(S):** The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon your request.

3. **ROUTINE USE(S):** The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals monitored for radiation exposure while employed by or visiting or temporarily assigned to certain NRC licensed facilities; to return data provided by licensee upon request. Information may be disclosed in accordance with any of the Routine Uses listed in the Prefatory Statement of General Routine Uses, including to an appropriate Federal, State, local or Foreign agency in the event the information indicates a violation or potential violation of law; in the course of an administrative or judicial proceeding; to an appropriate Federal, State, local and foreign agency to the extent relevant and necessary for an NRC decision about you or to the extent relevant and necessary for that agency's decision about you; in the course of discovery under a protective order issued by a court of competent jurisdiction, and in presenting evidence; to a Congressional office to respond to their inquiry made at your request; to NRC-paid experts, consultants, and others under contract with the NRC, on a need-to-know basis; or to appropriate persons and entities for purposes of response and remedial efforts in the event of a suspected or confirmed breach of data from this system of records.

4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** It is voluntary that you furnish the requested information, including the Social Security number (SSN) in block #2. The SSN is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birth dates among the large number of persons on who data is maintained. The licensee must complete NRC Form 5 on each individual for whom personnel monitoring is required under 10 CFR 20.2106. Failure to do so may subject the licensee to enforcement action in accordance with 10 CFR 20.2401.

5. **SYSTEM MANAGER AND ADDRESS**: REIRS Project Manager, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

ATTACHMENT 7-2

Dosimeter Issue Form

Name	Organization	Dosimeter Number	Calibration Date	Date issued	Date returned	Initial Reading (mr)	Final Reading (mr)	Issued by Initials

ATTACHMENT 7-3
Personal Dosimetry Badge Exchange Form

This form must be completed upon changeout of the dosimetry badges in accordance with RPP-SOP 07.

Year_____ Quarter_____

_____Replacement badges checked for correct labeling and acceptable condition.

_____Name and number checked for each badge exchanged.

_____Representative badges swiped for contamination. Copy of results attached to this form.

_____Chain of custody form completed. Copy attached to this form.

_____Changes in badge assignment documented

Badge assignment list:

Badge No.	Employee name	Emp. No.	Comments (e.g. changed badge assignment)

Badge No.	Employee name	Emp. No.	Comments (e.g. changed badge assignment)

Signed (RST) _____ Date _____

Reviewed (RSO) _____ Date _____

ATTACHMENT 7-4
MISSING DOSIMETRY BADGE FORM

Workers are required to report missing badge as soon as possible. The following form must be completed by the RST and RSO. A copy of this form will be filed with the employee's dose record.

Year_____ Quarter_____

Employee Name_____ Badge Number_____

Date badge lost_____

Date badge replaced_____ Replacement badge No._____

Reason/location for the badge loss:
Actions taken:

Employee signature_____ Date_____

RST signature_____ Date_____

MISSED DOSE CALCULATION

The "missed dose" will be calculated by the RSO by prorating the recorded dose for the quarter or by other method determined by the RSO to be more accurate.

Lost badge start date_____ Est. date of loss_____ No. of days_____

Replacement badge start date_____ Date of changeout_____

No. of days for replacement badge_____ Total quarter days_____

Replacement badge dose: DDE_____ LDE_____ SDE_____

Ratio of total quarter days to replacement badge days _____

Estimated total quarterly dose: DDE_____ LDE _____ SDE_____

Estimated total quarterly dose = recorded dose * qtr days/rep. badge days

RSO signature_____ Date_____

MIDNITE MINE RA RADIATION PROTECTION PROGRAM **STANDARD OPERATING PROCEDURES**	**RPP-SOP08** **REVISION 1**
RESPIRATORY PROTECTION	**PAGE: 1 OF 14** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER (RSO) 3
2.2. SAFETY OFFICER/RADIATION SAFETY TECHNICIAN 4
2.3. RESPIRATOR USERS 4

3. PRECAUTIONS 4

3.1. EXPOSURES TO RADIOLOGICAL MATERIALS 4
3.2. AIR RESPIRATOR USAGE 5
3.3. RESPIRATOR USAGE REQUIREMENTS 5
3.4. RESPIRATOR TEMPERATURES 5
3.5. SPECIAL CONSIDERATIONS FOR RESPIRATOR USE 5

4. EQUIPMENT AND MATERIALS 5

4.1. NIOSH APPROVED AIR PURIFYING RESPIRATORS MUST BE USED. 5

5. PROCEDURE 5

5.1. USE OF RESPIRATORS 5
5.2. SELECTION (RADIOLOGICAL) 6
5.3. RESPIRATORY PROTECTION ISSUE 7
5.4. MEDICAL REQUIREMENTS 7
5.5. CORRECTIVE LENSES 7
5.6. RESPIRATORY PROTECTION USE 7
5.7. RESPIRATOR RE-USE 8
5.8. TRAINING 9
5.9. RESPIRATOR FIT TESTING 10
5.10. QUALITATIVE RESPIRATOR FIT TEST 10
5.11. RESPIRATOR MAINTENANCE 11
5.12. HAND WASHING / PRE-WASH 11
5.13. RADIOLOGICAL SURVEYS OF RESPIRATORS 12
5.14. INSPECTION OF NEGATIVE PRESSURE AIR PURIFYING RESPIRATORS 12

6. RECORDS 13

7. REFERENCES AND BIBLIOGRAPHY 13

8. ATTACHMENTS 13

1. PURPOSE

This procedure describes the Respiratory Protection Program (RPP) for use during the Remedial Actions (RA) at the Midnite Mine Superfund Site (Site). The purpose of this procedure is to ensure that all Site personnel use respiratory protection appropriately, when necessary or advisable in accordance with the Radiation Protection Plan, to reduce intake by inhalation of hazardous and radioactive airborne contaminants in accordance with the Dawn Mining Company/Newmont USA Limited (hereafter referred to as the Company) Respiratory Protection Policy and OSHA regulations (29 C`FR 1910.134).

However, based on the very low levels of radioactivity associated with the materials to be excavated at the Midnite Mine RA project, it is not expected that respiratory protection will be necessary to maintain radiological exposures below project administrative limits and ALARA. At the discretion of the RSO, respiratory protection may be required if there is a potential for employee exposure to airborne radioactive material concentrations in air > 10 % of the DAC for ore dust of 6 E-11 from USNRC 10 CFR 20, Appendix B. For example, these circumstances could be possible during excavation of the uranium sledges from the pit bottom.

Respiratory Protection Policy Statement

The Company is committed to establishing and maintaining a respiratory protection program consistent with the goal of protecting its employees. It is therefore the policy of this company that all employees, when required to use respirators in the workplace, or administering the Respiratory Protection Program (RPP), shall adhere to the principles established in the written procedures.

Administrative controls will be used to limit personnel access to or time spent in an area. Engineering controls will be used to limit generation and to control dispersion of airborne radioactive materials. Respirators shall be used to control personnel exposure to airborne radioactive materials when administrative and engineered controls are not effective and the use of respirators is necessary to maintain worker exposures to airborne radioactive material below limits established in the RPP and ALARA.

Individuals using tight-fitting respirators shall not have any facial hair that interferes with the sealing surface of the respirator. Any intrusion of facial hair into the sealing surface of the respirator can result in air in-leakage.

The Company will maintain a respiratory protection program in accordance with OSHA regulations at 29 CFR 1910.134.

2. RESPONSIBILITY

2.1. Radiation Safety Officer (RSO)

- Responsible for the overall development and implementation of the Respiratory Protection Program.

- Responsible for providing technical direction and ensuring the evaluation of program effectiveness as it pertains to radioactive materials.

- Responsible for reviewing and approving Respiratory Protection Training Programs.

2.2. Safety Officer/Radiation Safety Technician

- Responsible for ensuring that the proper respirator cartridge is available.

- Responsible for providing technical direction and ensuring the evaluation of program effectiveness as it pertains to non-radioactive hazards.

- Responsible for reviewing and approving Respiratory Protection Training Programs.

- Responsible for cleaning, storing and issuing respirators as necessary in accordance with this procedure.

- Responsible for keeping records in regard to respirator use.

2.3. Respirator Users

- Responsible for complying with the requirements of the respiratory protection program.

- Responsible for using prescribed respiratory protection devices in compliance with instructions and training.

- Responsible for ensuring respiratory protection devices are returned to designated collection points.

- Responsible for protecting against damage to respiratory protection equipment.

- Responsible for reporting malfunctions of respiratory protection equipment to supervisors or safety personnel.

3. PRECAUTIONS

3.1. Exposures to Radiological Materials

Exposures to radiological materials through inhalation can be minimized through engineering and/or administrative controls and, as a last resort, the use of properly selected respiratory protection equipment. Any deviations from the established program(s) may result in unnecessary personnel exposure.

3.2. Air Respirator Usage

Air purifying respirators shall not be worn in atmospheres which are Immediately Dangerous to Life or Health (IDLH), or which contain an oxygen concentration of less than 19.5%.

3.3. Respirator Usage Requirements

The respirator user must have met all medical, training, and fit test requirements.

3.4. Respirator Temperatures

Respirators must not be exposed to temperatures exceeding 140 degrees F. Exposing respirators to temperatures in excess of 140 degrees F during the washing or drying process could cause deterioration of the rubber parts of the respirator or cracking of the lenses.

3.5. Special Considerations for Respirator Use

Since use of respirators may involve some decrease in ability to communicate and/or increase the effort and time required to perform certain tasks, respirator use should be justified by the potential for radionuclide exposure to workers in accordance with the RPP.

4. EQUIPMENT AND MATERIALS

4.1. NIOSH approved air purifying respirators must be used.

5. PROCEDURE

5.1. Use of Respirators

Respirator use is not expected to be necessary for routine operations and planned activities that are generally repetitive and/or occur with predictable frequencies. For such operations, potential sources of airborne contamination should be identified in advance so that engineering and/or administrative controls have been designed into the work practice and methods such that worker protection is accomplished by the use of process, containment, and ventilation measures and by preplanning of work. Respirators will not generally be used for such activities, if appropriate engineering and/or process controls present a reasonable alternative.

When respirators must be used, appropriate rest or relief periods shall be provided. An individual wearing a respirator may leave the work area at any time for relief in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of work area conditions, or any other condition that might require relief.

Non-routine operations are activities that are either non-repetitive, “ad –hoc” or occur so infrequently that adequate limitation of exposures by designed engineering controls is impractical. To the extent that process, containment, and ventilation controls are not reasonably feasible under such non-routine activities or operations, the use of respirators to minimize exposure to airborne

radionuclides above established criteria is appropriate.

Emergencies are unplanned events that require immediate action to avoid or mitigate a potentially dangerous situation. Although emergencies are unplanned, preparations are made to ensure that necessary and sufficient respiratory protection equipment is available for use in the event of an emergency.

5.2. Selection (Radiological)

- When selecting a respirator, consider the hazards that may be present, type and concentration of airborne radioactive materials as determined from pre-task air samples, available historical data on airborne radioactive material hazards for a particular work activity, levels of surface radioactive contamination, surface conditions (oily, wet, dry), worker comfort, radiation dose expected to be received wearing a respirator as opposed to expected dose without a respirator. Only NIOSH approved equipment shall be used.

- If both, radiological and non-radiological hazards are present, ensure that the prescribed respirator will protect against both hazards.

- Respiratory protection equipment shall be selected to provide a protection factor (PF) that will protect the wearer from peak concentrations of airborne radioactive materials in the working area. Equipment with a lower protection factor may be selected if it can be demonstrated that it will maintain the Total Effective Dose Equivalent (TEDE) ALARA.

  Example: Peak concentration = 10 Derived Air Concentration (DAC)

  Respiratory protection must provide a protection factor (PF) of at least 10 (or greater depending on administrative limits and criteria – see RPP). A half-face respirator has a nominal protection factor of 10 so it is suitable for this application. If the peak concentration is expected to be greater than 10 DAC, a full face filter respirator that provides a PF of 50, must be used. For peak concentrations greater than 50 DAC, the RSO and Safety Officer must be consulted since air-purifying respirators may not be adequate.

  Respirators should not be necessary or prescribed for radiological protection on jobs for which the expected air concentration is less than 0.1 DAC and at the discretion of the RSO will be used at concentrations > 0.1 DAC for ore dust.

- Respiratory protection measures may be appropriate as a precautionary measure for a situation in which no airborne hazard data is available and there is a large uncertainty in the magnitude of the concentrations of airborne radioactive material to which the workers may be exposed. A large uncertainty is considered to be where the airborne activity may be 10 times higher than anticipated for similar type jobs or situations. The use of

respiratory protection is valid until the true airborne hazard has been evaluated and the need for respiratory protection has been ascertained.

5.3. Respiratory Protection Issue

- Respiratory Protection Equipment shall be issued by the Safety Officer/Radiation Safety Technician.

- Respirators are to be issued for a maximum of one (1) work shift. The user shall be clean shaven prior to issue of the respirator.

5.4. Medical Requirements

Personnel who require the use of respiratory protection equipment in the course of work at the Site must have documented medical clearance from a physician.

5.5. Corrective Lenses

- Contact lenses shall not be used when wearing a full-face respirator.

- Personnel who require corrective lenses to perform normal responsibilities when wearing a full-face respirator shall wear prescription eye glasses approved for use inside a full-face respirator.

5.6. Respiratory Protection Use

- Inspection Prior to Use

  - ♦ Verify that the respirator issued is approved for the work to be performed.

  - ♦ Inspect the respirator to ensure it is free of defects or age, e.g., torn or frayed straps, bent or poor working buckles, loose or poor fitting lens, etc. If any defects or damages are noted, return the respirator to the Safety Manager's office.

  - ♦ If needed when using full-face respirators, insert prescription respiratory eyeglasses into the face piece. Only eyeglass assemblies approved for use in the specific respirator face piece shall be used.

- Respirator Donning

  - ♦ Pull all head harness straps out to the end tabs.

  - ♦ Insert chin into the face piece and lay the seal surface against the face.

- Pull the head harness back over the head.

- Make sure the headband straps are flat against the head.

- Adjust the headband straps for a snug, comfortable fit. Ensure that no hair or other material protrudes into the sealing surface of the face piece.

- Perform a negative and positive pressure test prior to entering the work area requiring respiratory protection to ensure a proper face to face piece seal. This test is performed as follows:
    - Cover the filter(s) inlet(s).
    - Gently inhale to collapse the face piece slightly.
    - Hold your breath for about 10 seconds.
    - If the face piece stays collapsed while holding your breath, the face to face piece seal is satisfactory.
    - If inward leakage is detected by the face piece not collapsing or not remaining collapsed while holding your breath, readjust the respirator by tightening the headband straps and retest.
    - If inward leakage is detected on the retest, return the respirator to the respiratory issue area.

- Respirator Removal

    - Unless required by an emergency situation (e.g., breathing becomes difficult), do not remove respirators until outside of the work area requiring respiratory protection.

    - If an emergency situation arises and breathing becomes difficult:
        - Remove the respirator and leave the work area immediately.
        - Immediately contact your supervisor.

    - To remove the respirator, remove potentially contaminated gloves and grasp the filters or face piece with both hands pulling the respirator forward and removing it from the head.

    - Following removal, swipe the inside surfaces to ensure it is not internally contaminated. If contamination in excess of background is detected, an intake may have occurred. The worker should be referred to the RSO for bioassay analysis (nasal /mouth swipes, urinalysis – See RPP-SOP03 Internal Exposure Monitoring)

5.7. Respirator Re-use

- If the respirator is to be reused on the same day and the same job, the following must be performed:
    - Wipe off the exposed surface of the mask.

    - Survey the mask to ensure that it is not internally contaminated.
    - Place the respirator in a clean plastic bag and ensure the respirator is labeled with the user's name.

- If the respirator is not to be reused, the user should place the respirator in a bag and return to the respirator to the RST for survey and cleaning.

5.8. Training

Training of personnel in the use of respiratory protective equipment shall be performed annually by the RSO or Radiation Safety Technician (RST). The instructor shall have a thorough knowledge of the application and use of respiratory protective equipment and the hazards associated with radioactive airborne contaminants. Training shall include, but is not limited to the following:

- The Company Respiratory Protection Policy.

- Discussion of the airborne contaminants against which the wearer is to be protected.

- Discussion of the construction, operating principles, and limitations of the various respirators in use.

- Instructions for assuring that respirators are in proper working condition.

- Instructions for donning and removing the respirator properly.

- Instructions in the proper method for checking to ensure an adequate face to face piece seal.

- Instruction in the proper use and maintenance of the respirator.

- Discussion of the types of cartridges and filters commonly used and the application for each type.

- Instruction in emergency actions to be taken in the event of a respirator malfunction.

- Radiation Safety Technicians shall receive training on equipment maintenance and decontamination to fulfill their responsibilities. This training shall include, but not be limited to the following:
    - Maintenance, inspection, and issuance of respiratory protection equipment.
    - Proper cleaning and disinfecting of respiratory protective equipment.
    - Analysis to detremine internal contamination following use
    - Proper storage of respirators.

5.9. Respirator Fit Testing

- Respirators with a tight-fitting face piece shall be fit tested to each individual to verify that an adequate seal can be obtained.

- The fit-testing shall be performed prior to first use for all users and shall be repeated at a frequency not to exceed 12 months for all potential users.

- Fit-testing shall be performed only on individuals who have current medical approval, received respiratory protection training, and are clean shaven.

- Qualitative fit testing shall be performed after performance of maintenance that could affect respirator integrity.

5.10. Qualitative Respirator Fit Test

- Initiate Respirator Log Sheet (Attachment to this SOP) by completing the following information:
  - Name of individual being fit tested.
  - Last four digits of his/her Social Security Number.
  - Department or Company.
  - Date.
  - Type, model and size of respirator.
  - Date of physician's medical clearance. If more than 12 months have elapsed, do not perform the fit test.
  - Date completed annual respirator users training.

- Select a medium size face piece or previously fitted size (if known).

- The following shall be reviewed with the individual being fit tested:
  - Skull caps worn under the respirator straps and away from the sealing surfaces are permissible.
  - A respirator sealing test shall always be performed after donning a respirator.
  - Respirators worn for protection against radionuclides in areas that are not IDLH can always be removed if there are any difficulties with the respiratory protection equipment, but the user shall exit the area immediately after removal.

- Remind the individual that a field seal test (either positive or negative) and an inspection must be performed each time a respirator is used. If the tests do not pass, attempt another size or style of respirator.

- Perform a qualitative fit test using irritant smoke, or equivalent, while talking and moving head.

- Record the results of the test on Attachment to this SOP, “Respirator Log Sheet”, as either Pass or Fail.

- If the individual passes the fit test, indicate the size of respirator on the Attachment.

- If the individual detects the irritant smoke while performing these activities, have him/her readjust the face piece or provide another size respirator, and repeat the test.

- If the individual does not detect the irritant smoke (or equivalent), then the qualitative fit test is satisfactory.

- Indicate on the Respiratory Log Sheet that the fit test was performed using the qualitative fit test method with the applicable challenge.

5.11. Respirator Maintenance

- Respirators shall be cleaned and disinfected after each use.

- Respirators shall be inspected after each cleaning and maintenance shall be performed if required.

- Respirators shall be stored face down (not on the rubber portion) in clean bags in clean locations. Storage facilities shall be located in an area free from chemical or physical agents that could be harmful to the respirator construction materials.

5.12. Hand Washing / Pre-Wash

Respirators may be washed and sanitized by hand. Hand washing and pre-washing shall be performed in the following manner:

- Prepare wash water by adding a commercial cleaner-sanitizer, according to the manufacturer’s directions, to hot water (120-130ºF). The normal detergent is MSA Cleaner-Sanitizer II. This cleaner-sanitizer requires one 2 oz. package per gallon of water.

- Immerse the respirator in the wash solution and scrub gently with a soft brush, cloth or sponge.

- After scrubbing all surfaces of the respirator thoroughly, rinse in clean hot water (120-130°F) to remove all traces of the wash solution. Rinsing of respirators must be thorough to prevent dermatitis or skin rashes to the respirator wearer caused by the cleaning-sanitizing solution.

- Remove all excessive water from the respirator.

- Allow respirators to air dry until all moisture has evaporated and the respirator is dry.

5.13. Radiological Surveys of Respirators

- Each cleaned and dried respirator shall be surveyed for radiological contamination in accordance with RPP-SOP04.

- Smears shall be taken of the inside and outside of each respirator face piece and evaluated for alpha contamination. If the smear survey results exceed alpha background, the respirator shall be re-washed.

5.14. Inspection of Negative Pressure Air Purifying Respirators

- Examine the face piece shell for dirt, cracks, tears, or distortion of the facial sealing surface.

- Examine the inner seal to ensure that it is smooth, supple, and continuous.

- Examine the lens for cracks, excessive scratches, tight seal, and discoloration (if applicable).

- Examine the lens retaining rings by grasping the lens retaining rings at each end gently flexing the lens to ensure the rings are secure and the lens stays securely in place.

- Examine the head harness for breaks, loss of elasticity or excessively worn strap serration that might permit slippage.

- Remove the exhalation valve cover and inspect valve for foreign materials such as dirt or soap crystals. Examine the valve for material cracks, tears, or distortion.

- Examine the speaking diaphragm assembly integrity (if applicable).

- Examine buckles to ensure they are free of defects, securely mounted and operational.

- Check all clamps and connections to ensure they are tight and secure.

- If the respirator does not successfully pass each of the examinations above, identify the respirator as being “Out-of-Service”.

6. RECORDS

Respirator fit test and medical doctor's approval records will be kept in the individual worker personnel file and duplicates in the near the respirator issue area. Surveys for contamination after cleaning shall be kept in the Safety Manager/RST office.

Respirator log sheets shall be completed on each individual who is issued a respirator.

7. REFERENCES AND BIBLIOGRAPHY

OSHA 29 CFR 1910.134

USNRC Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection

USNRC NUREG 0041, Manual of Respiratory Protection Against Airborne Radioactive Materials

ANSI Z88.2-1980, Practices for Respiratory Protection

ANSI Z88.6-1984, Respirator Use-Physical Qualification for Personnel

USNRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Mills

Midnite Mine Remedial Action Program Radiation Protection Plan

8. ATTACHMENTS

Respirator Log Sheet

ATTACHMENT 1-1
RESPIRATOR LOG SHEET

NAME:_____ DATE:_____

SOCIAL SECURITY NUMBER (Last four digits only):_____

MEDICAL EVALUATION DATE:_____
RESPIRATORS USERS TRAINING DATE:_____

	RESP. TYPE	RESP.TYPE	RESP.TYPE
Specify make, model, size	FULL FACE	HALF FACE	
Pre inspection			
Positive pressure check			
Negative pressure check			
Banana Oil			
Irritant smoke			
Performed By			

ISSUE DATE	ISSUE BY	RETURN DATE	INSPECTED BY/DATE

COMMENTS:_____
_____
_____
_____
_____

MIDNITE MINE RA **RADIATION PROTECTION PROGRAM** **STANDARD OPERATING PROCEDURES**	**RPP-SOP09** **REVISION: 2**
ACCESS CONTROL	**PAGE: 1 OF 6** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER (RSO) 3
2.2. RADIATION SAFETY TECHNICIAN 3
2.3. SUPERVISORS 3
2.4. ESCORTS 4
2.5. EMPLOYEES 4

3. PRECAUTIONS 4

3.1. APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT 4

4. PROCEDURE 4

4.1. GENERAL REQUIREMENTS 4
4.2. REQUIREMENTS FOR ACCESS TO A CONTROLLED AREA 5
4.3. ADDITIONAL REQUIREMENTS FOR CONTROLLED AREAS 5

5. REFERENCES AND BIBLIOGRAPHY 6

1. PURPOSE

This procedure provides the access control requirements for entry/egress to and from Controlled Areas at the Midnite Mine Superfund Site (Site). Controlled Areas are defined as areas inside the perimeter fence within which remedial activities are being conducted and radiological hazards may exist. Controlled Areas in other portions of the Site may be identified during the Remedial Action (RA) activities based on known or potential radiation hazards, and will be identified and delineated by the Radiation Safety Officer or Radiation Safety Technician. This procedure is designed to ensure that all individuals have received appropriate training, qualification and authorization for entry. This procedure is applicable to all project personnel, visitors, and contractors who enter Site Controlled Areas. This procedure also provides posting requirements for the Controlled Areas.

2. RESPONSIBILITY

2.1. Radiation Safety Officer (RSO)

- Responsible for approving training programs related to work within the Controlled Areas.
- Responsible for designing the requirements for all individuals needing access to the Controlled Areas, including remedial action workers, non-remedial action workers, visitors, and contractors.
- Responsible for ensuring that appropriate physical/administrative controls and the associated postings are in place based upon regulatory requirements and survey results.

2.2. Radiation Safety Technician

- Responsible for restricting access to individuals when necessary.
- Responsible for ensuring that all personnel entering the Controlled Areas have appropriate training.
- Responsible for ensuring that Controlled Area entry training is administered and documented.
- Providing training as required in the absence of the RSO.

2.3. Supervisors

- Responsible for ensuring that personnel under their direction are aware of the radiological and non-radiological hazards potentially present in all work areas.

2.4. Escorts

- Responsible for maintaining positive control over the escorted individual such that he/she does not enter an unauthorized area.

- Responsible for ensuring that the escorted individual has the required training and authorization to enter the Controlled Areas.

2.5. Employees

- Responsible for attending assigned training classes.

- Responsible for informing the RSO or RST of factors which may limit their entry into the Controlled Areas (i.e. medical radiation treatments, open wounds, etc.).

- Responsible for complying with radiological postings and applicable procedures and requirements.

- Responsible for notifying the RSO or RST of any unusual conditions.

- Responsible for returning personal dosimetry for storage upon exit from Controlled Areas.

- Responsible for complying with the entry requirements for the Controlled Area.

- Along with the RST, responsible for monitoring and providing documentation for materials leaving the Controlled Area to ensure that radiological contamination levels are within release limits.

3. PRECAUTIONS

3.1. Appropriate Personal Protective Equipment

Appropriate Personal Protective Equipment (PPE) and dosimetry, as required by RPP-SOP03, RPP-SOP07, and RPP-SOP08, shall be worn when entering the Controlled Area.

4. PROCEDURE

4.1. General Requirements

- Personnel who normally work within a Controlled Area will be issued personal dosimeters (TLD, or OSL dosimeters).

- Employees shall store dosimeters in designated, low background storage locations prior to leaving the site.

- Only properly trained or escorted personnel shall be permitted inside the Controlled Area.

- Unescorted individuals working in a Controlled Area shall be required to receive remedial action worker training.

4.2. Requirements for Access to a Controlled Area

- Individuals granted unescorted access to a Controlled Area shall be provided with dosimeters that shall be stored in designated, low background storage locations when not in use.

- Individuals entering a Controlled Area shall have completed the training requirements in RPP-SOP11, and the training shall be performed at least annually.

- Visitors, employees, and contractors who have not completed the requirements in RPP-SOP11 may be granted temporary access to a Controlled Area provided they have obtained approval from the RSO, RST, or designee and have a qualified escort.

- The RST shall be notified of the following prior to entering a Controlled Area:

  - ♦ Medical administration of radiopharmaceuticals.

  - ♦ Presence of open wounds.

  - ♦ Upon returning to the Site after or while being monitored for radiation exposure at another facility.

  - ♦ Declaration of pregnancy per RPP Sections 8 and 12.2.

4.3. Additional Requirements for Controlled Areas

- Boundaries shall be established in such a manner that a person cannot inadvertently enter the Controlled Area (e.g. postings, ribbons, fences, etc.).

- Postings shall be magenta (or black) and yellow in color, contain the conventional three-bladed radiation symbol, contain the word “Caution Radioactive Material”. An alternative is to post all Controlled Areas as “ Caution, any area within this boundary may contain radioactive material”.

- Protective clothing as specified (e.g. coveralls, gloves, head protection, work boots, etc.) and personnel contamination monitoring upon existing shall be required when working in control areas as directed by the RST or RSO. Work clothing (coveralls, etc.) will be provided to workers and will remain on site for laundering and subsequent re-issue.

5. REFERENCES AND BIBLIOGRAPHY

U.S. NRC Regulatory Guide 8.29, “Instruction Concerning Risk from Occupational Radiation Exposure”.

U.S. NRC Regulatory Guide 8.13, “Instruction Concerning Prenatal Radiation Exposure”.

USNRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Mills.

U.S. NRC Regulatory Guide 8.31, “Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Mills will be As Low As is Reasonably Achievable”.

MIDNITE MINE RA **RADIATION PROTECTION PROGRAM** **STANDARD OPERATING PROCEDURES**	**RPP-SOP10** **REVISION: 2**
DOSE CALCULATIONS	**PAGE: 1 OF 8** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3

2. RESPONSIBILITY 3

2.1. RADIATION SAFETY OFFICER (RSO) OR RST RESPONSIBILITIES 3
2.2. ALL EMPLOYEES 3

3. PROCEDURE 3

3.1. DOSE INVESTIGATION REPORT 3
3.2. INTERNAL EXPOSURE - DETERMINING THE AMOUNT OF INTAKE 4
3.3. DETERMINATION OF COMMITTED EFFECTIVE DOSE EQUIVALENTS (CEDE) 5
3.4. EXTERNAL EXPOSURE AND CALCULATION OF TOTAL EFFECTIVE DOSE EQUIVALENT 6

4. NOTIFICATIONS 6

4.1. PROJECT MANAGER NOTIFICATION 6
4.2. EVALUATION RECORDS 6
4.3. REGULATORY AUTHORITY NOTIFICATION 6
4.4. COMPLETED DOSE INVESTIGATION 6

5. RECORDS 7

5.1. EXPOSURE RECORDS 7
5.2. RECORDS OF EVALUATIONS 7

6. BIBLIOGRAPHY 7

7. ATTACHMENTS 7

1. PURPOSE

This procedure describes monitoring requirements, methods, evaluation criteria, and calculations necessary to determine intakes and doses for workers at the Midnite Mine Site.

2. RESPONSIBILITY

2.1. Radiation Safety Officer (RSO) or RST Responsibilities

The Radiation Safety Officer (RSO) or RST (as may be assigned by the RSO working under his/her supervision) is responsible for:

- Performing dose calculations.
- Ensuring that air samples provide representative samples of the work area, personnel breathing air, and the environment, as applicable, to allow for the identification and evaluation of potential radiological hazards.
- Authorizing sampling methods and instrumentation to be used for analysis of samples.
- Implementation of the exposure monitoring program.
- Providing the methodology for performing dose calculations.
- Investigating regulatory and/or administrative limits which are exceeded, including documentation of results.
- Review and approval of exposure data.

2.2. All Employees

- Responsible for notifying the RSO when medical treatments involving radionuclides have been received.
- Responsible for using and wearing assigned external dosimeters in accordance with RPP SOP 7 and supplying bioassay samples when requested in a timely manner in accordance with RPP SOP 3.
- Responsible for collecting the bioassay samples in accordance with instructions designed to prevent cross contamination.

3. PROCEDURE

3.1. Dose Investigation Report

- The Dose Investigation Report serves as a cover sheet for all supporting information that may be gathered during the evaluation of an internal deposition. (See Attachment 10-1)

- Final dose assignments (if applicable) shall be made on the Dose Investigation Report. Any assumptions made during the calculation of exposure assignments should be documented in the attachments to this report.

3.2. Internal exposure - Determining the Amount of Intake

- Intakes shall normally be calculated based upon the results of the air monitoring program, unless in the opinion of the RSO, bioassay data is more representative of intake. Airborne uranium at the Midnite Mine is assumed to be solubility / clearance Class Y (ICRP 30; USNRC Regulatory Guide 8.22 and USNRC NUREG 0874) unless otherwise determined by the RSO. Use of any other solubility / clearance class will be documented by the RSO with justification.

  The following information regarding potential internal exposure (intake) shall be collected if possible:

  - ♦ Time of the initial intake (use the actual event time, personnel estimation of time based on recollection of activities, the individual's work schedule, facility operations data, or historical air monitoring data.) When information is insufficient to determine the time of intake, it is acceptable to initially assume that the intake occurred at the mid-point of the time period since the last bioassay measurement.

  - ♦ The amount of time that has passed since the intake.

  - ♦ The inhalation class of the uranium (see discussion above)

- Intakes shall be calculated by the RSO or designee. Intakes will be evaluated using the models and data provided by:

  - ♦ Health Physics, November 2002: Intake Retention Fractions Developed from Models Used in the Determination of Dose Coefficients Developed for ICRP Publication 68 – Particulate Inhalation.

  - ♦ EPA 520/1-8-020 (Federal Guidance Report No. 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" or the ICRP Database of Dose Coefficients for Workers and Members of the Public

  - ♦ Accepted industry standards and practices.

- Calculation of intake for air samples is performed as follows:

  Intake = Sample result (µCi/ml) x std. man breathing rate (1.2 m^3/hour) x 1 E+06 ml/m^3 x time worked (hours) x respiratory protection

factor (if applicable and in accordance with RPP SOP 8, Respiratory Protection).

Calculation of intake for bioassay samples is performed will be performed by the RSO) in accordance with the models referenced in Section 3.2.2 above and/or similar standards of practice (e.g., HPS N13.22, American National Standard, Health Physics Society; HPS N13.22-1995; USNRC NUREG 0874, Internal Dosimetry Models for Applications to Bioassay at Uranium Mills.

- Intakes shall be recorded on the Dose Investigation Report (Attachment 10-1)

3.3. Determination of Committed Effective Dose Equivalents (CEDE)

- The internal dose of an individual (CEDE) may be determined using the methodology provided in Federal Guidance Report No. 11, or using the dose coefficients provided in ICRP in the ICRP Database of Dose Coefficients for Workers and Members of the Public as follows:

DAC-hour =

$$\frac{Concentration\ of\ Radionculide\ in\ Air}{DAC} * Time\ Exposed\ at\ Stated\ Concentration\ (in\ hours)$$

CEDE = $\frac{DAC_{hours}}{ALI} * 5rem$

Where:

CEDE = Committed Effective Dose Equivalent (mrem)

ALI = Annual Limit on Intake (µCi) from USNRC 10 CFR Part 20 Appendix B

DAC for natural uranium (assuming solubility Class Y) is 2E-11 µCi/mL.

ALI for natural uranium (assuming solubility Class Y) is 5E-2 µCi.

DAC-hour: The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one annual limit on intake (ALI), equivalent to a committed effective dose equivalent of 5 rem (0.05 Sv).

- The Committed Effective Dose Equivalent for each worker shall be recorded on his/her Employee Permanent Exposure Record (NRC Form 5 or equivalent).

- The committed dose equivalents should be recorded on the Dose Investigation Report (Attachment 10-1).

3.4. External Exposure and Calculation of Total Effective Dose Equivalent

The external whole body radiation dose is measured with TLDs or OSLs (See RPP SOP-7) reported and recorded as mrem/year. The total radiation dose is the sum of the internal and external radiation doses:

$$TEDE = CEDE + DDE$$

Where:

TEDE = Total effective dose equivalent in mrem = total radiation dose

CEDE = Committed effective dose equivalent in mrem from intake of natural uranium (and in combination with decay products as applicable) – from air sampling and/or bioassay results

DDE = The external deep dose equivalent as measured by TLDs or OSLs

4. NOTIFICATIONS

4.1. Project Manager Notification

The Project manager shall be notified by the RSO immediately if an individual received or may have received a Total Effective Dose Equivalent (TEDE) of 5 rem or more or a release of radioactive material such that an individual could have received an intake of > ALI (Annual Limit on Intake) within the year.

4.2. Evaluation Records

Records of evaluations, individual dose assessments and assignments and notifications to employees shall be maintained in the dosimetry files by the RSO. When a record pertains to a specific individual, a copy of the record shall be placed into the individual's dosimetry file (See also RPP SOP3, Internal Dosimetry and RPP SOP 7, External Dosimetry)

4.3. Regulatory Authority Notification

The appropriate regulatory authority (OSHA, e.g.) shall be notified by the RSO within 24 hours if an individual received or may have received in a period of 24 hours a TEDE exceeding 5 rem, an Eye Dose Equivalent (LDE) exceeding 15 rem, or a SDE to the skin or extremities exceeding 50 rem, or a release of radioactive material such that an individual could have received an intake exceeding 1 ALI. RPP-SOP01 contains more information on reporting.

4.4. Completed Dose Investigation

Completed Dose Investigation Reports shall be retained in the affected individual's exposure history records.

5. RECORDS

5.1. Exposure Records

Records related to exposure assignments of workers, including air sampling and bioassay monitoring, TLD or OSL results, dose calculations, etc. shall be maintained for a period of 10 years following project completion.

5.2. Records of Evaluations

Records of evaluations and notifications shall be maintained in the dosimetry files. When a record pertains to a specific individual, a copy of the record shall be placed into the individual's dosimetry file.

6. BIBLIOGRAPHY

U.S. NRC Regulatory Guide 8.11, "Applications of Bioassay for Uranium" and NUREG 0874, Internal Dosimetry Models for Applications to Bioassay at Uranium Mills.

U.S. NRC Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses".

ANSI N13.30-1989 (Draft) "American National Standard for Performance Criteria for Radiobioassay".

NUREG/CR-4884, "Interpretation of Bioassay Measurements".

EPA 520/1-8-020 (Federal Guidance Report No. 11), "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion".

U.S. NRC Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program".

U.S. NRC Regulatory Guide 8.22, "Bioassay at Uranium Mills".

U.S. NRC 10 CFR Part 20 Appendix B.

Midnite Mine Radiation Protection Plan.

Midnite Mine Quality Assurance Plan .

7. ATTACHMENTS

Attachment 10-1 - Dose Investigation Report

ATTACHMENT 10-1
DOSE INVESTIGATION REPORT

SECTION I		BADGE #	
For:	Last Name	First	MI
SSN# (last 4 digits only):	Type of Exposure: External:	Internal:	
Date/Time of Exposure	SWP#	Location	
Activity being performed by individual			
External Monitoring Method	Results	Internal monitoring method	Results
TLD	Mrem	Bioassay (in-vitro)	pCi/L
OSL	Mrem	Bioassay (in-vitro)	nCi
Area survey (describe)		Lapel air sample	µCi/ml
Other (describe)		Area air sample	µCi/ml
		Other (describe)	
SECTION II			
Interview/Investigation Results:			
Other Personnel Involved:			
SECTION III			
Cause of Exposure:			
SECTION IV			
Calculations/Dose Assignment	Permanent Record	Estimated	
SECTION V			
Recommendations:	Follow-up Monitoring Required?	Yes	No
Exposed Individual Signature:		Date:	
RSO Signature:		Date:	
Supervisor Signature:		Date:	

MIDNITE MINE RA **RADIATION PROTECTION PROGRAM** **STANDARD OPERATING PROCEDURES**	**RPP-SOP11** **REVISION: 2**
RADIATION SAFETY TRAINING	**PAGE: 1 OF 5** **DATE: May, 2014**

Table of Contents

1. PURPOSE 3
2. RESPONSIBILITY 3
3. PROCEDURE 3
4. RECORDS 5
5. REFERENCES AND BIBLIOGRAPHY 5

1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to outline the training requirements for all employees and contractors working on the Remedial Action Project at the Midnite Mine site.

This SOP provides an outline for guidance in preparing and implementing the radiation safety training program for employees and contractors. The Radiation Safety Officer (RSO) is responsible for preparing or approving training materials for all staff including General Employee Radiation Training (GERT) and Remedial Action Worker Training (RAWT) prior to the start of the remedial action.

2. RESPONSIBILITY

The Site Manager is responsible for ensuring that all staff at the site are properly trained in accordance with approved training schedules and guidelines, as well as records retention and document control. The RSO is responsible for developing and/or approving and providing training to all site employees, preparation of exam materials, and ensuring that the training materials represent current radiation safety best practices as applicable to the radiological environment at the site and the radiation hazards potentially associated with the Remedial Action. The RSO should ensure that the training materials are consistent with the requirements of the RPP and this SOP. The RSO should ensure that training reflects work methods that are consistent with the site ALARA policy. The RSO is responsible for maintaining all training records for project workers and contractors. Successful completion of radiation safety training will be documented via achieving a score of at least 70% on the exams prepared and administered by the RSO.

3. PROCEDURE

Radiation safety training for the Midnite Mine RA Project will be designed to inform employees of the inherent risks of exposure to radiation as well as the fundamentals of protection against exposure to uranium and its progeny. The radiation safety training program will be administered according to guidance provided in NRC Regulatory Guide 8.31, NRC Regulatory Guide 8.29, and NRC Regulatory Guide 8.13. All employees will be provided access to and made familiar with instructions outlining radiation safety and emergency procedures.

All new employees will receive at a minimum General Employee Radiation Training (GERT) which will provide general awareness of:

- Nature and hazards associated with ionizing radiation;
- Expected radiation levels and sources of radioactivity at the project site;
- Monitoring methods and procedures;
- Summary of plant operating procedures including the RPP and HASP;
- Emergency procedures;
- Employee rights per 10 CFR Part 19.

Employees at the facility who will be working in Controlled Areas will be designated, as “remedial action workers” and will receive additional training on the following topics:

- Fundamentals of Radiological Health Protection;
- Human Exposure pathways associated with uranium and its decay products (external exposure, inhalation and ingestion);
- Why the concept of ALARA is important with respect to exposure from uranium and its progeny;
- Radiological environment and hazards at the Midnite Mine RA Project (associated with uranium, radium and other uranium decay products);
- Personal hygiene at uranium projects- Eating, drinking, and smoking in only in designated areas;
- The use of protective clothing;
- The potential need for and correct use of respiratory protective equipment;
- Standard operating procedures;
- Security and access control to designated areas;
- Measurement of external exposure rates;
- Measurement of airborne radioactive materials;
- Bioassay to detect uranium under special circumstances;
- Surveys to detect contamination of personnel and equipment;
- Using proper methods for decontamination;
- Applicable Radiation Protection Regulations;
- Employee rights per 10 CFR Part 19;
- Emergency Procedures.

In addition to the above topics, female employees will be given instruction and training to addresses risks associated with prenatal radiation exposure. The training will be based upon NRC Regulatory Guide 8.13, and may be given as instruction in a classroom setting or as an informational pamphlet. This training will consist of the following:

- Risks associated with prenatal radiation exposure;
- Regulations concerning exposure limits and dose monitoring provisions for pregnant women;
- Midnite Mine policy for pregnancy declaration.

A written test with questions directly related to the radiation safety training will be administered to each employee. The instructor will review the test with each employee and discuss any incorrect answers so that the employee understands the error. Workers who do not pass the test with 70% of the answers correct will be retested after receiving additional training.

Employees will also be given specific instruction on the health and radiation safety aspects and non-radiological hazards potentially associated with the specific jobs and tasks they will perform (“on the job” training). If the employee is a supervisor, they will be given special instruction pertaining to their supervisory responsibilities in the area of worker radiation protection.

Radiation safety issues or concerns that arise during the Remedial Action will be addressed during regularly scheduled daily or weekly safety (“tail – gate”) meetings.

Each employee will receive a radiation safety training refresher course annually. The training will include a brief review of topics covered in the initial training as well as relevant information that has subsequently become available with regard to radiation safety issues that have arisen, changes in requirements, experience ("lessons learned") and employee exposure trends.

Contractors who have previously received complete remedial action worker training within the previous 12 months from prior work experience at the project or have documented evidence of recent and relevant radiation safety training elsewhere may receive only GERT and job-specific radiation safety training (at the discretion of the RSO). All other visitors to the site will be given hazard recognition training and will be escorted at all times by properly trained staff.

4. RECORDS

After completion of training, employees and contractors will be required to sign a statement that they have received radiation safety training that documents the training program syllabus. The statement will outline the extent of the training and the dates when the training was received. The statement will also be signed by the RSO. These statements, as well as employee test records will be maintained on-site until the site is released.

5. REFERENCES AND BIBLIOGRAPHY

USNRC, Regulatory Guide 8.13 "Instruction Concerning Prenatal Radiation Exposure" 1999

USNRC, Regulatory Guide 8.29 "Instruction Concerning Risks from Occupational Radiation Exposure" 1996

USNRC, Regulatory Guide 8.31 "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable" 2002.

ATTACHMENT B
TOXICOLOGICAL PROFILE FOR URANIUM AND URANIUM DECAY PRODUCTS

TOXICOLOGICAL PROFILE FOR URANIUM AND ITS DECAY PRODUCTS

The only radionuclides present at the Midnite Mine are uranium isotopes and their decay products. The uranium decay series characteristics are shown in Table B-1. Natural uranium (U-nat) consists of three isotopes: U-238, U-234, and U-235. Uranium-235 has a natural abundance of 0.72 percent (by weight) and is present at an activity concentration of 2.3 percent of the activity concentration of natural uranium (about 49% each U-238 and U-234). Thorium-230 and Ra-226 are long-lived decay products of U-238. Radon-222 is a decay product of Ra-226 and may be present at the Midnite Mine in air.

Table B-1. Uranium-238 Decay Series

Nuclide	Atomic Number	Mode of Decay	Energy (MeV) (percent) [emissions greater than 10% only]	Half-life	Decay Product
U-238	92	Alpha	4.15 (22.9) 4.20 (76.8)	4.47E9 y	Th-234
Th-234	90	Beta	0.189 (72.5) 0.096 (18.6)	24.1 d	Pa-234m
Pa-234m	91	Beta	2.28 (98.6)	1.17 m	U-234
U-234	92	Alpha	4.72 (27.4) 4.77 (72.3)	2.45E5 y	Th-230
Th-230	90	Alpha	4.62 (23.4) 4.69 (76.2)	7.7E4 y	Ra-226 -214
Ra-226	88	Alpha	4.78 (94.4)	1.6E3 y	Rn-222
Rn-222	86	Alpha	5.49 (99.9)	3.82 d	Po-218
Po-218	84	Alpha	6.00 (100)	3.05 m	Pb-214
Pb-214	82	Beta Gamma	0.67 (48) 0.73 (42.5) 0.295 (19.2) 0.352 (37.1)	26.8 m	Bi-214
Bi-214	83	Beta Gamma	3.27 (17.7) 1.54 (17.9) 1.51 (17.6) 0.609 (46.1) 1.12 (15.0) 1.77 (15.9)	19.9 m	Po-214
Po-214	84	Alpha	7.69 (100)	0.164 ms	Pb-210
Pb-210	82	Beta	0.016 (80) 0.063 (20)	22.3 y	Bi-210
Bi-210	83	Beta	1.16 (100)	5.01 d	Po-210
Po-210	84	Alpha	5.305 (100)	138.4 d	Pb-206 Stable

RADIOLOGICAL ENVIRONMENT AT THE MIDNITE MINE REMEDIAL ACTION PROJECT AND BIOLOGICAL EFFECTS OF IONIZING RADIATION

It must first be recognized that the levels of radiation above background expected to be encountered at the Midnite Mine Remedial Action project are low. The primary type of exposure to workers that will be encountered at this project will be external exposure to gamma rays from uranium's decay products, primarily from radium 226 and its decay products. The degree of exposure is expected to be much less than what the workers get from natural background radiation exposure each year (about 300 - 400 mrem as the US average). Natural background can vary considerably across the United States depending on local conditions of mineralization in the rocks and soils and elevation above sea level. For example, the annual natural background in areas of Colorado can be 600 - 700 mrem or more.

The principal health hazard from chronic exposure to ionizing radiation is increased risk of cancer. Ionizing radiation has been shown to be a carcinogen at high doses; however, there are no data to show that negligible doses of radiation, in the range of radiation doses anticipated for workers at the Midnite Mine (which are expected to be less than natural background), can lead to cancer. The estimated risks of cancer for low doses of radiation are based on risk estimates derived from human epidemiologic studies of atomic bomb survivors and, in the case of radon decay products, underground miners decades ago that were exposed to much higher levels than are permitted today. The Radiation safety plan as described in the RPP was developed consistent with the "ALARA philosophy" in that exposures to ionizing radiation should be maintained "As Low as Is Reasonably Achievable (ALARA), social and economic factors taken into account" and that any additional risk associated with radiation exposure is proportional to the dose.

Other potential adverse health effects of chronic radiation exposure include increased risk of genetic mutations and adverse reproductive effects. Genetic effects have been observed in experimental animals exposed to very high doses but not in human populations. Potential effects on the fetus due to irradiation in utero at high doses include increased risk of childhood leukemia and spontaneous abortion. The human epidemiological data show an increased risk of childhood leukemia in children of women exposed to high doses of diagnostic x-rays during pregnancy.

Alpha, beta, and gamma radiation, commonly termed "ionizing radiation", are emitted by uranium decay series radionuclides. Alphas and betas are particulate radiation, i.e. they have mass. Gamma radiation is a form of electromagnetic radiation, similar to x-rays, visible light, and ultraviolet radiation. Of the types of radiation in the electromagnetic spectrum, only x-rays and gamma rays have sufficient energy to ionize atoms; hence they are also termed ionizing radiation.

Alpha radiation penetrates only very short distances, less than 0.1 mm in tissue. Alpha particles are not hazardous outside of the body because all of the energy of the alpha radiation is absorbed by the layer of dead cells on the skin surface. However, alpha emitting radionuclides which are taken into the body by inhalation or ingestion can cause damage by coming in direct contact with live cells. Beta radiation is somewhat more penetrating than alpha radiation and can damage the growth layers of the skin. Gamma rays, like x-rays, are very penetrating, and, depending on the energy can reach any organ in the body.

Radiotoxicity of Uranium

All of the uranium isotopes are low specific activity alpha-emitting radionuclides. Natural Uranium, because of its very low specific activity, that is the ratio of activity to mass, when taken into the body via inhalation or ingestion, exhibits chemical toxicity as well as radiotoxicity. For natural uranium, because the levels of radioactivity are so low, its chemical properties (chemotoxicity) are much more important to human health than “radiation dose” (radiotoxicity).

Chemotoxicity of Uranium

Uranium, like many heavy metals (lead, mercury, cadmium, etc.) is chemically toxic. If enough uranium is taken into the body it can cause kidney damage. Due to its chemical toxicity, the amount of soluble uranium that a worker is allowed to inhale in any one week is limited to 10 mg. However, there are no known cases of permanent kidney damage due to occupational intakes of uranium.

Radiotoxicity of Th-230 and Ra-226

The target organ for ingested alpha emitters Th-230 and Ra-226 is the bone surface; for inhaled Th-230 and Ra-226 the lung and to a lesser degree the bone are the target organs. Both nuclides have long physical half-lives and, when incorporated into bone remain in the body for many years.

The gamma radiation from the uranium decay series, which presents an external radiation hazard, is generally attributed to Ra-226 although it emits a low energy gamma photon in only a very small percentage of its decays and contributes little to the gamma radiation exposure. The gamma radiation attributed to Ra-226 actually comes from the decay of Pb-214 and Bi-214, short-lived Ra-226 decay products. These two nuclides account for more than 90 percent of the gamma radiation from the uranium decay series. Uranium itself emits a small amount of low energy gamma radiation.

Radiotoxicity of Rn-222 and its Decay Products

Radon-222 is a noble gas and presents little health hazard as a gas. However, when it undergoes radioactive decay it forms several short-lived decay products, Po-218, Pb-214, Bi-214, and Po-214. These nuclides are generated in air as individual atoms that attach to existing aerosols that may then be deposited in the lung as particles. Inhalation of radon decay products has been demonstrated to cause lung cancer in underground miners who worked in the mines decades ago and exposed to radon decay product levels 100-1000 times higher than current allowable limits. Many of these early uranium miners were also heavy cigarette smokers. The risk is a function of total dose and dose rate. Smoking and radon are synergistic, i.e. smokers have a greater risk of developing lung cancer due to radon decay product exposure than do non-smokers. No other adverse health effects attributable to inhalation of radon and its decay products have been demonstrated and only in these early underground miners.

Lead-214 and Bi-214 emit gamma radiation as well as beta particles. As noted earlier, they account for more than 90 percent of the gamma radiation from the uranium decay series. The whole body is the "target organ" for external gamma radiation.

Radiotoxicity of Pb-210 and its Decay Products

Lead-210 is a beta-emitter with a half-life of 22 years. It accumulates in the environment from the decay of Rn-222 in the atmosphere. The target organ for Pb-210 is the bone. The Pb-210 beta particle has a very low energy, thus produces little damage to tissue. However, Pb-210 decays to a short-lived beta emitter, Bi-210, which, in turn, decays to Po-210, an alpha emitter. Bismuth-210 beta particles have moderate energies. As noted previously, alpha and beta radiation can damage tissues in which the radionuclides are deposited as result of ingestion or inhalation. Radiation effects attributed to Pb-210 actually result from the decay of Bi-210 and Po-210. Polonium-210 decays to stable Pb-206, ending the U-238 decay series.

Effective Dose

The target organs and the doses attributable to these uranium decay series radionuclides are a function of their chemical as well as their radiological characteristics. The target organ and the biological half-life of a nuclide are determined by its chemical form. The effective radiation dose, thus the increased risk, associated with internal deposition (ingestion or inhalation) of these radionuclides is a function of the amount and distribution of energy deposited in tissue, the length of time the nuclide remains in the organ, and the radiosensitivity of the organ.

ALARA Principle

The system of radiological protection recommended by the International Commission on Radiological Protection (ICRP) incorporates the principle that doses should be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account. The regulations governing facilities licensed by the US Nuclear Regulatory Commission (NRC) define ALARA as "making every reasonable effort to maintain exposures to radiation as far below the dose limits, as is practical consistent with the purpose for which the licensed activity is undertaken." (10 CFR 20) This RPP has been designed to keep radiation doses ALARA.

BASIC PRINCIPLES OF RADIATION PROTECTION

Protection against External Radiation

In general, external radiation doses can be minimized by:

Reducing the time spent in the vicinity of the source or in areas with the highest exposure rates (TIME).
Staying as far from the source as practical (DISTANCE).
Placing a shield between the source and the receptor (SHIELDING).

Only the first of the three methods of reducing external radiation dose can be practically applied at the Midnite Mine. Workers should take breaks in areas where exposure rates are close to background levels.

Protection against Internal Dose

The three major routes of intake for radioactive materials are inhalation, ingestion, and absorption through the skin. Good housekeeping practices including regular conduct of contamination surveys , especially prior to eating, drinking, smoking or leaving the Controlled Areas of the, are the best way of preventing intake of radioactive materials.

ATTACHMENT C
RAD7 RADON DETECTOR USER MANUAL

RAD7 RADON DETECTOR

User Manual

Owner_____

Serial #_____

SERVICE RECORD

Date	Service

It is recommended that the unit be returned to DURRIDGE Company annually, for recalibration.

DURRIDGE Company Inc.
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Billerica, MA 01821
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Fax: (978)-667-9557
service@durridge.com
www.durridge.com

Revision 7.3.4. © 2015 DURRIDGE Company

WARNING

Opening the cover of this instrument is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened. Due to battery power, the instrument may still be dangerous.

Using this instrument in a manner not specified by the manufacturer may impair the protection provided by the instrument.

TABLE OF CONTENTS

INTRODUCTION.....9

1. GETTING STARTED:.....10

YOUR FIRST DAY WITH THE RAD7 10

1.1 Unpacking.....10

RAD7 Packing List 10

1.2 General Safety Instructions.....11

1.2.1 Air Travel.....12

1.3 Taking a Look.....12

The RAD7 Professional Electronic Radon Detector 12

1.4 Starting a Two-day Test.....13

RAD7 Normal Configuration 13

1.5 Starting a Sniff Test.....15

RAD7 SNIFF Configuration 15

2. BASICS OF RAD7 OPERATION.....17

2.1 Introduction.....17

2.1.1 The Key Pad.....17

2.1.2 Command List.....17

2.2 Test.....17

2.2.1 Test Status.....17

2.2.1a Quick Save-and-Restart.....18

2.2.2 Test Start and Test Stop.....19

2.2.3 Test Save.....19

2.2.4 Test Clear.....19

2.2.5 Test Purge.....19

2.2.6 Test Lock.....20

2.2.7 Test Sleep.....20

2.2.8 Test Print.....20

2.2.9 Test Com.....20

2.3 Data.....20

2.3.1 Data Read.....20

2.3.2 Data Print.....21

2.3.3 Data Com.....21

2.3.4 Data Summary.....22

2.3.5 Data Free.....22

2.3.6 Data Delete 22
2.3.7 Data Renumber 23
2.3.8 Data Erase 23
2.4 Setup 23
2.4.1 Setup Protocol 23
Table 2.4.1 Preset protocols 23
2.4.2 Setup Cycle 23
2.4.3 Setup Recycle 24
2.4.4 Setup Mode 24
2.4.5 Setup Thoron 24
2.4.6 Setup Pump 25
2.4.7 Setup Tone 25
2.4.8 Setup Format 25
2.4.9 Setup Units 26
2.4.10 Setup Savuser 26
2.4.11 Setup Clock 26
2.4.12 Setup Review 27
2.5 Special 27
2.5.1 Special Ident 27
2.5.2 Special SPrOn 27
2.5.3 Special SPrOff 27
2.5.4 Special SetBaud 27
2.5.5 Special Status 27
2.5.6 Special Start 27
2.5.7 Special Stop 27
2.5.8 Special Comspec 28
2.5.9 Special ComAll 28
2.5.10 Special SPrAll 28
2.5.11 Special S-Load 28
2.5.12 Special Version 28
2.5.13 Special Model 28
2.5.14 Special Serial 28
2.5.15 Special Beep 28
2.5.16 Special Relays 28
2.6 Infrared Printer 28
Alpha Energy Spectrum 29

3. BASICS OF RAD7 TECHNOLOGY: 30
HOW IT WORKS 30
3.1 Introduction 30
3.2 Radon Decay Chain 30
Radon and Thoron decay chains 31
3.2.1 Radon-222 (Radon) 32
3.2.2 Radon-220 (Thoron) 32
3.3 Continuous Monitors 32

3.4 Sniffers 33
3.5 Working Level 33
3.6 RAD7 Solid-State Detector 34
3.6.1 RAD7 Calibration and Data Correction 34
3.7 RAD7 Spectrum 35
3.8 Windows 36
3.9 Isotope Equilibrium 37
3.10 Modes: Sniff and Auto 38
3.11 Background 38
3.11.1 Short-lived Radon and Thoron Daughters 39
3.11.2 Adsorbed Radon Gas 39
3.11.4 Long-lived Radon Daughters 39
3.11.5 Contamination by Radon, or Thoron, Producing Solids 39
3.11.6 Other Alpha Emitters 39
3.11.7 Beta and Gamma Emitters 40
3.12 Precision & Accuracy 40
3.12.1 Dry operation 40
Table: 3.12 Typical RAD7 precision based on counting statistics only. 40
3.12.2 Humidity Correction 41
3.12.3 Concentration Uncertainties 41
3.13 Spectrum Examples 43
3.13.1 Operational Radon Spectra 43
3.13.2 Thoron Spectra 44
3.13.3 Combination Spectra 45
3.13.4 Pathological Spectra 47

4. USING THE RAD7: 49
RADON AND THORON MEASUREMENT IN AIR 49
4.1 Introduction 49
4.2 Continuous Monitoring 49
4.2.1 Preparation 49
4.2.2 Purging 49
4.2.3 Test Location 50
4.2.4 Test Protocol 50
4.2.5 To Print Or Not To Print 50
4.2.6 Running the Test 51
4.2.7 Security and Quality Control 51
4.2.8 Finishing the Run 51
4.2.9 Examining the Data 52
4.2.10 Very Short Term Monitoring 52

4.3 Sniffing 52
4.3.1 *Why Sniff?* 52
4.3.2 *Locating Radon Entry Points* 53
4.3.3 *Preparation* 53
4.3.4 *Purging* 53
4.3.5 *Running the Test* 53
4.3.6 *Drilled Sampling Points* 54
4.3.7 *Spot Readings* 54
4.4 Grab Sampling 54
4.4.1 *Applicability* 54
4.4.2 *Preparation* 54
4.4.3 *Protocol* 55
4.4.4 *Taking the Sample* 55
4.4.5 *Analysis* 55
4.5 Thoron Measurement 55
4.5.1 *Thoron and Radon* 55
4.5.2 *Thoron Measurement Issues* 55
4.5.3 *Calculation and Interference Correction* 56
4.5.4 *Avoiding Longer Lived Decay Products* 56
4.5.5 *Decay Correction, Flow Rate, and Thoron Calibration* 57
4.5.6 *Calculating Sample Decay* 57
4.5.7 *Calculating Internal Cell Concentration* 57
4.5.8 *Internal Cell Thoron Sensitivity Calibration* 57
4.5.9 *Setting up a Thoron Measurement* 57
4.5.10 *Thoron Mode* 58
Recommended RAD7 Thoron Configuration **58**
4.6 Managing Background 59
4.7 Harsh and Hazardous Environments 59
4.7.1 *Splashing Water* 59
4.7.2 *Dusty Environment* 59
4.7.3 *Radiation Hazard* 60

5. USING RAD7 ACCESSORIES: 61
TESTING FOR RADON IN THE GROUND AND WATER **61**
5.1 Introduction 61
5.2 Radon in Water 61
5.2.1 *The RAD H2O Accessory* 61
The RAD H2O Accessory **61**
The RAD AQUA Accessory **61**
5.2.2 *The RAD AQUA Accessory* 62
5.2.3 *The WATER PROBE Accessory* 62
5.3 Soil Gas Sampling 62
5.3.1 *Application* 62
5.3.2 *The Soil Gas Probe Accessory* 62

5.3.3 *Soil Gas Probe Preparation* 62
5.3.4 *Running the Test* 63
5.3.5 *Interpreting the Data* 63

5.4 Emission Measurements 63
5.4.1 *Application* 63
5.4.2 *Open or Closed Loop Configurations* 63
5.4.3 *Bulk Emissions* 64
5.4.4 *Surface Emission* 64
The Bulk Emission Chamber 64
The Surface Emission Chamber 64

5.5 Supporting Accessories 65
5.5.1 *Overview* 65
5.5.2 *The Range Extender* 65
The Range Extender 65
5.5.3 *The DRYSTIK* 65
The DRYSTIK (Model ADS-3R) 66

6. PC Connectivity 67

6.1 PC Connectivity Basics 67
Connecting the RAD7 to a computer 67

6.2 CAPTURE Software 68
CAPTURE Software running in Windows 7 68
6.2.1 *CAPTURE Installation* 68
6.2.2 *Feature Summary* 69
6.2.3 *Downloading RAD7 Data* 69
6.2.4 *Graphing and Analysis* 69
6.2.5 *Real-Time RAD7 Monitoring* 69

6.3 RAD7 Communication Protocol 70
6.3.1 *Communication Requirements* 70
6.3.2 *RAD7 Command Format* 70
6.3.3 *Parsing RAD7 Data* 70
RAD7 Data Record Content: 71
6.3.4 *Terminal Emulator Tips* 72

6.4 Serial Port Specifications 72
6.4.1 *Communication Protocol* 72
RAD7 Serial Port Pin Assignments 72
RAD7 Communication Parameters 72
6.4.2 *Extending the RS-232 Range* 72

7. Maintenance 73

7.1 Accessories - Usage and Care 73
7.1.1 *Desiccant* 73
7.1.2 *Laboratory Drying Unit* 73
7.1.3 *Small Drying Tube (small tube)* 73

7.1.4 Cascading Drying Tubes *74*
7.1.5 Filters *74*
7.1.6 Batteries *74*
7.1.7 Real-time Clock and Non-volatile Memory *75*
7.1.8 Printer and Adapter *75*
7.2 Operating ranges 75
Table 7.2 RAD7 Operating Ranges **75**
7.3 Service and Repair 76
7.3.1 Calibration *76*
7.3.2 Repair *76*
7.3.3 Shipping *76*
7.3.4 Upgrades *76*
7.4 RAD7 Quality Assurance 77
7.4.1 Spectrum *77*
7.4.2 Spill Factor *77*

8. TROUBLESHOOTING 78
8.1 Display 78
8.1.1 Blank Display *78*
8.1.2 Frozen Display *78*
8.1.3 Incomplete Or Garbage Characters *78*
8.2 Readings 78
8.2.1 No Counts *78*
8.2.2 Excessive Uncertainty In Reading *78*
8.2.3 Run/Cycle Number 0000 ..... *78*
8.3 Relative Humidity high 78
8.4 Water Catastrophe 79
8.5 Battery Voltage Low 79
8.6 Pathological Values and Error Messages 79

Appendix: RAD7 Specifications 80
Part 1 Functionality 80
Part 2 Technical Specifications 80
Part 3 Physical Specifications 81

INTRODUCTION

The RAD7 is a highly versatile instrument that can form the basis of a comprehensive radon measurement system. It may be used in many different modes for different purposes. This manual adopts a progressive approach, in which there is, first, a simple, step-by-step description of how to get readings for a) real-time monitoring, and b) sniffing. Next comes a more detailed description of the many features of the instrument and how to access them. The rest of the manual covers a whole range of topics, in somewhat arbitrary order. We recommend that, as soon as possible, you read the entire text, just so that you will have an idea of what there is. While you can start to make good measurements on the first day of ownership of the RAD7, it can take years to master the subtleties of radon and thoron behavior, and to appreciate the full capabilities of the instrument.

We have tried to make the manual easy to use, with a useful table of contents. Please let us know how well we have succeeded. If there are some topics inadequately covered, please tell us. We will issue updates from time to time.

Points of special note

The RAD7 is a rugged and long-lasting piece of equipment. There are many units still in daily use that were sold ten years ago or more. However, it is a sophisticated, precision electronic device, and it is not hermetically sealed, so please treat it with respect. Please do not allow water, other liquids or dirt to get into the machine. If using it somewhere where it may get splashed, damaged, or exposed to rain, please protect it. See Chapter 4.7.1.

The batteries are lead-acid technology, like a car's. If left in a discharged state they will lose capacity. After running the RAD7 on its batteries please recharge them as soon as possible (by plugging in the unit). With careful use the batteries will last five years or more.

Finally, there is one security feature that is sometimes inadvertently set by an inexperienced, though authorized, user; namely the key pad lockout. If the key pad ceases to function, and all you see is `DURRIDGE RAD7` on the display, just do the following: Hold down the `[ENTER]` and two arrow keys until you hear a beep, release the three keys and immediately push `[MENU]`. You should then be rewarded by `>Test` on the display. If the tone was set to `OFF`, then you will not hear the beep, so hold the three keys down for three to four seconds, before releasing them and pushing `[MENU]`, - try hold-down times a little longer, or shorter, if, at first, you do not succeed.

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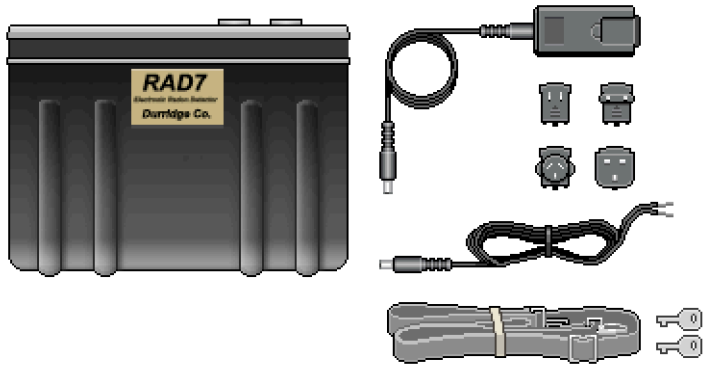
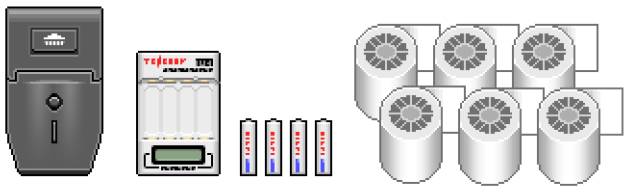
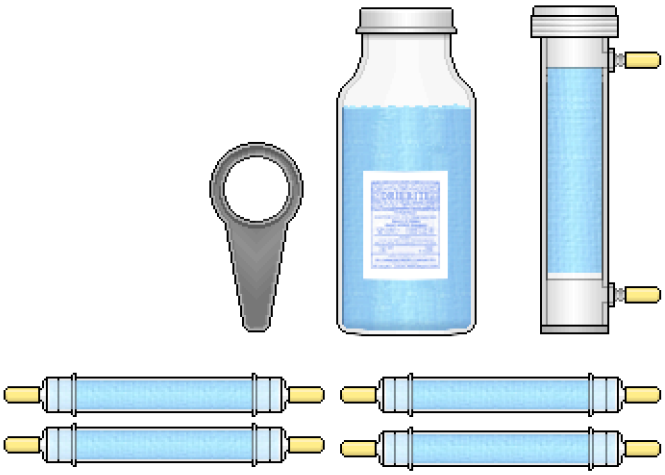
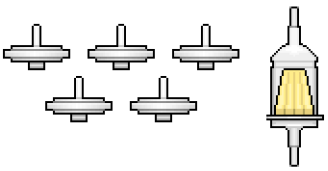
1. GETTING STARTED:
YOUR FIRST DAY WITH THE *RAD7*

1.1 Unpacking

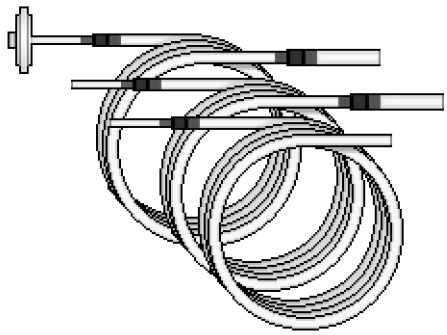
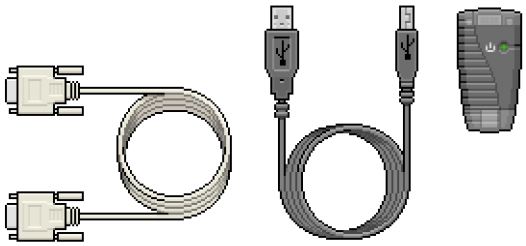
First make sure you have everything you are supposed to have. Take the materials out of the packing boxes and see if you have all the items shown in the diagram below, or on the packing list enclosed with the shipment. If anything is missing, please email DURRIDGE immediately or call us at (978) 667-9556.

RAD7 Packing List

	**RAD7 and Case Accessories** •RAD7 electronic radon detector •12V adaptor w/ 4 plugs • 12V cord for custom applications •RAD7 Carrying Strap •Keys for RAD7 case
	**RAD7 Printer Supplies** •Newhandy infrared printer •Battery Charger •4 Rechargeable AA batteries •6 Rolls printer paper
	**Drying Tubes and Desiccant** •Gas drying unit •Opener tool for drying unit •5 lbs desiccant •4 drying tubes
	**RAD7 Filters** •5 RAD7 inlet filters •1 Dust filter

(Continued on next page.)

RAD7 Packing List (Continued)

	**Vinyl Tubing Set (3ft x 3)** •From sample to drying tube •From drying tube to RAD7 inlet •From RAD7 outlet to exhaust
	**USB/Serial Supplies** •Null modem cable •USB Cable •Keyspan USB-19HS serial adaptor
	RAD7 Documentation Binder •RAD7 User's Manual •Infrared Printer Manual •Additional documentation •DURRIDGE Software CD •DURRIDGE Software USB Stick

1.2 General Safety Instructions

For your own safety and the proper operation of RAD7:

DO NOT spill liquids onto the machine.
DO NOT expose operating panel of machine to rain or any other excess moisture.
DO NOT allow liquid to be sucked into inlet tube.

If you intend to use the instrument in a harsh environment, give it some protection. Even just a transparent plastic bag enclosing the RAD7 (but not the air sampling tube) can protect it from splashing mud and water. Allowing the dry air from the RAD7 outlet to exhaust into the interior of the bag will keep the RAD7 in a clean and dry environment.

If liquid does get into the machine, please disconnect the power cord, turn off the power switch, and follow the instructions in Chapter 4.7.1, Harsh and Hazardous Environments: Splashing Water. It will be necessary to return the RAD7 to DURRIDGE for repair.

Do not use your RAD7 if the instrument is damaged or malfunctioning. Please call, or email, the DURRIDGE service department, who will advise what to do about the problem.

Replace a frayed or damaged power cord immediately. Electrical equipment may be hazardous if misused. Keep away from children.

Do not open or attempt to repair the machine. The detector has an internal high voltage supply that can generate more than 2,500V.

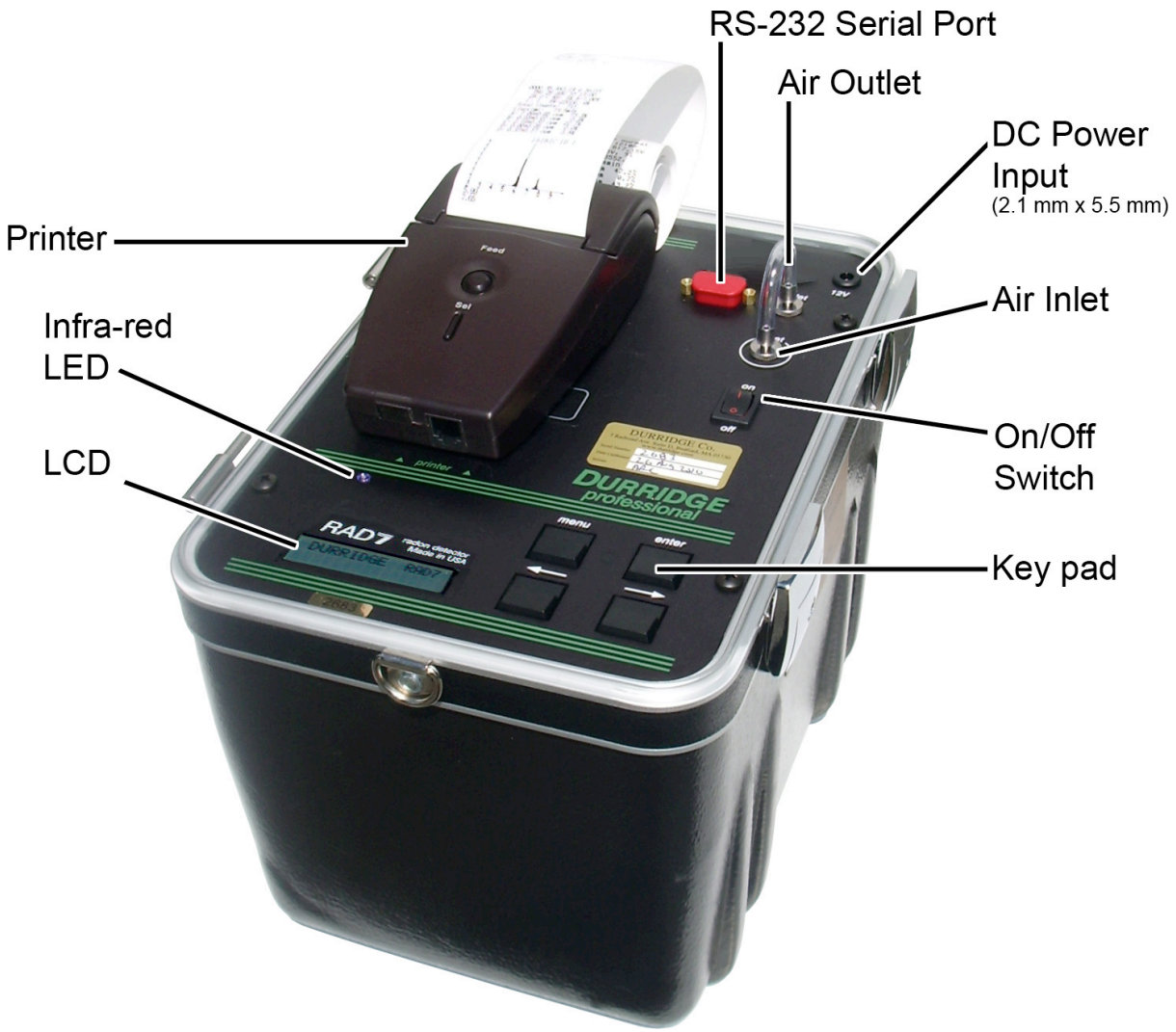
The batteries are Gates Monobloc type 0819-0012, 6V 2.5Ah. There are two installed in the instrument. They are not user replaceable.

1.2.1 Air Travel

The RAD7 is safe to take on an airplane either as carry-on or checked baggage. It is probably easiest, and least likely to cause problems, if it is put inside a suitcase, with clothes, and checked in.

Some airlines and some airline staff are concerned about lead-technology batteries, such as those in the RAD7. An MSDS sheet, issued by the battery manufacturer, is enclosed with the manual in the RAD7 documentation. A copy of that should be carried and presented when requested, when traveling with a RAD7 by air.

1.3 Taking a Look



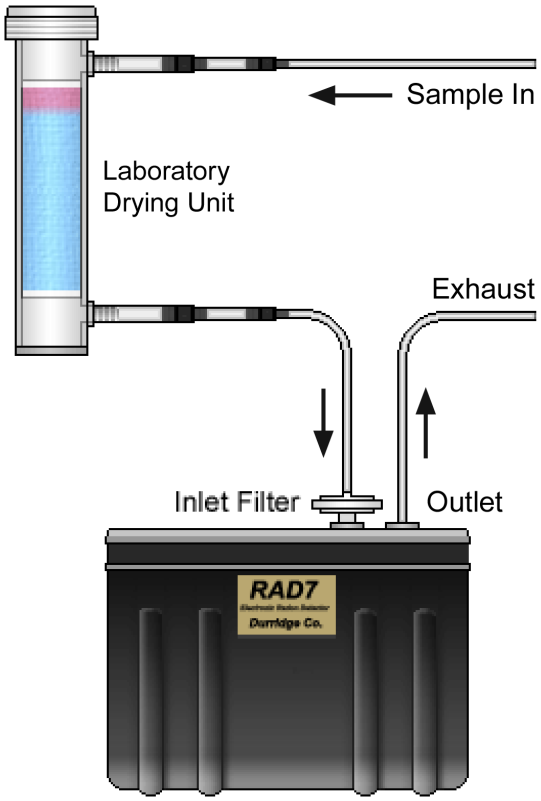
The RAD7 Professional Electronic Radon Detector

1.4 Starting a Two-day Test

You will need the RAD7 and power cord, the Laboratory Drying Unit (the large tube of desiccant, with a screw cap at one end), an inlet filter (one of the six small filters supplied), the piece of tubing with a 5/16" ID segment at one end and a ⅛" ID segment at the other and the printer.

On first starting up, you may need to set the clock for your time zone (See Setup Clock, Chapter 2.4.11). Switch on the RAD7, push [MENU], then push [➔] twice. You will see Setup on the display. Push [ENTER], then push [➔] ten times. You will see Setup Clock. Push [ENTER]. Use the arrow keys to adjust hours, minutes, seconds, day, month and year, pushing [ENTER] to confirm each setting. Now we are ready to continue.

RAD7 Normal Configuration



DURRIDGE RAD7
Radon Monitor

a) Attach the filter to the tubing (push it into the end with the insert).

b) Carefully remove both plastic caps from the Drying Unit (you will need them later, to reseal the unit). Attach the sleeved end of the tubing to the tube fitting, on the Drying Unit, farthest from the screw cap.

c) Attach the filter to the Inlet port of the RAD7. The air sampling system is now set up for the measurement. (See RAD7 Standard Configuration diagram at left.)

d) Plug in the RAD7 and switch on.

e) Push [MENU], [ENTER], then push [➔] four times. You should see on the LCD display: Test Purge.

f) Push [ENTER]. The pump should start.

g) Set up the printer (insert paper and batteries - see manual).

h) Place printer between green lines on face plate (See photo, Chapter 1.3).

i) After purging for some time (normally, at least five minutes), push [MENU], and [➔] two times, you will see: Setup on the display.

j) Push [ENTER] twice, then push either arrow key repeatedly until you see:
Protocol: 2-Day on the display. Push [ENTER].

k) With Setup on the display, push [ENTER], then [➔] seven times, to see >Setup Format on the display. Push [ENTER] then use arrow keys to select Format: Short. Push [ENTER].

l) Switch off the RAD7. Switch on the printer, now switch the RAD7 back on. The printer will print out something like the following:

```
DURRIDGE RAD7
Vers 2.5f   991128
Model 711
Serial 00512
Calib 21-MAY-13

Last used
```

```
   FRI 21-MAY-13  17:30

Current settings
   FRI 21-MAY-13  19:09

Protocol: 2-Day
Cycle: 01:00
Recycle: 48
Mode: Auto
Thoron: Off
Pump: Auto
Tone: Geiger
Format: Short
Units: pCi/L   C
```

m) Push [MENU], [ENTER], [➔]. You should see on the LCD display: >Test Start

n) Push [ENTER]. The pump will start running. On the LCD display you will see something like:

```
0101        Live     Sniff
00:59:37             00001
```

You are now monitoring the radon level right where you are. Every hour, the printer will print out a reading something like this:

```
0102   2.69  " 0.73  p   Sniff
   FRI  21-MAY-13    19:41
   26.8 C   RH: 7%   B:7.06V
```

Where 0102 are the run (01) and cycle (02) numbers, 2.69 is the measured radon concentration, 0.73 is the two-sigma STATISTICAL uncertainty, p indicates the units (in this case pCi/L), and Sniff shows that, for this reading, only the Po-218 decays are being counted (after three hours, the mode changes automatically to Normal). The second line is clearly the date and time, while the third shows the temperature and humidity inside the measurement chamber, and the battery voltage. Medium and Long format settings print more information each cycle.

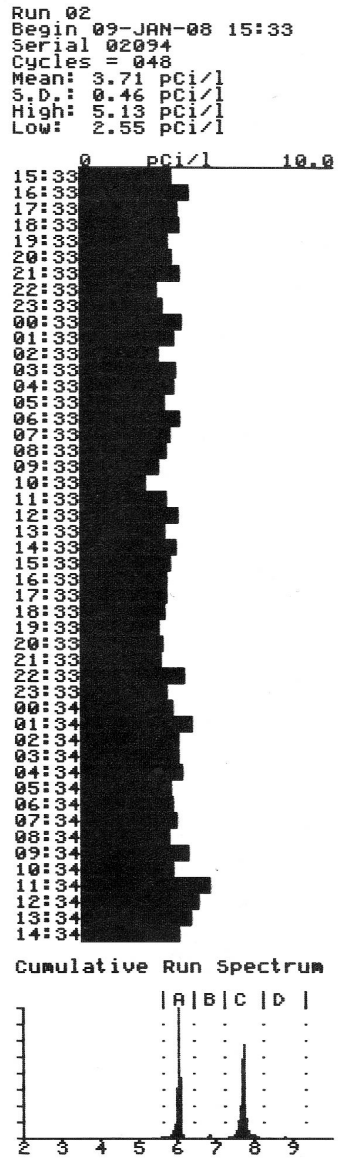
If you allow the RAD7 to complete a run, it will print out a summary of the entire run, including:

1. Date and time
2. Machine serial number
3. Average value for the test
4. Bar chart of the individual readings, and
5. Cumulative alpha energy spectrum.

In the example shown it may be seen that the average level was 3.71 pCi/L, or 137 Bq/m^3.

To terminate the run early, you may switch off the RAD7. The data collected, to the end of the last completed cycle, is automatically stored in the RAD7 memory, and available for later display, printing or download to a PC. If you wish to store the last, incomplete cycle data as well, use Test Save before switching off the RAD7. When you do this, the end-of-run printout does not take place. The summary is stored in memory and may be printed at any time, except that the cumulative spectrum, which would have been printed out at the end of the run, is lost.

End-of-Run Printout



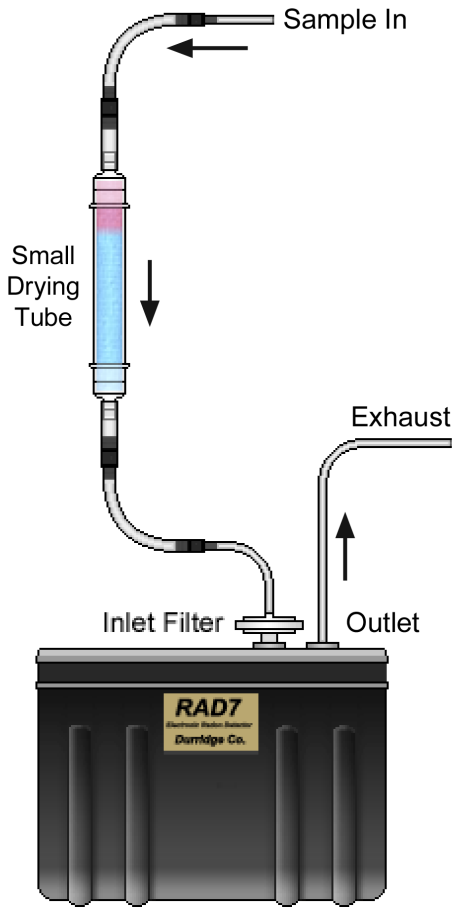
1.5 Starting a Sniff Test

Sniffing lets you make quick, qualitative surveys of radon and thoron levels. It may be used to search for radon entry points. There are some advantages in sniffing for both thoron and radon at the same time, (see Chapter 3.13.3), so that is the procedure described here.

You will need the same equipment as for the 2-day test, above, except that a small drying tube should be used, instead of the laboratory drying unit. Also, for portability, you may remove the external power from the RAD7, and run the RAD7 on its batteries.

If you have not already done so, set the clock, as described above.

RAD7 SNIFF Configuration



DURRIDGE RAD7
Radon Monitor

a) Attach the filter to the tubing (push it into the end with the ⅛" ID segment)

b) Carefully remove both plastic caps from the small drying tube (you will need them later, to reseal the unit). Attach the 5/16" ID end of the tubing to one end of the tube.

c) Attach the filter to the Inlet port of the RAD7. Make sure it is firmly fit onto the inlet. The air sampling system is now set up for the measurement. While testing, you can use the small drying tube as a wand, to collect your air sample from the location of interest.

d) Plug in the RAD7 and switch on.

e) Push `[MENU]`, `[ENTER]`, then push `[➔]` four times. You should see on the LCD display: Test Purge.

f) Push `[ENTER]`. The pump should start.

g) Set up the printer.

h) Place printer between green lines on the face plate (See photo, Chapter 1.3).

i) After purging for a few minutes push `[MENU]`, and `[➔]` two times, you will see: `>Setup` on the display.

j) Push `[ENTER]` twice, then push either arrow key repeatedly until you see: `Protocol: Thoron` on the display. Push `[ENTER]`. (See Chapter 2.4.5 for difference between Thoron and Sniff protocols).

k) With Setup on the display, push `[ENTER]`, then `[➔]` seven times, to see Setup Format on the display. Push `[ENTER]` then use arrow keys to select `Format: Short`. Push `[ENTER]`.

l) Switch off the RAD7. Switch on the printer, now switch the RAD7 back on. The printer will print out something like the following:

```
DURRIDGE RAD7
Vers 2.5f   991128
Model 711
Serial 00512
Calib 21-MAY-08

Last used
   WED 23-MAY-08  17:30

Current settings
   FRI 25-MAY-08  19:09

Protocol: Thoron
Cycle: 00:05
Recycle: 00
Mode: Sniff
Thoron: On
Pump: Auto
Tone: Geiger
Format: Short
Units: pCi/L   C
```

m) Push [MENU], [ENTER], [➔]. You should see on the LCD display: `>Test Start`
n) Push [ENTER]. The pump will start running. On the LCD display you will see something like:

```
0201        Live     Sniff
00:04:37             00001
```

You are now sniffing for thoron and radon. Every five minutes, the printer will print out a reading something like this:

```
0203  2.69  " 2.83   p  Sniff
      1.68  " 2.15   p  Thoron
   FRI  21-MAY-99     19:41
   26.8 °C   RH: 7%   B:7.06V
```

Where 0203 are the run (02) and cycle (03) numbers, 2.69 is the measured radon concentration, 2.83 is the two-sigma STATISTICAL uncertainty, p indicates the units (in this case pCi/L), and Sniff shows that, for this reading, only the Po-218 decays are being counted. The second line is the measured thoron concentration and uncertainty. The third line is now the date and time, while the fourth shows the temperature and humidity inside the measurement chamber, and the battery voltage. Medium and Long format settings print more information each cycle.

Note that the Po-218 has a 3-minute half life. After moving to a new location, it will take about 15 minutes for the count rate to reach equilibrium with the new radon concentration. So not until after the third 5-minute cycle will the reading indicate the new level. However, the thoron daughter, Po-216, has a very short half life (150 ms), so the response of the RAD7 to thoron is virtually instantaneous. For thoron, the first 5-minute cycle is as good as any other.
Thoron will only be found very close to radon entry points. That, together with its fast response, makes thoron sniffing an excellent sleuth for radon entry points.

To terminate the run any time, you may switch off the RAD7. The data collected, of completed cycles, is stored in the RAD7 memory, and available for later display, printing or downloading to a PC.

2. BASICS OF *RAD7* OPERATION

2.1 Introduction

2.1.1 The Key Pad

The RAD7 is operated through a four-key menu-driven interface. These four keys allow you to look at the commands, select one, and then do it.

Menu Key

Press [MENU] and you see the menu prompt (>) and the word Test:

```
>Test
```

Arrow Keys

Press the forward and backward arrow keys to go through the available options. To advance quickly through the options, hold down the key so that it "auto-repeats."

The arrow keys allow you to move right and left through the various commands, looking for the action you want.

Enter Key

When you have decided on a certain menu option, you select it by pressing [ENTER]. The enter key tells the RAD7 that you have made your selection. You are telling it what you want it to do.

The enter key makes it happen.

2.1.2 Command List

The RAD7 command list has four command groups: Test, Data, Setup and Special. The Test group of commands controls the collection of new radon data. The Data group retrieves data from memory, outputs them, and gets rid of old, unwanted data. The Setup group prepares the RAD7 to operate according to your requirements. The Special group is a set of commands that are available when RADLINK, the remote control software, is loaded.

2.2 Test

The Test group of commands controls the collection of radon data and allows you to manipulate the current test (test-in-progress). You can start and stop data collection, save or clear the current test, or print the current test as it stands. (The Test commands do not allow access to stored data. You have to go to Data for that.)

2.2.1 Test Status

To see the status display, enter the Test Status command. Press [MENU], [ENTER], [ENTER]

On the LCD display, you will see:

```
0501        Idle     Sniff
00:30:00             00000
```

On the upper left, you see the current run number/ cycle number (0501 - run 05, cycle 01.).

The middle shows the detector status (Idle or Live), and the upper right gives the current test mode (Sniff, Normal or Grab). (Note that in AUTO mode, the indication will change from Sniff to Normal after three hours of measurement.

Lower left shows the count-down timer (00:30:00 = 30 minutes) which counts down to zero when the detector is Live (i.e., a test is in progress). The lower right shows the total number of counts since the beginning of the current cycle.

The arrow keys may now be used to access additional status information.

Press [➔] once, and you will see something like this:

```
Last reading:
0409  1.80 " 0.74 p
```

The lower left is the run number (2 digits) and cycle number (2 digits) of the last completed cycle stored to memory.

The lower right is the radon reading and two-sigma statistical uncertainty, followed by "p",

indicating picoCuries/liter, or "b" for Becquerels/ cubic meter.

When a cycle ends, the information on this display is updated. If there have been no readings yet, the display will show

```
No readings yet.
```

Press [➔] once again, and now you will see something like this:

```
24.8°C      RH:3%
B: 6.36V    P:  00mA
```

Top left is the internal temperature. (To change from Celsius to Fahrenheit, see Chapter 2.4.9, Setup Units.)

Top right shows the internal Relative Humidity reading. When testing, maintain this value at 10% or less, by using the desiccant.

Bottom left is the battery voltage. This should range from about 6.00V to 7.10V. A discharged battery (less than 6.00) should be recharged as soon as possible. A fully charged battery will rest at 6.40 to 6.50 V. During a recharge, the voltage will eventually rise above 7.00 V. At no time should this read higher than 7.20V. In the lower right is the pump current. This number should vary from 00mA (pump off) to 80mA. When the pump is running with a light load, the current will range from 40-70mA. When the pump is running with a heavy load (clogged filter or blocked hose), the current will go to 90mA or higher. Pump currents above 90mA are considered a sign of trouble. Try changing the filters and check for blockage.

Press [➔] again, and you will see something like this:

```
HV:  2218V,  10%
L:   02       S:  0.21V
```

This is a display of diagnostic values. Ordinarily it will be of little interest to you.

The top line is the high voltage reading and duty cycle. The range of normal values is from 2000 to 2500V, and from 8% to 18%.

The lower left corner is the leakage current. At room temperature, this value will normally range from 0 to 10. Higher temperatures ordinarily cause this value to rise. Excessive leakage current will result in "noise" in the lower energy end of the spectrum, and will also cause broadening of the alpha peaks.

The lower right corner is the signal voltage from the analog circuit. This number should be "stable"; that is, fluctuations should be no more than " 0.05V from the average value.

Press [➔] yet again, and you will see something like this:

```
w  |  cpm   | +/-    |  %tot
A  |  6.0   |  4.3   |  48.8
```

This is the display for the A window data. You may press [➔] to advance to B, C, D, etc.

The RAD7 records 8 windows (A - H) every time you make a measurement. They separate counts due to daughters of radon and thoron, and the background. Specific alpha particles end up in specific windows.

W: The window letter.
cpm: The counts per minute observed in the window.
+/-: The two-sigma statistical uncertainty of the cpm value, also in units of cpm.
%tot: The number of counts in the window as a percentage of the total counts in the spectrum. This tells you quickly where the majority of the counts are: In the 3-minute radon peak (window A), or the long-lived radon peak (window C), etc.

As always, you press the [MENU] key to exit this display and return to the start of the menu.

2.2.1a Quick Save-and-Restart

This function allows the user to end a sniff test, store it to memory, and start up a new sniff test, all using a single key. It operates only from the SNIFF mode.

From the status display (showing the countdown timer), press the [ENTER] key once. The display will show:

```
Save and restart
```

```
? Yes
```

Press the [ENTER] key once more to confirm your intention. To escape, push the [MENU] key or push an arrow key to select “No” and push [ENTER].

2.2.2 Test Start and Test Stop

To start testing (or "counting"), after you have chosen the required setup, go to >Test Start by pressing [MENU], [ENTER], [➔], and then [ENTER]. The display will indicate that counting has begun:

```
Start counting.
```

One second later, the Status display will appear with the countdown timer in motion:

```
0501        Live     Sniff
00:29:37             00001
```

When the countdown reaches zero, the RAD7 will automatically calculate the radon concentration, store (or "save") the counts to memory, and clear the counters to begin a new cycle.

To interrupt the measurement, go to >Test Stop by pressing [MENU], [ENTER], [➔], [ENTER].

The display will respond:

```
Stop counting.
```

After one second, the display will go back to the top of the menu >Test.

You may wish to examine the Status display to verify that the status is Idle.

To resume testing from exactly the same point in the cycle where you stopped, select >Test Start as described above.

Note that Stop does not terminate the run, it is a pause. If you do not wish to resume testing from the same point, you should select either >Test Save or >Test Clear before continuing. This will terminate the suspended test, store it to memory (Save) or wipe it out (Clear), and clear the counters to begin a new run.

2.2.3 Test Save

The >Test Save command suspends counting and saves the suspended test (test-in-progress) to memory as if it had reached completion. Test Save completes the current run, so any subsequent test data will be stored as a new run. The display momentarily shows the run and cycle number in the form of 0101 Saved. This command may be accessed whether the status is Live or Idle. It always leaves the status Idle.

You will find this command especially useful when you wish to move the instrument to another location without waiting for the countdown to reach zero, but without losing that last incomplete cycle. The calculated radon concentration from the incomplete cycle is still good.

2.2.4 Test Clear

The >Test Clear command causes counting to be suspended and the current run to be completed without saving the last (suspended) incomplete cycle. Subsequent test data will be stored as a new run. You must answer Yes to the question Are you sure? in order to activate this command.

This command may be accessed whether the status is Live or Idle. It always leaves the status Idle.

2.2.5 Test Purge

The >Test Purge command suspends counting and begins purging the detector. The pump begins running and the high voltage circuit turns off in order to clear the sample chamber of radon gas and daughters as quickly as possible. You must provide clean, desiccated, radon-free air to the inlet in order to push out any radon that was previously sampled. Outdoor air is usually adequate for this purpose.

As always, use the inlet filter and drying tube. Ten minutes is usually sufficient for bringing the background down after exposure to moderate amounts of radon.

In order to dry out the RAD7 without using up much desiccant, connect the hoses from the RAD7 to the drying unit, as a loop. When the pump runs, the same air will circulate repeatedly through the desiccant. This procedure will

efficiently remove residual moisture from the RAD7. This does not introduce any fresh air, and so does not change the radon level in the instrument, but you can make a measurement of the background while it is set up in this configuration.

To end the purge, answer `Yes` to the question `Stop purge?` which appears on the display. Alternatively, you may push `[MENU]` to end the purge.

2.2.6 Test Lock

If you push `[ENTER]` when this is displayed, it will lock the key pad. The LCD display will just show:

```
DURRIDGE RAD7
```

Nobody will be able to unlock the key pad, unless they know the secret.
If the key pad was locked during a measurement, then the readings will continue as normal, with the RAD7 recording all the data, until the end of the run.

Switching the unit off, while locked, will stop the measurement, but the key pad will still be locked when the RAD7 is switched on again.

To unlock the key pad, hold the `[ENTER]` and both arrow keys down, all together, for 3 - 4 seconds, or until the unit beeps, then release the three keys and push `[MENU]` immediately.

2.2.7 Test Sleep

The `>Test Sleep` command allows you to turn off most of the electronic circuits, with the power switch on, in order to conserve battery charge. A fully charged RAD7 should be able to "sleep" for about one week on batteries alone. Press the menu key to "wake up" the RAD7.

The Sleep function was for older models that did not have the Real Time Clock (RTC) and Non-Volatile Memory (NVRAM) options. New and upgraded instruments may be shut down completely, power switch off, without losing any stored data or clock.

2.2.8 Test Print

The `>Test Print` command calculates results for an incomplete or suspended test cycle and prints them according to the print format that is currently set.

Spectrum output is available by selecting `>Setup Format Long` beforehand.

If you wish to abort printing, press the `[MENU]` key. The run number and cycle number that ordinarily appear on printed data are replaced by 0000 to signify that the cycle is not completed.

2.2.9 Test Com

The `>Test Com` command outputs the results for an incomplete test cycle to the serial port.

If you wish to abort output, press the menu key. The run number and cycle number that ordinarily appear with the data are replaced by 0000 to signify that the cycle is not completed.

2.3 Data

The Data group of commands retrieves data from memory, displays it, prints it, reports it graphically, and outputs it to the serial port. The Data group also includes commands for managing memory. The memory will hold the data for 1,000 cycles, in up to 100 runs.

Many commands in the Data group require you to enter a two-digit run number after the command. The "default" run number (the one automatically set if you do nothing) is the run number of the last complete cycle of data stored. The arrow keys allow you to select any other run number.

2.3.1 Data Read

Select `>Data Read` followed by a two-digit run number, to examine radon readings from that particular run. For example, select `>Data Read 01` to examine readings from run number 01, the first test in memory.

You will see something like this:

```
0101  23.3 " 1.54 p
  11:45     19-MAY-99
```

Line 1 is the run/cycle number followed by the radon concentration, two-sigma uncertainty, and unit indicator. This example shows:

Run 01, Cycle 01, 23.3 " 1.54 pCi/L.

Line 2 is the time (24-hour military time) and date the reading was completed.

Press [➔] to advance to the next reading in memory; press the backward arrow to go back to the previous reading.

To quit examining data, press [ENTER] or [MENU].

Note that large numbers are presented in shorthand notation. The symbol “K” stands for 1,000 and “M” stands for 1,000,000. For example, 33K2 stands for 33,200.

2.3.2 Data Print

To print out a run of data from memory, select >Data Print followed by the two-digit run number. For example, to print the data from run number 05, select >Data Print 05.

If the printer format has been set to Short, the following printout will be made for each cycle of the run:

```
0501  2.69  " 2.83   p        Sniff
   FRI  21-MAY-99   19:41
   26.8 EC   RH: 7%   B:7.06V
```

Line 1 is the run/cycle number, the radon concentration, the two-sigma uncertainty, the units indicator (p=picoCuries per liter, B=Becquerels per cubic meter), and the mode indicator.

Line 2 is the date and time that the cycle was completed and stored to memory.

Line 3 is the temperature (in either "C" Celsius or "F" Fahrenheit), relative humidity (internal), and battery voltage at the time the cycle ended.

If the printer format has been set to Medium or Long, then you will see a printout like this for each cycle:

```
0501  2.69  " 2.83   p        Sniff
   FRI  21-MAY-99   19:41
   26.8 EC   RH: 7%   B:7.06V
Total Counts:     42.
Livetime:   27.8min
A: 0.53"0.08      cpm         47.3%
B: 0.02"0.02      cpm         1.7%
C: 0.52"0.08      cpm         46.4%
D: 0.01"0.02      cpm         0.9%
O: 0.04"0.03      cpm         3.6%
```

Lines l, 2 and 3 are the same as in Short format, as outlined above. Line 4 is the total number of counts detected during the cycle.

Line 5 is the livetime, the time that the detector was actively collecting data.

Lines 6 through 10 are the windows data for windows A, B, C, D, and O. (O is the consolidated window for "others", or counts that are not included in windows A through D.)

Each line of windows data contains the window letter (A, B, C, etc.) followed by the window's counts per minute (cpm), two-sigma statistical uncertainty of the counts per minute, and percent of the total counts included within that window.

NOTE: The RAD7 does not store spectra from old cycles, so no spectra will print from memory even if the printer format is Long. If you need a spectrum, be sure you print while the test is still running.

If no data are available to print, the RAD7 will beep and display No tests stored.

To abort a printout, press the menu key, then press the printer paper advance button.

2.3.3 Data Com

The RAD7 has an RS232 port that can transfer data to your computer. Status must be Idle.

To send a run of data to the serial port, select >Data Com followed by the two-digit run number. When ready, push [ENTER].

The following message will appear on the display as the data is sent:

```
Data transfer ...
```

When the data transfer finishes, the RAD7 will beep.

To enable your PC to receive data, appropriate software should be running. A terminal emulation program, or CAPTURE, the data link software provided with the RAD7, may be used. See Chapter 6 for more details on data communication.

2.3.4 Data Summary

To print a summary report and time graph of a run's data, select `>Data Summary` followed by the two-digit run number. The following information will be printed:

```
Run 31
Begin 01-Jun-99   12:49
Serial      00500
Cycles = 048
Mean: 0.77 pCi/l
S.D.: 0.27 pCi/l
High: 1.41 pCi/l
Low:  0.20 pCi/l
```

where:
Line 1 is the run number.
Line 2 shows the date and time of the first reading.
Line 3 is the serial number of the instrument.
Line 4 is the number of completed cycles in the run.
Line 5 is the arithmetic mean (or "average") of the radon concentrations recorded.
Line 6 is the standard deviation of the readings taken during the run.
Lines 7 and 8 are the highest and lowest radon concentrations.

Following Line 8 is a bar graph of radon concentration through time. Time-of-day is printed along the left-hand edge of the graph. If there is only one cycle of data, the bar graph will not print.

This printout procedure has been programmed into several protocols. When you choose one of the pre-programmed protocols, this report is printed out automatically at the end of the run, together with a cumulative spectrum.

2.3.5 Data Free

To determine the amount of free memory available for storing new radon readings, select `>Data Free`, and push `[ENTER]`.

For about two seconds, the display will look something like this:

```
910 cycles free.
```

The RAD7 can store up to 999 cycles of data. As the memory fills with data, the Data Free indicator decreases. If the Data Free indicator reaches 000, any subsequent attempt to store data to memory will result in a "memory full" error.

Keep your eye on this indicator to avoid embarrassment! When the amount of free memory gets uncomfortably low (i.e. 200 or less), consider deleting un-needed old data to open up space for new data. See Data Delete and Data Erase.

2.3.6 Data Delete

To delete an entire run of data, select `>Data Delete` followed by the two-digit run number.

The display will prompt you for confirmation:

```
Delete run 31?
No
```

Press `[➔]` to find `Yes`, then press `[ENTER]` to delete the run's data from memory and free the space for new data. No other run's data will be affected.

After deletion of a run's data, any attempt to retrieve the data will result in a `No tests stored` message. The main purpose of the Data Delete command is to selectively free up memory space for new tests. Do not confuse Data Delete with Data Erase, which wipes out all runs of data from memory. See also Data Free, Data Renumber, and Data Erase.

2.3.7 Data Renumber

Select `>Data Renumber` to renumber remaining runs into consecutive order after deleting one or more runs. This allows you to free up run numbers for new runs to be added, which is necessary when the run number approaches 99.

Say you have used all 99 runs and you wish to clear out some space for new runs. Furthermore, you have decided that you no longer need the data from runs 01 to 10. Delete these runs using `Data Delete`. Now select `>Data Renumber` to renumber runs. Runs 11 to 99 become runs 01 to 89, leaving 90 to 99 free to take new data.

The Data Renumber command does not free up memory space, only run numbers. The 999 cycle memory limit remains whether or not all 99 runs have been used.

2.3.8 Data Erase

Select `>Data Erase` only if you wish to completely wipe all data from the entire RAD7 memory. Data Erase deletes all runs and resets the current run/cycle number to 0101.

Select `>Data Erase`. The RAD7 will ask for confirmation:

```
Erase all Tests?  No
```

Press [➔] to find `Yes`. Press `[ENTER]` to complete the erasure. Use with caution!

2.4 Setup

The Setup group of commands configures the RAD7 to perform tests according to your needs. The RAD7 remembers all Setup parameters when it is turned off, so access the Setup commands only to change parameters.

Setup includes a 1-step `>Setup Protocol` command to configure the most frequently used parameters (Cycle time, Recycle number, Mode setting, and Pump setting) according to preset "protocols". These standard preset protocols include (None), Sniff, 1-day, 2-day, Weeks (that is, indefinite), User (which lets you preset your own), Grab, Wat-40 and Wat250 (for use with the RAD H_20), and Thoron.

The special command `>Setup SavUser` defines the user protocol according to the current parameter settings.

2.4.1 Setup Protocol

Select `>Setup Protocol` to automatically load in a group of predefined Setup parameters under one of the standardized protocols, or the User protocol. If you do not wish to select a protocol, you may abort the command by pressing the menu key, and no parameters will be changed.

Table 2.4.1 Preset protocols

	Cycle	Recycle	Mode	Thoron	Pump
Sniff	00:05	0	Sniff	Off	Auto
1-day	00:30	48	Auto	Off	Auto
2-day	01:00	48	Auto	Off	Auto
Weeks	02:00	0	Auto	Off	Auto
User	xxx	xxx	xxx	xxx	xxx
Grab	00:05	4	Sniff	Off	Grab
Wat-40	00:05	4	Wat-40	Off	Grab
Wat250	00:05	4	Wat250	Off	Grab
Thoron	00:05	0	Sniff	On	Auto

A Recycle number of 00 indicates indefinite test length. The test ends only if the operator intervenes, or if the RAD7 memory fills.

2.4.2 Setup Cycle

How long a test do you want, and how often do you want the RAD7 to take a reading (a cycle)? A typical radon test is made up of many cycles.

Select `>Setup Cycle` to adjust the Cycle time, or integration time, for a single radon reading. The Cycle time can be adjusted anywhere from two minutes to 24 hours. For continuous monitoring, the Cycle time is usually 30 minutes or longer. For radon sniffing, the Cycle time is usually 5 or 10 minutes. For thoron sniffing, the cycle time may be as little as 3 minutes.

Upon selection of `>Setup Cycle`, push `[ENTER]` and you will see something like this:

```
Cycle:    00:30
```

First, select the number of hours (00 to 23), and press [ENTER]. Then select the number of minutes (00 to 59) and press [ENTER].

Remember that a run includes many cycles in sequence, and the total duration of the radon test is determined by the Cycle time multiplied by the number of cycles, or Recycle number. To adjust the Recycle number, use the >Setup Recycle command.

2.4.3 Setup Recycle

How long a test do you want, and how often do you want the RAD7 to take a reading (a cycle)? You determine the length of your test by choosing both the length and number of cycles. If you make a reading every 30 minutes, you will need 48 cycles to get a 24-hour test. In this case, 48 is the Recycle number.

Use >Setup Recycle to set the total number of cycles in a complete run. Multiply Cycle time by Recycle number to determine the total duration of the run.

Select >Setup Recycle. Push [ENTER] and you will see something like this:

```
Recycle:   48
```

Use the arrow keys to change the Recycle number, and press [ENTER] to complete the selection. Recycle number may be set from 00 to 99.

If 00 is selected, then the number of cycles is assumed to be infinite. Select 00 if you want the RAD7 to collect data indefinitely, or to go beyond the 99th cycle. After the 99th cycle, the RAD7 will then simply start a new run, and continue collecting data. Data collection will stop only when the operator intervenes, or when the memory completely fills up.

2.4.4 Setup Mode

Select >Setup Mode to change the RAD7 mode of operation. Five modes are available: Sniff, Auto, Wat-40, Wat-250, and Normal.

SNIFF mode is used when you want to follow rapid changes of radon concentration. In SNIFF mode, the RAD7 achieves rapid response to changing radon levels by focusing on the 3-minute polonium-218 alpha peak, calculating the radon concentration on the basis of this peak alone.

In NORMAL mode, the RAD7 achieves higher statistical precision by counting both polonium-218 and polonium-214 alpha peaks.

AUTO mode automatically switches from SNIFF mode to NORMAL mode after three hours of continuous measurement. This allows time for the equilibrium of the longer-lived radon daughter isotopes. The earliest part of the run will have the benefit of the SNIFF mode's quick response, while the latter parts of the run will benefit from the NORMAL mode's superior statistical precision.

We recommend that the AUTO mode be used for all screening tests and any tests to measure the average concentration over a period of time. With the AUTO mode there is no need to throw away the first three hours of data, or to calculate adjustments to correct for disequilibrium. The mean concentration reported in the run summary should accurately reflect the actual mean. SNIFF mode should be used where the goal is to follow, and measure, rapid changes in the radon concentration.

Wat-40 and Wat250 make calculations of the radon concentration in 40 mL and 250 mL water samples, respectively. They require the RAD H_2O water accessory kit to aerate the water under the controlled conditions necessary for these calculations.

2.4.5 Setup Thoron

Select >Setup Thoron. Push [ENTER] and you will see:

```
Thoron:   Off
```

Use the arrow keys to toggle between On and Off, and press `[ENTER]` to complete the selection.

With Thoron On, the calculated thoron concentration will be printed during continuous data logging, or in subsequent printing of data. Also, if the pump is in AUTO mode, it will be directed to pump continuously during the thoron measurement.

Note that the thoron calculation assumes a standard setup for the measurement. A small drying tube, three feet of vinyl tubing, and the inlet filter, should be used. Typically, the small drying tube is held in the hand, and used as a wand. If the laboratory drying unit is used instead of the small drying tube, it creates additional sampling delay, which allows more of the thoron to decay before reaching the RAD7, reducing the sensitivity of the measurement to about half that of the standard setup.

The only difference between Sniff protocol and Thoron protocol is that this setting, 'Setup Thoron', is Off in Sniff protocol and On in Thoron protocol (See Setup Protocol, Chapter 2.4.1).

2.4.6 Setup Pump

Select `>Setup Pump` to change the Pump setting. Four settings are available: Auto, On, Grab, and Off.

Auto means that the RAD7 switches the pump on and off according to a predetermined pattern that allows for sufficient sampling of air while conserving battery charge and pump wear.

In Auto pump setting, the pump always switches on for 4 minutes at the beginning of a new test cycle to ensure a good initial sample. If the humidity in the sample cell remains above 10%, then the pump stays on to allow the cell to dry out. Then the pump runs for just one minute in every five, until the end of the cycle.

On means the pump is always on, whether the RAD7 is counting (Live) or not (Idle).

Grab initiates a standard grab sampling sequence at the beginning of a run. When you start a new run with the pump set to Grab, the pump will run for exactly 5 minutes. This is followed by a five-minute equilibrium delay, after which the counting period begins. The pump does not run at all during the counting period. As usual, you can determine the length of the count period by multiplying the cycle time by the recycle number. The total time to complete a test is the pump sample time (5 minutes) plus the delay period (5 minutes) plus the count period. Note that the Grab, Wat-40 and Wat250 protocols, under `>Setup Protocol`, above, all use this pump setting.

Off means the pump is always off.

Use Auto pump setting for routine radon testing. The RAD7 has been factory calibrated with the pump in this setting.

2.4.7 Setup Tone

Select `>Setup Tone` to choose the audible tone type. Three settings are available: Off, Chime, and Geiger. Off means the beeper remains quiet. Chime means the beeper will sound only at the end of a cycle, and is otherwise silent. Geiger means the beeper will emit a chirp whenever a particle is detected, much like the familiar Geiger counter. But unlike a Geiger counter, the pitch of the chirp depends on the energy of the alpha particle. A trained ear can distinguish "old" radon from "new" radon by the sound of the chirps. The thoron beep is the highest pitch. In the Geiger setting, anyone will recognize a radon "gusher" by the rapid-fire chirping the RAD7 produces.

2.4.8 Setup Format

Select `>Setup Format` to change the way data are printed out. Four settings are available: Short, Medium, Long, and Off.

Short causes the RAD7 to print results in an abbreviated form. Three lines of printed text contain a cycle's most important data: the run/cycle number, radon concentration and two-sigma uncertainty, units and mode, time and date, temperature, relative humidity (internal), and battery voltage.

Medium and Long printouts include seven additional lines of data: total counts, livetime, and counts per minute for five alpha energy windows. These seven lines are the raw data from which the

radon concentrations shown in the first line of the printout are calculated.

The Long format, when printing from a test in progress (Live) includes a graph of the alpha energy spectrum. Since spectra cannot be saved to long-term memory, the spectrum will not be printed when retrieving past data.

Off means that no data will print out at the end of each cycle, but the summary and cumulative spectrum will print at the end of the run (if the printer is set up and switched on).

2.4.9 Setup Units

Select `>Setup Units` to change the measurement units with which the RAD7 reports radon concentration and temperature. First, enter the radon concentration unit (pCi/L = picoCuries per liter, Bq/m3 = Becquerels per cubic meter, cpm = counts per minute, #cnts = number of raw counts). Next, enter the temperature unit (_F = degrees Fahrenheit, _C = degrees Celsius or Centigrade).

PicoCurie is the favored unit of radon activity in the U.S., while Becquerel is the favored unit in Europe and Canada. 1 pCi/L equals 37 Bq/m^3. "Counts per minute" is the direct output of the RAD7 while "number of raw counts" is the raw direct output. With livetime, mode, and calibration factor, one can convert from any of these units to any other, but it is usually easier to let the RAD7 do the work.

The choice is retroactive. Change the unit using the `>Setup Units` command, then print out the same data. Everything will print as before, but in the new units.

2.4.10 Setup Savuser

Select `>Setup SavUser` to program the special User protocol according to the present Setup parameters. You must answer Yes, and push `[ENTER]`, to confirm that you wish to change the User protocol. The purpose of this command is to give you an opportunity to customize a protocol according to a set of favorite parameters. Thereafter, it's a cinch to return to the same set of parameters; simply select `>Setup Protocol [➔] User`.

The User protocol has many possible applications. One RAD7 owner uses her instrument for 3-day screening tests. To make the setup easy, she programs the User protocol with the parameters for a 72-hour screening test. To do this, she first sets up all the parameters as she wants them. She enters 2 hour for the Cycle time, 36 for the Recycle number, Auto for the Mode setting, Off for thoron, and Auto for the Pump setting.

Finally, to program the User protocol with these values, she selects `>Setup SavUser` and answers Yes to the confirmation question. After that, she can easily return to the 72-hour protocol by selecting `>Setup, Protocol, User,` any time she wishes.

2.4.11 Setup Clock

Use `>Setup Clock` to change time zones, go in or out of daylight savings time, or to synchronize the RAD7 clock with another clock. The Real Time Clock (RTC) will maintain time-of-day and calendar date for as long as 10 years, and is accurate to within one minute per month at room temperature.

Select `>Setup Clock` to set the time and date of the RAD7 clock. You will see:

```
Time:   15:05:34
```

The time is listed with hours first, then minutes, then seconds. The arrow keys can be used to change each value. Holding an arrow key down will cause the number to change quickly. The cursor (blinking square) will start on the hour. Set the correct number with the arrow keys, then push `[ENTER]` to confirm. Do the same for the minutes and seconds.

Next you should see:

```
Date:  13-DEC-11
```

Dates are listed with the day of the month first, then the month, then the year. As with the RAD7 clock, the date is set by using the arrow keys to change each value. Press `[ENTER]` after each figure is set to move on to the next.

2.4.12 Setup Review

The `>Setup Review` command allows you to display and print a listing of the current instrument settings, including Date and Time, Protocol, CycleTime, Recycle, Mode, Thoron, Pump, Tone, Format and Units. Thus you can check that the instrument is set up properly, and confirm this, in hard copy, right on the data printout.

2.5 Special

The Special menu offers access to a selection of additional commands, provided by the RAD7's RADLINK remote control software. If for any reason RADLINK is not present, you will see the following when entering the Special menu:

```
Not installed.
Install?   No
```

Use the arrow keys to toggle between Yes and No. If you confirm Yes, the RAD7 will sit, waiting for a data string at the RS232 port. If necessary, DURRIDGE will complete this RADLINK installation process when the RAD7 is returned for calibration.

If RADLINK is installed, then `>Special` opens a menu of special commands available from the keypad of the RAD7. All the commands, both standard and special, will also be accessible from a remote PC, either directly, or by modem connection.

The following command set are those available with RADLINK version 0252. Earlier versions will have a subset of these.

2.5.1 Special Ident

Output the RAD7 identification sequence, including firmware version, hardware model number, unit serial number, and last calibration date.

2.5.2 Special SPrOn

Re-direct subsequent output from the infrared printer to the serial port. In other words, everything that would ordinarily be printed will shoot out the serial port, but nothing will be printed, even when you say "Print". One reason to use this might be to move the data very quickly into a computer without waiting for the (slow) infrared printer link. You can cancel the re-direction order and restore the use to the infrared printer with the "Special SPrOff" command. When you turn off the RAD7 and turn it on again, it always restores output to the infrared printer.

Note that the spectra that would be printed on the infrared printer are not sent to the serial port by Special SprOn.

2.5.3 Special SPrOff

Cancel the printer to serial port re-direction, so that output can go to the printer again.

2.5.4 Special SetBaud

Set the serial port bit rate. The following standard speeds are available: 300, 600, 1200, 2400, 4800, 9600, and 19,200 bps. The other communication settings are always 8 bit, no parity, and 1 stop bit. The RAD7 remembers the serial port speed when you power down. Note that at the highest serial speed settings the RAD7 may not be able to keep up with incoming character strings unless the characters are "paced". An "echo-wait" strategy will avoid this problem. Also note that the RAD7 recognizes XOFF/XON flow control protocol when sending data.

2.5.5 Special Status

Gives a snapshot of the RAD7 status page, including run and cycle numbers, countdown timer, last reading, temperature, humidity, and so on. This is basically the same information that you can get with "Test Status", but it gives the data in one shot and does not continue to update every second.

2.5.6 Special Start

Same as "Test Start" (see Chapter 2.2.2, Test Start), but does not go into a continuously updating status display.

2.5.7 Special Stop

Same as "Test Stop" (see Chapter 2.2.2 Test Stop).

2.5.8 Special Comspec

Output the current test data, including the counts in all 200 alpha energy bins. These counts can be imported into a spreadsheet program and displayed as a graph of the energy spectrum.

2.5.9 Special ComAll

(Version 0244/940221 or later) - Output complete set of RAD7 test data (up to 1000 readings) to the serial port in comma delimited format.

2.5.10 Special SPrAll

Output complete set of RAD7 test data (up to 1000 readings) to the serial port in standard, readable 24 column printer format, without affecting the infrared printer.

2.5.11 Special S-Load

Used to load special software into the RAD7 through the serial port.

2.5.12 Special Version

Output the special extension version number.

2.5.13 Special Model

Output the RAD7 hardware version number.

2.5.14 Special Serial

Output the RAD7 unit serial number.

2.5.15 Special Beep

The RAD7 gives an audible beep tone. Does not make any sound if the tone setting is "Off".

2.5.16 Special Relays

Access the RELAYS set of commands. At the end of every cycle, if the function is enabled, the RAD7 will set or reset two external relays according to the individually set thresholds and the measured radon level. The commands consist of ‘relay1', ‘relay2', ‘enable’, and ‘disable’. Use the arrow keys to scroll between these commands. Relay1 permits the user to set a level, above which the RAD7 will turn on relay1, and below which it will turn the relay off. Relay2 does the same for the second relay. ‘Enable’ causes the function to go into effect. Note that the command to the relays is sent after the RAD7 has finished printing data at the end of the cycle. ‘Disable’ stops the RAD7 from sending any commands to the relays.

2.6 Infrared Printer

The RAD7 uses an infrared link to print to the supplied printer. Note that all references to the RAD7 printer in this manual refer to the Chamjin I&C New Handy printer, model 700-BT . The most significant difference between this printer and the previously supplied, now obsolete HP 82240B printer is that the HP printer had to have external 12V power supplied in order to stay awake for more than 10 minutes between printouts. The Chamjin printer does not accept external power.

The printer should be placed on the RAD7 face plate, between the green lines as indicated. Because the print mechanism uses thermal technology, only thermal paper will work. Detailed instructions are provided in the Chamjin printer manual.

If the printer is placed in position and switched on before switching on the RAD7, it will print out identity information and a review of the setup, before the RAD7 goes to `>Test`. It is good practice to do this if the measurement data are to be printed out, because it automatically provides a header for the data printout, with instrument identity and setup:

```
DURRIDGE RAD7
Vers 2.5f   991128
Model 711
Serial 00512
Calib 20-MAY-11
Last used
   FRI 21-MAY-11  17:30

Current settings
   FRI 21-MAY-11  19:09

Protocol: 2-Day
Cycle: 00:60
Recycle: 48
Mode: Auto
```

```
Thoron: Off
Pump: Auto
Tone: Geiger
Format: Short
Units: pCi/L   EC
```

At the end of every cycle, the printer will print the data of that cycle, according to the format setting. In short format, it prints:

```
0102   2.69  " 0.73   p   Sniff
   FRI  21-MAY-99   19:41
   26.8 EC   RH: 7%   B:7.06V
```

With the run and cycle number, radon level, two-sigma uncertainty, units and mode in the top row, date and time in the second, and temperature, humidity and battery voltage in the third.

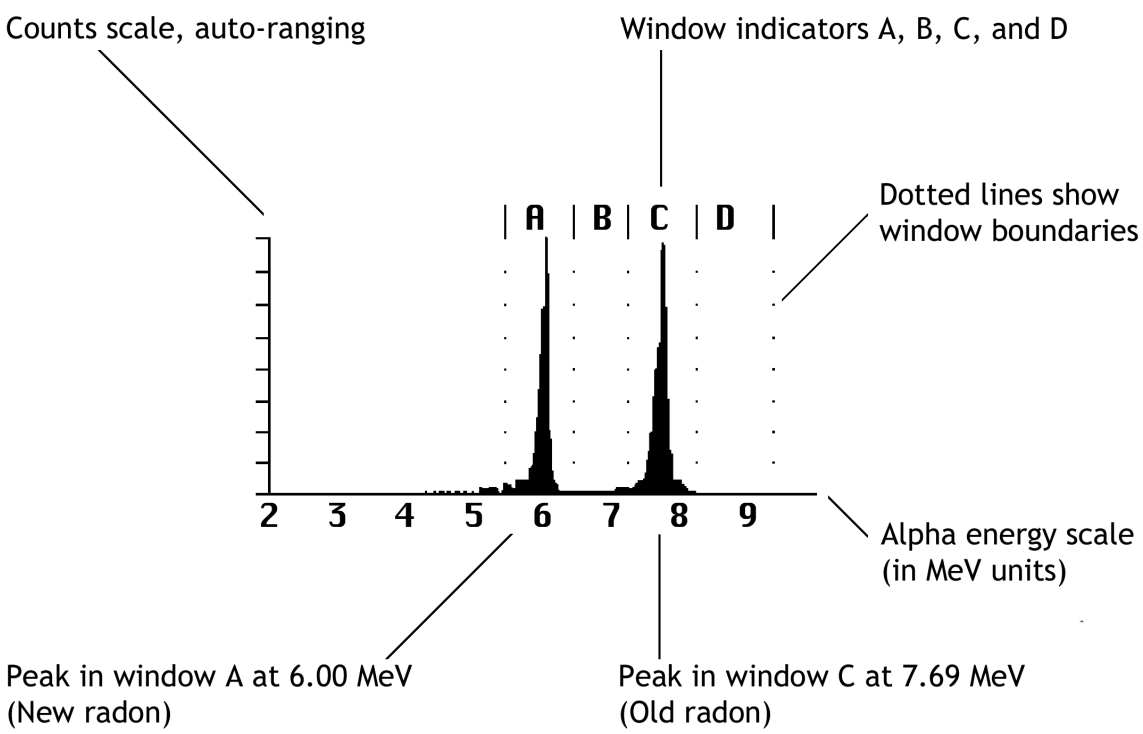
Medium format adds:

```
Total Counts:    357.
Livetime:   28.2 min
A: 5.74" 0.98 cpm 45.4%
B: 0.32" 0.29 cpm 2.5%
C: 6.13" 1.01 cpm 48.5%
D: 0.00" 0.14 cpm 0.0%
O: 0.46" 0.34 cpm 3.7%
```

Where the lifetime is the actual time spent waiting for an event, slightly less than the elapsed time. The windows, A, B, C, D, and all the rest, O, correspond to the different alpha energies in the spectrum.

Long format adds, to the short and medium formats, a printed spectrum of the alpha energies, as shown below.

At the end of a run, the printer will print a summary, see figure in Chapter 1.4. It will include an average of the radon concentrations, the high value, low value and standard deviation. These are followed by a bar chart, showing the variation of radon concentration from cycle to cycle throughout the run. Finally, it prints a cumulative spectrum, showing the distribution of energy of all the alpha decays counted during the run. This spectrum is very informative. It gives a good indication of the condition of the instrument and the quality of the measurement. It is a useful habit to look at the cumulative spectrum from time to time, just to be sure that it has not changed in character.



Alpha Energy Spectrum

3. BASICS OF *RAD7* TECHNOLOGY: HOW IT WORKS

3.1 Introduction

This chapter deals with a number of fundamental facts concerning radon and thoron, their measurement in general and their measurement, specifically, with the RAD7. It is not necessary to master the underlying physics to become proficient in the use of the instrument, but some understanding of what is happening is helpful.

It is recommended that the user read the entire manual, including this chapter, on first acquiring the instrument, and then again after gaining some experience in the field.

3.2 Radon Decay Chain

When the earth was formed, billions of years ago, there were probably many radioactive elements included in the mix of material that became the earth. Three, of interest, have survived to this day, namely uranium-235, uranium-238, and thorium-232. Each has a half life measured in billions of years, and each stands at the top of a natural radioactive decay chain.

A radioactive element is unstable. At some indeterminate moment, it will change to another element, emitting some form of radiation in the process. While it is impossible to predict exactly when the transformation of an individual atom will take place, we have a very good measure of the probability of decay, within a given time slot. If we started with a very large number of atoms of a radioactive element, we know quite precisely how long it would take before half those atoms had decayed (though we could not identify the decaying atoms individually, beforehand). This time interval is called the half-life of that particular element.

A natural radioactive transformation is accompanied by the emission of one or more of alpha, beta or gamma radiation. An alpha particle is the nucleus of a helium atom. It has two protons and two neutrons. Thus an ‘alpha decay’ will reduce the atomic number by two and reduce the atomic weight by four. A beta particle is an electron, with its negative charge. Thus a beta decay will increase the atomic number by one and leave the atomic weight unchanged. A gamma ray is just a packet of energy, so a gamma decay by itself would leave both the atomic number and atomic weight unchanged.

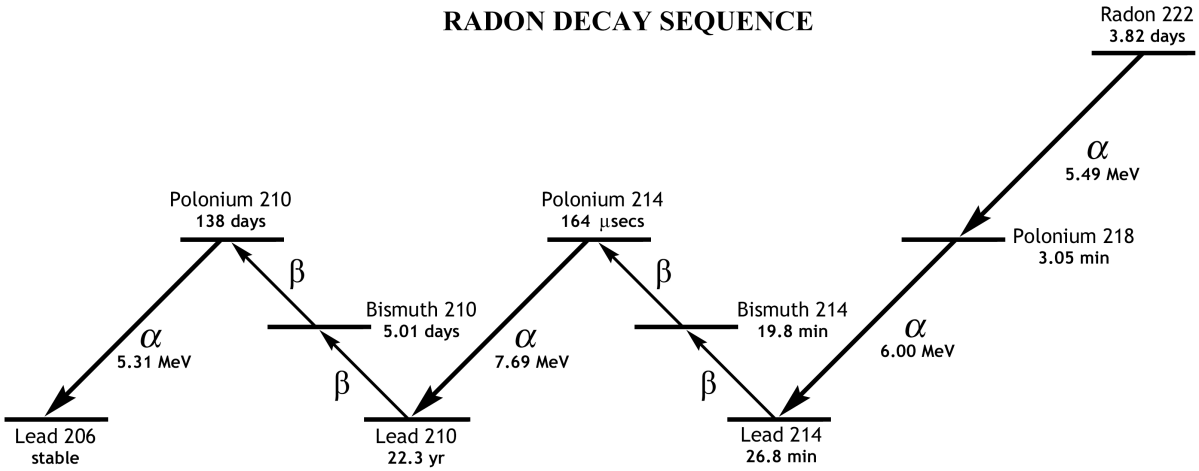
A decay chain is a series of distinct transformations. A uranium-235 nucleus goes through a series of 11 transformations to become stable lead-207. A thorium-232 nucleus goes through 10 transformations to become stable lead-208. And a uranium-238 nucleus goes through 14 transformations to become stable lead-206.

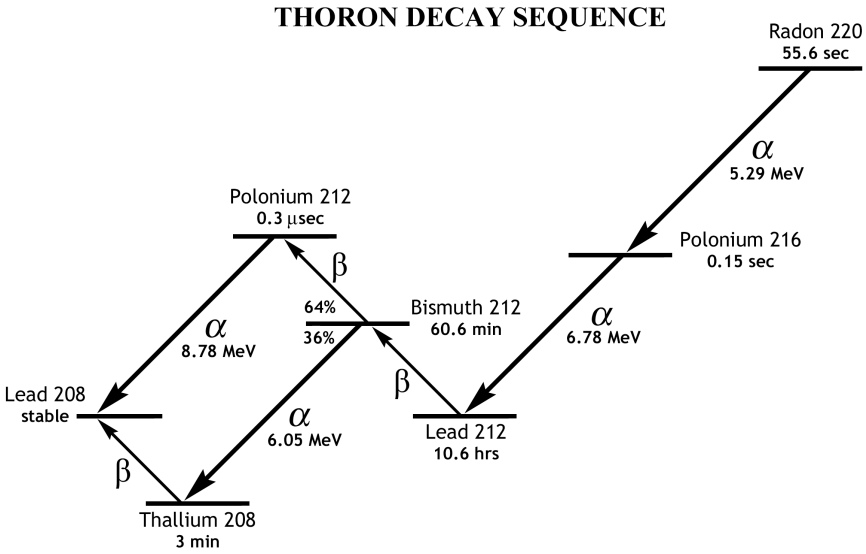
All three of these natural decay chains include isotopes of radon. Radon-219, or "actinon", is a link in the uranium-235 chain. You will probably never encounter actinon in indoor air, due to its scarcity and short half-life. Radon-220, or "thoron", is part of the thorium-232 decay chain. You will sometimes encounter thoron in indoor air, particularly near radon entry points, and, more often, in soil gas. Radon-222, or familiar "radon", is part of the uranium-238 decay chain. You will almost always be able to detect radon-222 in indoor air, outdoor air, and soil gas.

The radon isotope is the first element, in each of the decay chains, that is not a metal. It is, in fact, an inert, or “noble”, gas. So it can escape any chemical compound its parent (radium) was in, and diffuse into the air.

To focus on these inert gases, the thoron and radon decay chains, shown below, are those parts of the thorium-232 and uranium-238 decay chains that include just these radioactive gases and their short-lived progeny.

It may be noted that only alpha decays change the atomic weight, and then only in steps of four. Thus the atomic weights of all the members of the radon-220, thoron, decay chain are divisible by four, while none of the radon-222 are.





Radon and Thoron decay chains

3.2.1 Radon-222 (Radon)

Every nucleus of radon-222 eventually decays through the sequence polonium-218, lead-214, bismuth-214, polonium-214, and lead-210. With each transformation along this path the nucleus emits characteristic radiations: alpha particles, beta particles, or gamma rays, or combinations of these. The RAD7 was designed to detect alpha particles only, so we will emphasize alpha radiation .

Radon-222 is an inert gaseous alpha-emitter that does not stick to or react with any materials. It has a half-life of 3.82 days. A particular radon nucleus may decay at any time, but it is most likely to decay between now and 8 days (two half-lives) from now. When the radon nucleus decays, it releases an alpha particle with 5.49 MeV of energy, and the nucleus transforms to polonium-218. The polonium nucleus can never go back to radon again. Polonium atoms are metals and tend to stick to surfaces they come in contact with, e.g., a dust particle in the air, or a wall, or the inside of your lung!

Polonium-218 nuclei have a short half-life, only 3.05 minutes, which means that most of them will decay within 6 minutes of their formation. The average polonium-218 nucleus lives for only 4.40 minutes before it decays (1.443 times the half-life gives the mean life). Like radon, polonium-218 emits an alpha particle when it decays, but with an energy of 6.00 MeV rather than radon's 5.49 MeV.

When polonium-218 decays, it transforms to lead-214, also a radioactive solid. But lead-214 has a half-life of 26.8 minutes, and it emits beta radiation rather than alpha radiation. When lead-214 decays, it becomes bismuth-214, also a radioactive solid and a beta emitter. Bismuth-214 has a half-life of 19.8 minutes, and transforms to polonium-214 when it decays.

Polonium-214 is a bit different. It has a half-life of only 164 microseconds (0.000164 seconds) and it emits a 7.69 MeV alpha particle when it decays. When polonium-214 decays, it becomes lead-210, which has a half-life of 22.3 years. This means that an average lead-210 nucleus takes 1.443 times 22.3 years, or 32.2 years, to decay. Because of its long half-life, we usually ignore lead-210 as a factor in radon measurement, though it adversely affects the background of some instruments (not the RAD7).

Lead-210 eventually undergoes beta decay to Bismuth-210 which quickly (5 days half-life) undergoes a further beta decay to Polonium-210. Polonium-210 has a half-life of 138 days and decays with a 5.30 MeV alpha particle to Lead-206, which is stable. The 5.30 MeV alpha particle from Polonium-210 creates unwanted background in most radon monitors, but not in the RAD7.

3.2.2 Radon-220 (Thoron)

Similarly to radon-222, every radon-220 (thoron) nucleus eventually decays through a sequence of 5 transformations to Lead-208. The main distinction is the very different half lives involved.

Thoron has a half life of only 55.6 seconds. It emits a 6.29 MeV alpha particle and transforms to polonium-216, which in turn has only a 0.15 second half-life before emitting a 6.78 MeV alpha particle and transforming to Lead-212.

Lead-212 hangs around for a long time, with a half-life of 10.6 hours. It transforms by beta decay to bismuth-212, which, in turn, has a half life of 60.6 min.

Bismuth-212 has a 2:1 split, with two thirds transforming by beta decay to polonium-212 and one third transforming by 6.05 MeV alpha decay to thallium-208. The polonium-212 decays immediately to lead-208, emitting an 8.78 MeV alpha particle in the process, while the thallium-208, with a half-life of 3 min, undergoes a beta decay to the same destination, lead-208.

3.3 Continuous Monitors

There are several types of continuous radon monitors on the market. Nearly all of these are designed to detect alpha radiation, but not beta or gamma radiation. Why? Because it is very difficult to build a portable detector of beta or gamma radiation that has both low background and high sensitivity.

Three types of alpha particle detectors are presently used in electronic radon monitors:

1. Scintillation cells or "Lucas cells"
2. Ion chambers
3. Solid state alpha detectors.

Each of these types has advantages and disadvantages relative to the others. All of these types can be used for low background alpha particle counting.

The DURRIDGE RAD7 uses a solid state alpha detector. A solid state detector is a semiconductor material (usually silicon) that converts alpha radiation directly to an electrical signal. One important advantage of solid state devices is ruggedness. Another advantage is the ability to electronically determine the energy of each alpha particle. This makes it possible to tell exactly which isotope (polonium-218, polonium-214, etc.) produced the radiation, so that you can immediately distinguish old radon from new radon, radon from thoron, and signal from noise. This technique, known as alpha spectrometry, is a tremendous advantage in sniffing, or grab-sampling, applications. Very few instruments other than the RAD7 are able to do this.

A distinction should be made between true, real-time continuous monitors, and other instruments and devices. With a continuous monitor, you are able to observe the variation of radon level during the period of the measurement. This can sometimes show big swings in radon concentration and may allow you to infer the presence of processes influencing the level. For good data, it is important that there be sufficient counts to provide statistically precise readings. Devices which give just a single, average reading, or whose precision is inadequate except after a long measurement time, are not, in this sense, continuous monitors.

Another important parameter is background. This is the reading given by the instrument when there is no radon in the air sample. For low level continuous monitoring, it is necessary that the background be extremely low and stable. Because of the high quality alpha detector, and unique, real-time spectral analysis, the RAD7 background is vanishingly small, and is immune to the buildup of lead-210, which plagues other instruments.

3.4 Sniffers

Sniffing means taking quick, spot readings. Thus you can get a rough idea of the radon level, without waiting for a full, 48-hour, EPA protocol test. The technique is often used to locate radon entry points in a building.

Any fast-response, continuous radon monitor, with a pump, can be used for sniffing. However, there are some factors to consider: One is the rate of recovery after exposure to high radon levels. When the sniffer finds a radon gusher, the whole radon decay chain builds up inside the instrument, and the various daughters become well populated. If the sniffer now moves to a low level region, it will take many hours for the lead/bismuth/ polonium-214 daughters to decay away. In the RAD7 this doesn't matter, because, in SNIFF mode, it looks only at the polonium-218 decays, and ignores the polonium-214 decays left over from previous sniffs. The polonium-218 has a three-minute half life, so the RAD7, sniffing for radon, has a 15 minute response time to both sudden increases and sudden decreases in level.

Unique to the RAD7 is the ability to sniff for thoron. Polonium-216 has a 150 ms half life, so the instrument response is virtually instantaneous. The only delay is the time required to put the air sample into the measurement chamber, which is about 45 seconds.

Another factor, when sniffing, is the vulnerability (of other instruments) to lead-210 buildup. Only with the RAD7 can you continue to sample high levels, without having to worry about increasing the background.

3.5 Working Level

Radon concentrations are determined by measuring the radioactivity of the radon or by measuring the radioactivity of the radon decay products. Instruments that measure radon decay products in the air are called "working level" monitors. Working level monitors sample air through a fine filter and then analyze the filter for radioactivity. The radon progeny are metal and they stick to the filter and are counted by a working level instrument. Radon-222, an inert gas, passes through the filter, so it is not counted

in such an instrument. Therefore, a working level instrument measures the radon progeny concentration (polonium-218, etc.), in the air, but not the radon gas concentration.

The RAD7, on the other hand, measures radon gas concentration. Radon daughters do not have any effect on the measurement. The RAD7 pulls samples of air through a fine inlet filter, which excludes the progeny, into a chamber for analysis. The radon in the RAD7 chamber decays, producing detectable alpha emitting progeny, particularly the polonium isotopes. Though the RAD7 detects progeny radiation internally, the only measurement it makes is of radon gas concentration.

In short, the RAD7 does not measure radon daughter concentrations (working levels), only radon gas concentrations.

3.6 RAD7 Solid-State Detector

The RAD7 's internal sample cell is a 0.7 liter hemisphere, coated on the inside with an electrical conductor. A solid-state, Ion-implanted, Planar, Silicon alpha detector is at the center of the hemisphere. The high voltage power circuit charges the inside conductor to a potential of 2000 to 2500V, relative to the detector, creating an electric field throughout the volume of the cell. The electric field propels positively charged particles onto the detector.

A radon-222 nucleus that decays within the cell leaves its transformed nucleus, polonium-218, as a positively charged ion. The electric field within the cell drives this positively charged ion to the detector, to which it sticks. When the short-lived polonium-218 nucleus decays upon the detector's active surface, its alpha particle has a 50% probability of entering the detector and producing an electrical signal proportional in strength to the energy of the alpha particle. Subsequent decays of the same nucleus produce beta particles, which are not detected, or alpha particles of different energy. Different isotopes have different alpha energies, and produce different strength signals in the detector.

The RAD7 amplifies, filters, and sorts the signals according to their strength. In SNIFF mode, the RAD7 uses only the polonium-218 signal to determine radon concentration, and the polonium-216 signal to determine thoron concentration, ignoring the subsequent and longer-lived radon daughters. In this way, the RAD7 achieves fast response to changes in radon concentration, and fast recovery from high concentrations.

3.6.1 RAD7 Calibration and Data Correction

The RAD7 depends on calibration to determine the radon and thoron concentrations it measures. Built into the RAD7 firmware are three sensitivities:

1. Sniff sensitivity, counting only 218-Po for fast response.
2. Normal sensitivity, counting both 218-Po and 214-Po decays for higher precision.
3. Thoron sensitivity, counting 216-Po decays for thoron.

In calibration, the RAD7 is exposed to a known concentration of radon (or thoron) and the count rates are measured. Your radon calibration certificate gives the two radon sensitivities.

For thoron calibration, a separate calibration letter gives the calibrated thoron sensitivity. If thoron calibration is not conducted, the thoron sensitivity is estimated to be half the radon Sniff sensitivity, which is usually a reasonable estimate. In either case, when making a thoron measurement the RAD7 has to be set up and used in Thoron Protocol for the thoron reading to be valid.

In addition to the bare count rates in the three windows, there are various corrections and calculations that may be applied to calculate more precise radon and thoron concentrations. Some of these corrections are made automatically by the RAD7 itself. Others are optionally applied using DURRIDGE's CAPTURE software, after the data has been downloaded onto your computer.

The RAD7's internal corrections and calculations are:

a. Spill from window C into window B. This is important when measuring thoron in the presence of radon-222. The DURRIDGE calibration system has no thoron in the sample air and it is therefore easy, during

calibration, to measure the spill and calculate it as a fraction of the count rate in window C.

b. Bi-212 alpha decays occurring in the A window. This is important when measuring low radon concentrations in the presence of high thoron. The Bi-212 count rate is approximately half the Po-212 count rate, whose decays are in the D window. So, again, it is easy to measure the Po-212 count rate and use it to determine the Bi-212 count rate and consequently the correction to be applied to the 218-Po count rate in window A.

c. In WAT-40 and WAT250 protocols (used when recording RAD H_2O data), the RAD7 calculates the radon concentration of a water sample based on the radon concentration in the air loop. A known calibration factor is applied to achieve the necessary conversion.

After RAD7 data has been downloaded onto a computer, the DURRIDGE CAPTURE software can perform additional calculations and corrections:

a. B window to A window spill correction. This is important when measuring low radon levels in the presence of high thoron.

b. Humidity correction. This is essential if the desiccant becomes completely hydrated during a measurement.

c. Radon-in-water calculation. With the RAD AQUA and Radon-in-Water Probe, the equilibrium ratio between the radon concentration in the water and that of the air entering the RAD7 is a function of the temperature at the air/water interface. CAPTURE can be given the necessary temperature information via a data file produced by a temperature logger, or it can use the air temperature as measured by the RAD7, or it can be given a single temperature value. This temperature information is then used along with the radon-in-air readings to calculate the radon concentration of the water.

d. Meaningful thoron threshold: The spill from window C to window B produces counts that must be deducted from the B count rate before the thoron concentration can be determined, but those spill counts have statistical uncertainty. That means that a count rate in B that is slightly above the calculated spill from C may, in fact, be merely a statistical variation of the spill rather than actual thoron. The spill, therefore, increases the uncertainty in the thoron reading. CAPTURE calculates a ‘meaningful thoron threshold’, taking into account the statistical uncertainty in the spill, and will display this threshold on the graph if so instructed.

e. Forced Sniff mode: For long-term measurements, the RAD7 is normally put in Auto mode, in which the measurement starts in Sniff mode so as to achieve a fast initial response, before automatically switching to Normal mode after three hours, when the 214-Po decays have nearly reached equilibrium with the radon concentration. This assumes that the radon concentration is steady. If it appears that rapid changes in radon concentration were taking place, the user can, in CAPTURE, force the graph to display the data as if the RAD7 stayed in Sniff mode throughout the measurement, and thus see the rapid changes with a measurement time constant of just 12 minutes.

3.7 RAD7 Spectrum

The RAD7 spectrum is a scale of alpha energies from 0 to 10 MeV. Of particular interest are the radon and thoron daughters that produce alpha particles in the range of 6 to 9 MeV.

When the radon and thoron daughters, deposited on the surface of the detector, decay, they emit alpha particles of characteristic energy directly into the solid state detector. The detector produces an electrical signal. Electronic circuits amplify and condition the signal, then convert it to digital form. The RAD7 's microprocessor picks up the signal and stores it in a special place in its memory according to the energy of the particle. The accumulations of many signals results in a spectrum.

The RAD7 divides the spectrum's 0 to 10 MeV energy scale into a series of 200 individual counters, each representing a 0.05 MeV channel. Whenever the RAD7 detects an alpha particle, it increments one of these 200 counters by one.

Every so often, the RAD7 manipulates, condenses, prints out and stores data to long-term memory. Then it resets all 200 counters to zero, and begins the process anew.

The idealized spectrum of a 6.00 MeV alpha emitter looks like a single needle-thin spike at exactly 6.00 MeV.

Although the RAD7 approaches this ideal, the actual spectrum shows a broadened peak centered at or near 6.00 MeV with a characteristic "tail" that stretches into lower energy channels. Electronic noise in the detector and amplifier causes the peaks to widen, while alpha particles that enter the detector at glancing angles cause the tail. Higher than normal operating temperatures tend to increase electronic noise, and so increase the width of the peaks.
A combination of different alpha emitters appears on the spectrum as a series of different peaks. For example, a combination of equal amounts of Po218 and Po214 (as would occur in the case of radon daughter equilibrium) appears as twin alpha peaks. One peak (Po218) is centered at 6.00 MeV, while the other (Po214) is centered at 7.69 MeV.

The second example spectrum, shown in Chapter 3.13, is the characteristic signature of radon at equilibrium with its alpha emitting daughters. We would expect to see a spectrum like this after several hours at a constant radon level. The 5.49 MeV alpha particle directly emitted by radon-222 does not appear on the RAD7 spectrum, because it was created in the air, not on the surface of the detector. The radon-222 atom is inert and electrically neutral, and cannot be attracted to the solid state detector. Only after it decays to polonium-218 does the atom become positively charged and is thus driven to the detector surface.

The RAD7 spectrum shows radon daughters, but not radon itself. Do not confuse the RAD7's spectrum with that of a working level instrument. The alpha peaks may appear the same, but the RAD7 is really measuring radon gas, not working level.

3.8 Windows

The RAD7 groups the spectrum's 200 channels into 8 separate "windows" or energy ranges. Window A, for example, covers the energy range of 5.40 to 6.40 MeV. So window A includes the 6.00 MeV alpha particle from polonium-218. The first step toward converting raw spectral data to radon measurement is to add up all the counts in each window and divide by the detector "livetime" or duration of active data collection. The RAD7 microprocessor does this task and stores the results to memory in this form. You can recall and print window data from past measurements. The RAD7 adds windows E, F, G, and H together to form window O (for "other") before storing the data to memory. Spectrum printouts clearly mark windows A, B, C, and D with dotted lines.

Each window's function:

A. Radon Sniffer Mode counts. The total counts of alpha particles from the 3-minute, 6.00 MeV, Po218 decay.

B. Thoron 1 Window. The total counts in the region of the 0.15 second, 6.78 MeV decay of Po216. This window lies between windows A and C of the radon groups and may have some counts from spill-over from adjacent windows.

C. Radon Po214 counts. The total counts of the 7.69 MeV alpha particles from the decay of the great-great granddaughter of radon, which has an effective half-life of nearly an hour.

D. Thoron 2 Window. The total counts in the region of the effective 8.78 MeV decay of Po212, which has a half-life of about 10 hours.

E. High Energy Window. A diagnostics window that normally has close to zero counts. If the counts in this window are a large fraction of the counts in A or B or C or D, the RAD7 is probably not working properly.

F. Low Noise counts. A diagnostics window that gives the total counts in the first 10 channels. The count rate in Window F is a measure of the noise in the system. The counts may be high if the RAD7 is operated at very high temperatures.

G. Medium Noise counts. A diagnostics window that gives the total count in the region around channels 30 to 40. Window G normally has few counts, even when Window F shows a high count rate.

H. High Noise or Po210 Window. The total counts in the region of the 5.31 MeV alpha particle due to Po210 (polonium-210), the grand-daughter of Pb210 (lead-210). Since lead-210 (22 year half-life) results from the decay of the radon progeny we measure, this isotope will build up on the detector's sensitive surface through sustained measurement of very high radon concentrations, or many years of normal use. This window is not used in calculating radon levels, so the RAD7 will function well even with this isotope present, and the background will not be affected.

O. Composite window for "Others". The RAD7 groups windows E, F, G, and H together to form the composite window O. Window O catches all the counts that did not go into the major windows A, B, C, and D. If window O consistently receives more than 30% of the total counts, you should inspect the spectrum printout for signs of trouble.

3.9 Isotope Equilibrium

Take a RAD7 that is completely clean, with no radon or daughters inside. What does the detector see? Close to nothing. Less than one alpha count per hour, due to unavoidable contamination of the materials of the instrument's construction. That is the instrument's intrinsic background. It is ignored by most people as of no consequence. Intrinsic background may add 0.01 pCi/L to a typical measurement, far below the radon concentration of outdoor air (usually 0.10 to 1.00 pCi/L).

Now introduce some radon into the RAD7. What do you see? At first, maybe nothing. But within a few minutes, you begin to get counts in the A window. The RAD7 chirps merrily with each count. That's polonium-218, a result of the decay of radon-222 within the RAD7 sample chamber.

For the first 5 minutes or so, the count rate increases, then begins to approach a steady level. After about 10 minutes, we say that the polonium-218 daughter has reached close to equilibrium with the radon-222 parent.

Equilibrium is when the activity of the daughter stabilizes, neither increasing or decreasing. At this point, nearly all of the counts land in window A, and you see a single peak in the spectrum printout.

But the total count rate is still increasing, more slowly now. You begin to see counts appear in window C. Just a few, but more and more of them over the course of the next hour or two. After 3 hours or so, we reach full equilibrium, when the activities of all the daughters stabilize. Now the spectrum shows the characteristic twin peaks: polonium-218 in window A and polonium-214 in window C. The peaks are of almost identical size.

Now flush the RAD7 with fresh, radon-free air. The count rate in window A immediately begins to drop, just as fast as it rose when you first put the radon in. Without radon inside the RAD7, there is no source to replace the polonium-218 that decays. So the polonium-218 disappears with its characteristic half-life of 3.05 minutes.

After 3.05 minutes, the count rate in window A is half of what it was before. After 6.10 minutes, the count rate is half of that, or one-quarter of what it was before. You get the picture. After 10 minutes, there are hardly any counts at all in window A. Not so for window C, however. The spectrum still shows a single strong peak in window C.

The peak in Window C takes hours to disappear. After half an hour, the count rate in window C has not even halved. Polonium-214 may have a very short half-life, but its parents, lead-214 and bismuth-214, certainly don't. One has a half-life of 26.8 minutes, and the other has a half-life of 19.8 minutes. And they are sequential, which makes matters worse.

After you completely remove the radon, it may be a good 3 or more hours before the counts really die down in window C. We call window C the "old radon" window, since it represents counts from radon that was present in the RAD7 an hour or more before.

The effects of time in windows B and D, is similar, but much more pronounced. There is no delay in the RAD7 to polonium-216, so the count rate in window B is always in equilibrium with the thoron gas in the measurement chamber. In contrast, there is a 10-hour half life in the decay chain down to polonium-212, so it will take days for window D to reach equilibrium. Window D is, therefore, not counted when sniffing for thoron.

Note however, that for every 66 counts in window D, there will be 34 counts in window A. This is because of the two-way split from Bismuth-212. So, in calculating radon concentration, the RAD7 corrects the counts in window A for any thoron daughters that show in window D.

3.10 Modes: Sniff and Auto

"Old" radon daughters can be a real pain in the neck if you can't tell them apart from "new" radon. Most radon monitors don't help you at all here, but the RAD7 does. Waiting around for equilibrium is also a trial if it means sitting around for more than 2 hours. It is possible to calculate your way out of that problem, but the "old" radon always comes back to bite you. With the RAD7, the solution is simple and painless. Put the RAD7 in SNIFF mode.

SNIFF mode means that the RAD7 calculates radon concentration from the data in window A only. It ignores window C. Now the instrument responds to changes almost instantaneously. Hit a "hot spot?" No problem. In SNIFF mode, you can purge the sample chamber and, in 10 minutes, you're ready to measure low levels again with reasonable accuracy. You can move from point to point in minutes, looking for radon entry points in foundation cracks or test holes.

For continuous monitoring in one location over many hours, NORMAL mode is the way to go. NORMAL mode means that the RAD7 uses both radon peaks, A and C, to calculate concentration. With double the count rate, you increase the precision of the measurement. In indoor environments, the radon concentrations rarely fluctuate quickly enough to justify using SNIFF mode for continuous monitoring.

The best of both worlds is provided by AUTO mode. Here, the RAD7 starts a test run in SNIFF mode, and then, after three hours, switches automatically to NORMAL mode. In this way, the first few cycles give readings without any bias from either “old” radon daughters left on the detector, or the slow build-up to reach equilibrium in window C, while the rest of the readings benefit from the higher precision given by twice the number of counts in each cycle.

For real-time monitoring, you are always better off to leave the mode in AUTO. The RAD7 is up to speed quickly, and is not influenced by old measurements. The final average of the run is therefore more accurate and more reliable.

CAPTURE can read a data file and force SNIFF mode presentation of the data, allowing the user to change the setting retrospectively.

Thus if, on looking at data taken in NORMAL mode, there is what appears to be a rapid change in radon concentration, changing to forced SNIFF mode presentation in CAPTURE will permit another look at the changes with better time resolution.

3.11 Background

"Background" in a radon detector refers to spurious counts that occur even in the absence of radon. Background can arise from the properties of the instrument or its components, other forms of radiation in the instrument's environment, or contamination of the instrument.

The RAD7's design makes it much less susceptible to background than other radon monitors, but one should still be aware of background in the RAD7 to avoid mistakes. The following list gives possible sources of background in the RAD7:

3.11.1 Short-lived Radon and Thoron Daughters

These are by far the most important components to background in the RAD7. Radon and thoron daughters that normally build up on the RAD7's solid state alpha detector continue to produce alpha counts for some time after the radon and thoron gases have been removed from the instrument. These lingering daughters can greatly confuse the result when you try to measure a low radon sample immediately after a high radon sample.

Many radon detectors require that you wait for the daughters to decay away (about three hours) before counting another sample. With the RAD7, however, you can go from high to low concentrations in a matter of minutes by counting in SNIFF mode, since the RAD7 distinguishes the different alpha-emitting daughters by their alpha energy. The resulting measurement responds with a 3.05 minute half-life. Thus, 10 minutes after the radon has been removed from the instrument, the background will have been reduced by more than 90% and you can count a new sample.

Thoron daughters are worse behaved than radon daughters. One thoron daughter, Lead-212, has a half-life of 10.6 hours, so that, with other radon monitors, if you build up huge amounts of this daughter, you may have to wait one to two days before using your radon instrument again. The RAD7's ability to distinguish daughters by their alpha energy almost always makes it possible to continue working.

3.11.2 Adsorbed Radon Gas

Radon atoms can adsorb on or absorb into internal surfaces of the RAD7, on the inside of tubing or on desiccant granules. This radon can stay behind after you purge the instrument, then desorb (or out-gas) from these surfaces and enter the sample cell volume. This effect is ordinarily negligible since only a small fraction of the radon ever becomes adsorbed. But at very high radon concentrations (over 1000 pCi/L), even a small fraction can be significant, and you can expect to see some lingering radon after purging the instrument.

The best solution is to purge for 10 minutes every few hours until the count rate goes down. Even in the worst possible case, the radon must decay with a 3.82 day half-life, so you will eventually be able to use the instrument again.

3.11.3 Intrinsic Background

Due to very low concentrations of alpha emitting contaminants in the materials of the RAD7's construction, you can expect to get as much as one count every two hours (0.009 cpm) without any radon present. This count rate, corresponding to about 0.02 pCi/L, is low enough to neglect when doing routine indoor radon work. But for very low-leveled outdoor radon levels, or special clean room applications, this background may be significant. With painstaking technique, and long-term monitoring, it can be measured. Very low level readings can then be corrected for background, bringing the detection threshold of the instrument down below 0.02 pCi/L.

3.11.4 Long-lived Radon Daughters

After many years of use at elevated radon levels, your RAD7's detector will accumulate lead-210, an isotope with a 22-year half-life. Though Lead-210 is itself a beta emitter, one of its daughters is polonium-210, which produces a 5.3 MeV alpha particle. The RAD7 is able to distinguish this isotope by its energy, and exclude it from all calculations. We do not expect lead-210 buildup to contribute significantly to background in the RAD7, even after years of ordinary use.

3.11.5 Contamination by Radon, or Thoron, Producing Solids

If radon- or thoron-producing solids, such as radium-226 or thorium-228, become trapped in inlet hoses or filters, they may emanate radon or thoron gas that will be carried through the filters and into the instrument. Certain dusty soils may contain enough of these isotopes to make this scenario possible. If you suspect this kind of contamination, please call DURRIDGE. We would like to discuss your experience with you and help you solve your problem.

3.11.6 Other Alpha Emitters

As long as you filter the incoming air stream, there is little or no possibility for contamination of the instrument with other alpha emitters.

Virtually all solids will be stopped by the inlet filters. The only naturally-occurring alpha-emitting gas other than radon and thoron is radon-219, or "actinon." Actinon, which has a very short half-life (less than four seconds), results from the decay of naturally-occurring uranium-235. But since uranium-235 is so much less abundant than uranium-238 (the ancestor of radon-222), we do not expect to ever see actinon in significant quantities apart from even more significant quantities of radon.

3.11.7 Beta and Gamma Emitters

The RAD7's solid state alpha particle detector is almost completely insensitive to beta or gamma radiation, so there will be no interference from beta-emitting gases or from gamma radiation fields. The most likely effect of high levels of beta or gamma radiation will probably be an increase in detector leakage current and increased alpha peak width. Typical environmental levels of beta and gamma emitters have absolutely no effect on the RAD7.

3.12 Precision & Accuracy

3.12.1 Dry operation

"Precision" means exactness of measurement with regard to reliability, consistency and repeatability. "Accuracy" means exactness of measurement with regard to conformity to a measurement standard. An accurate instrument is necessarily precise, but a precise instrument can be inaccurate (due to mis-calibration, for example).

As long as the operator follows consistent procedures, counting statistics will dominate the RAD7's precision. Environmental factors have proven to be much less significant over normal ranges of operation. Aside from precision, the most important factor in RAD7 accuracy is calibration.

DURRIDGE calibrates all instruments to a set of four "master" instrument with a calibration precision of about 1%. The master instruments have been calibrated by way of inter-comparison with secondary standard radon chambers designed by the U.S. EPA. We estimate the accuracy of the master instrument to be within 4%, based on inter-comparison results. We estimate the overall calibration accuracy of your RAD7 to be better than 5%. We look forward to new developments in calibration standardization and traceability, which we expect will help improve calibration accuracy.

The table below summarizes the precision of the RAD7 according to the contribution of counting statistics. Counting statistics depend on sensitivity (calibration factor) and background count rate. The RAD7's intrinsic, or "fixed," background count rate is so low as to be a negligible contributor to precision, for the range of radon concentrations covered by the table. Environmental and other factors may affect precision by as much as 2%. The uncertainty values reported by the RAD7 are estimates of precision based on counting statistics alone, and are two-sigma values, as are the values in the following table.

Table: 3.12 Typical RAD7 precision based on counting statistics only.

NORMAL mode with sensitivity 0.500 cpm/pCi/L. Table values are two-sigma uncertainty (or 95% confidence interval) in units of pCi/L (percent).

	1 pCi/L	4 pCi/L	20 pCi/L	100 pCi/L
1 hr	0.37 (37%)	0.73 (32%)	1.64 (8.2%)	3.65 (3.7%)
2 hr	0.26 (26%)	0.52 (13%)	1.15 (5.8%)	2.58 (2.6%)
6 hr	0.15 (15%)	0.30 (7.4%)	0.67 (3.4%)	1.49 (1.5%)
24 hr	0.07 (7.4%)	0.15 (3.8%)	0.33 (1.7%)	0.74 (0.7%)
48 hr	0.05 (5.3%)	0.10 (2.6%)	0.23 (1.2%)	0.53 (0.5%)
72 hr	0.04 (4.3%)	0.09 (2.1%)	0.19 (1.0%)	0.43 (0.4%)

3.12.2 Humidity Correction

Much of the superior functionality of the RAD7 is a result of the high-precision real-time spectral analysis it performs. The high resolution of the energy spectrum is obtained by precipitating the radon daughters, formed by the decay of radon, right onto the active surface of the alpha detector. The high sensitivity of the RAD7 is a result of the large collecting volume of the measurement chamber. The combination of a precipitation process and large collecting volume means that humidity inside the measurement chamber will affect the sensitivity of the instrument. The affect is a function of the absolute humidity; specifically, ions in the presence of water vapor will attract water molecules, as they are polar, until a cluster of 6 - 10 water molecules gathers around each of them. These cluster molecules move more slowly in the electrostatic field and thus there is more time for the 218-Po atoms to become neutralized en route to the detector surface, and therefore lost. So with high humidity the sensitivity of the instrument drops. In addition the high voltage (2,200V) that maintains the electrostatic field is from a high impedance source. Excessive humidity inside the chamber makes it more difficult to maintain the high insulation resistance necessary.

At normal room temperature and with good desiccant in the air sample path, the humidity in the measurement chamber at the start of a measurement will quickly be brought down below 10% RH and will eventually settle below 6%. In these conditions the collection has maximum efficiency and there is no humidity correction required. Should the desiccant expire and/or should the operating temperature rise well above normal room temperature, the absolute humidity may become significant and a humidity correction may be required to compensate for the drop in sensitivity.

While high humidity reduces the sensitivity of a RAD7, CAPTURE offers an automatic correction of the data, bringing readings back close to dry values. Please note, however, that the precision will be degraded, compared with readings taken in dry conditions. See Chapter 6.

3.12.3 Concentration Uncertainties

Obtaining accurate readings of a low radon concentrations often requires long cycle times, because when there are zero or very few counts within a given timeframe, the statistical uncertainty is proportionately high. Radioactive decays obey Poisson statistics, where the standard deviation (one-sigma) is the square root of the count. However, at very low counts Poisson statistics underestimates the uncertainty. To compensate, the RAD7 defines sigma as 1 + SQR(N+1), where N is the number of counts. Thus when there are no counts, instead of reporting a nonsensical zero uncertainty, the RAD7 reports an uncertainty value based on a two-sigma, 95% confidence interval, equivalent to +/- 4 counts for a cycle in which zero counts were recorded.

Typically, an average count rate of 0.2 cpm (i.e. one count in five minutes) would indicate a radon concentration of about 36 Bq/m3, but sigma would be 1 + SQR(N + 1) or 2.4 counts, and the reported two-sigma value would be 4.8 counts. Thus after 5 minutes, the uncertainty would be reported as 0.96 cpm, or +/- 173 Bq/m3.

Large uncertainty values are often the product of the fact that it is impossible to measure low radon concentrations quickly. Greater certainty can be achieved by increasing the cycle time and/or by averaging multiple cycles. In Sniff mode, 218-Po (which has a 3.05 min half life) takes more than 10 minutes to reach equilibrium with the radon concentration in the RAD7 chamber. Note that in Sniff protocol, which uses 5-minute cycles, it is important not possible to start averaging the readings to reduce uncertainty only after the first two cycles.

It is possible to measure radon and thoron concentrations simultaneously, but since their requirements are sufficiently different, it may be desirable to optimize the measurement first for one gas and then for the other. For radon, it is advisable to select SNIFF protocol and then change the cycle time to 10 minutes. After starting a run, the first reading can be ignored, with only the second and subsequent readings

being used. As more readings are recorded, more precise concentrations will be obtainable.

Occasionally, a concentration uncertainty greater than the base value may be reported, e.g. 0.00 +/- 83.1 Bq/m3. Such values are typical for cycles containing zero counts. This should not be taken to suggest that a negative concentration may have occurred. The RAD7 does not report different positive and negative uncertainties, and it is expected that the user will recognize that the negative uncertainty can never be greater than the base value of the reading.

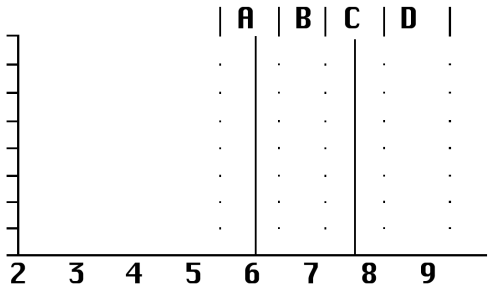
3.13 Spectrum Examples

3.13.1 Operational Radon Spectra

A. Idealized radon in equilibrium

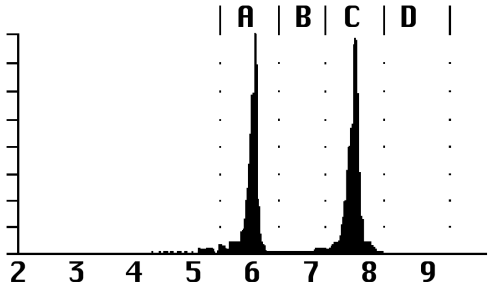
This is what you would see if both the detector and electronics reached theoretical perfection. At full equilibrium, both peaks are at the same height.

A	6.00 MeV	Po218
C	7.69 MeV	Po214



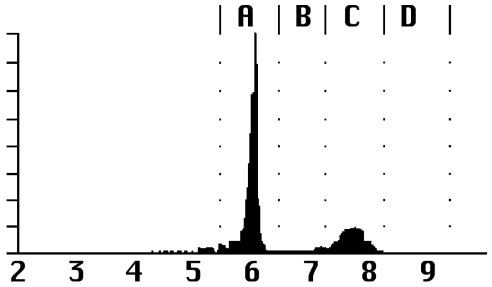
B. Radon in full equilibrium

After more than three hours at a constant radon level. The count rate in window C is about the same as in window A.



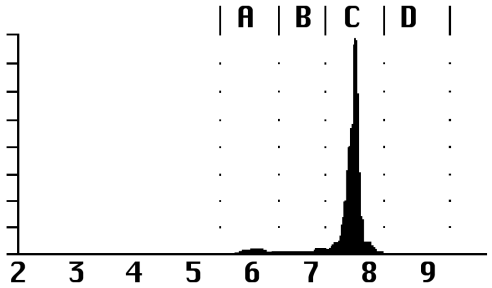
C. New radon

The RAD7 spectrum after less than one hour of exposure to radon. The peak in window C is just beginning to grow in, but its count rate is still much less than in window A.

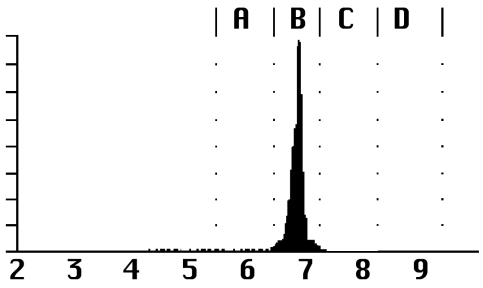


D. Old radon

The RAD7 spectrum after purging the instrument with radon-free air for more than 10 minutes, following exposure to radon.



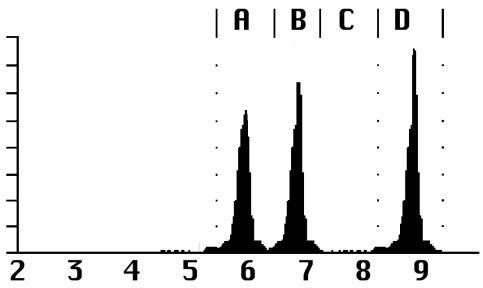
3.13.2 Thoron Spectra



A. New thoron

The RAD7 spectrum while continuously sampling thoron laden air

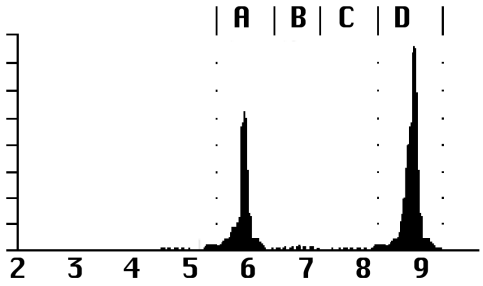
B 6.78 MeV Po216



B. Thoron in equilibrium

The spectrum after continuously sampling thoron laden air for more than 12 hours. The count rate in window A should be about half the count rate in window D

A	6.05 MeV	Bi212
B	6.78 MeV	Po216
D	8.78 MeV	Po212



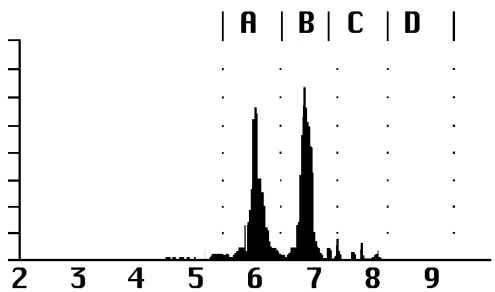
C. Old thoron

The spectrum after discontinuing a lengthy sampling of thoron laden air. The thoron peak, B, disappears immediately. The remaining two peaks decay together with a 10.6 hour half-life. The count rate in window A should be about half the count rate in window D.

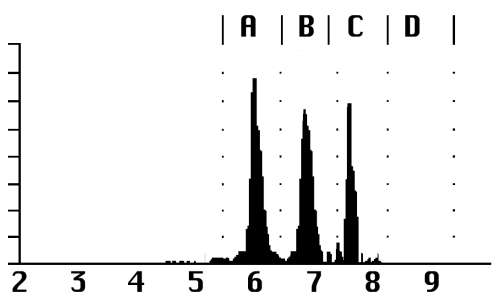
3.13.3 Combination Spectra

Radon and thoron spectra can add together to form combination spectra. Peaks in window B and/or D come from thoron, while a peak in window C comes from radon. The peak in window A is usually entirely from radon, but if there is a peak in window D, then there will a contribution of about half the D count rate to the peak in window A.

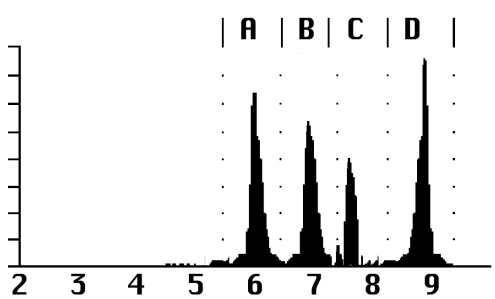
The RAD7 takes this into account, and always adjusts the window A count rate to correct for the Bi212 count, before calculating the radon concentration. The spectra below have comparable amounts of radon and thoron, but you will usually see one of the two much stronger than the other.



A. New radon with new thoron.



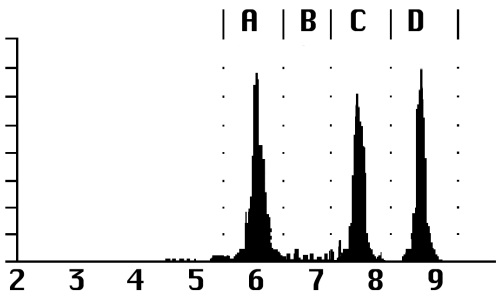
B. Equilibrium radon with new thoron



C. Equilibrium radon with equilibrium thoron.

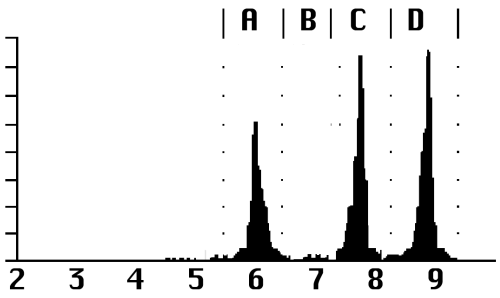
The count rate in window A is roughly the rate of window C plus half the rate of window D.

A	6.00 MeV	Po218
	+6.05 MeV	Bi212
B	6.78 MeV	Po216
C	7.69 MeV	Po214
D	8.78 MeV	Po212



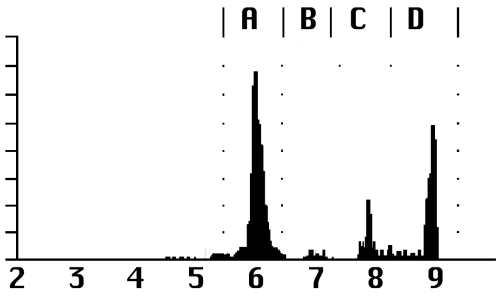
D. Equilibrium radon with old thoron

The count rate of A is roughly the rate of window C plus half the rate of window D.



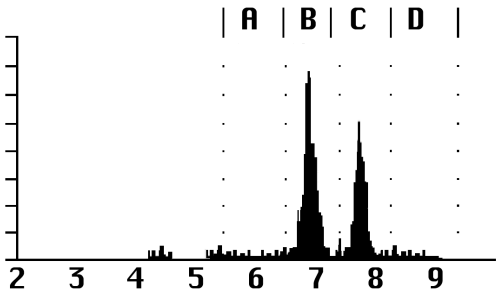
E. Old radon with old thoron.

The count rate in window A is no more than about half the count rate of window D.



F. New radon with old thoron.

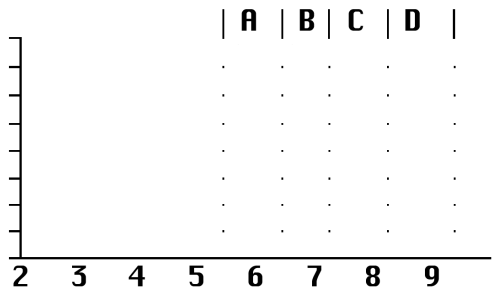
Looks like an old thoron spectrum, but the count rate of window A is significantly more than half the count rate of window D.



G. New thoron with old radon.

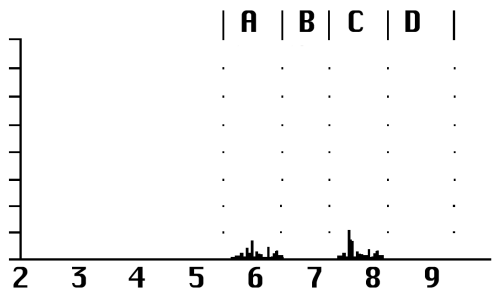
3.13.4 Pathological Spectra

If any of the following occur, and an external cause is not identified, the user should contact DURRIDGE immediately. Email to service@durridge.com would be a good way to initiate the contact.



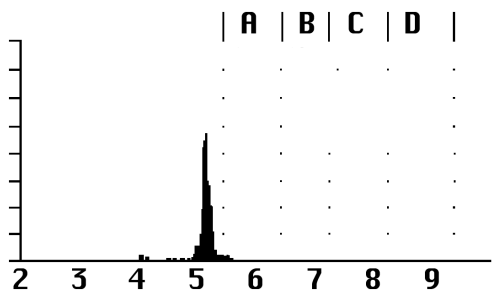
A. No counts.

Try a longer counting time. If there is not a single count in an hour, that is clear indication of instrument malfunction.



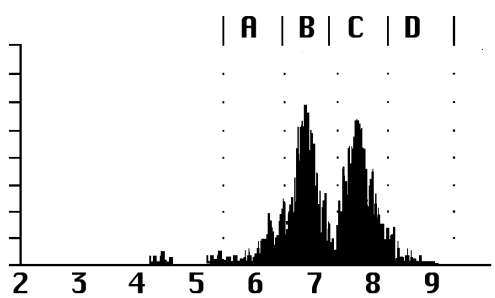
B. Few counts.

Normal for low radon levels and short counting times. Abnormally low counts could be caused by disruption of the air flow, or by malfunction in the high voltage circuit.



C. Lead-210/polonium-210.

A persistent peak at 5.3 MeV will develop from many years of regular use, or from sustained exposure to very high radon levels. It results from the buildup of lead-210 on the detector surface. Lead-210 has a 22 year half-life. It is not a problem for the RAD7 because the peak is outside window A, and thus does not contribute to the background.

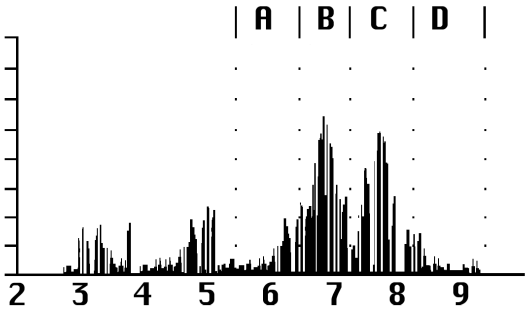


D. Wide alpha peaks.

Typically caused by electronic noise in the system. May be associated with vibration, with high operating temperature, or with degradation of the surface barrier detectors used in older model RAD7's, built prior to 1996.

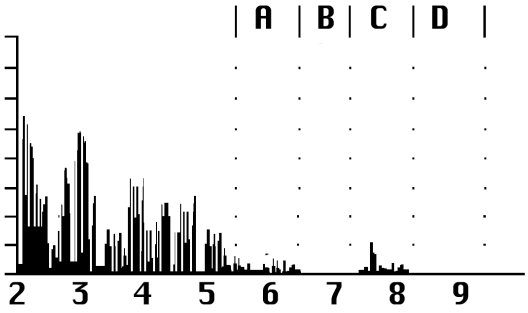
E. Smeared spectrum.

Alpha peaks cannot be discerned by the eye. Severe electronic noise.



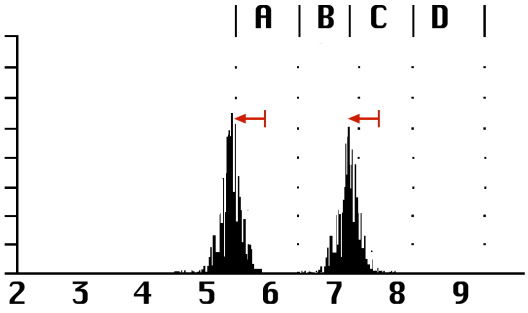
F. Low energy noise.

Independent of radon or thoron, such electronic noise may be intermittent or be associated with vibration.



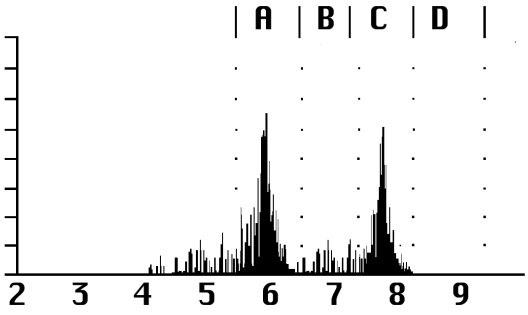
G. Shifted peaks.

Peaks appear normal, but are shifted in position. Shows a malfunction of the RAD7, which should be returned to DURRIDGE for service without delay.



H. Heavy tails on alpha peaks.

The peaks are narrow, but have unusually thick tails. This may be caused by electronic noise, or by malfunction of the alpha detector.



4. USING THE *RAD7*: RADON AND THORON MEASUREMENT IN AIR

4.1 Introduction

The different ways of using the RAD7 may be arranged in six categories:

(a) continuous monitoring of radon in air
(b) sniffing for radon and/or thoron
(c) testing air grab samples
(d) measuring radon in water
(e) testing soil gas
(f) measuring radon and thoron emissions from objects and surfaces.

While all six are discussed below, it is primarily categories (a) and (d) that require standard operating procedures. The other applications tend to be more interactive, and individuals will develop protocols which work best for them. This chapter focuses on using the RAD7 to measure radon and thoron in air, without the user of special hardware accessories. Chapter 5 introduces applications involving the RAD AQUA, RAD H_2O, and other DURRIDGE accessories.

4.2 Continuous Monitoring

4.2.1 Preparation

The RAD7 batteries should be fully charged so that, even if there is a power cut, the test will be completed. Similarly, there should be more than sufficient active desiccant in the Laboratory Drying Unit.

For an EPA protocol test, the house should be fully closed from 12 hours before the start of the test. This means that ALL doors and windows should be shut tight. No air exchange system, or ventilation fans, may be running.

In winter it is not difficult to satisfy this requirement. Continued operation of the furnace is permitted. Closed house conditions are usually maintained anyway, to save heating costs. Doors may be opened momentarily, for access, but should otherwise remain closed throughout the test.

In summer it may be impossible to satisfy the requirement, without the residents moving out for the duration of the test. If doors and windows are left open, it can nullify the test, except that if there is a radon problem under these conditions, then there will be a greater problem under closed house conditions.

Air conditioning often includes some fresh air ventilation, which dilutes the radon. Even if there is no ventilation, the cold air in the house will want to sink, increasing pressure in the basement, and thus reducing any flow of soil gas into the house. So air conditioning in the summer will tend to lower the radon level in the house.

For further detailed information, see the EPA "Indoor Radon and Radon Decay Product Measurement Device Protocols" publication, EPA 402-R-92-004, or view it at http://www.epa.gov/radon/pubs/devprot1.html

4.2.2 Purging

For the RAD7 to be all set to go, ready to start a test, it should be purged for at least five minutes beforehand. This may be done in the car, en route to the test site.

Locate an inlet filter, a piece of tubing with a sleeve at one end and small tube at the other, and the laboratory drying unit. Connect the filter to the tubing: It should be a tight fit into the small diameter section. Remove the plastic caps from the drying unit and push the sleeved end of the tubing onto the tube connector, on the drying unit, farthest from the metal screw cap. Now attach the filter to the inlet of the RAD7.

Switch on the RAD7, push `[MENU]`, `[ENTER]`, [➔] four times, to see `>Test Purge` on the display, then push `[ENTER]`. The pump will start. The display will show Stop purge? No. Leave the unit purging for five minutes, or longer. When you are ready to start the test, the easiest way to stop purging is to push the Menu key, or switch off the instrument.

4.2.3 Test Location

In general, the test should be conducted in the "lowest area in the house that is used, or could be adapted for use, as a living area". This would include a full-height basement, but not a crawl space.

Place the RAD7 near the center of the room, about 3 - 4 feet above the floor. Avoid walls, vents, fireplaces, windows, draft, and direct sunlight.

Where possible, connect DC power to the RAD7, to conserve and recharge the batteries.

The air intake will be the connector of the drying unit without any tubing attached (nearest the end with the metal screw cap), or the far end of the tube if one is attached to this connector. Make sure the air intake is at least 30 inches (75 cm) above the floor, and away from the walls.

Once set up in location, let the RAD7 continue to purge until ready to start the test.

4.2.4 Test Protocol

In any location there is often a diurnal variation of radon level. It is preferable, therefore, that the test period be an exact number of whole days. The EPA protocols require an average taken over at least two days. The RAD7 gives time resolution as well. A choice must be made, therefore, of the cycle time and the number of cycles (recycle). For 24-hour and 48-hour tests, the RAD7 has preset protocols which will make the choice for you. You can always change the choices (even in the middle of a test!), and, if you wish, save your preferences as the user protocol. You may, for instance, prefer to conduct 3-day tests, and, perhaps, use 24 cycles, each 3 hours long. The longer the test, the greater the precision of the result.

For a 24-hour or 48-hour test, using the preset protocol, before starting the test, go to `>Setup Protocol [➔] 1-day`, or `2-day`, and push `[ENTER]`. You need, also, to decide whether to leave the tone Off, Chime, or Geiger, and whether to have short, medium or long format of printouts at the end of each cycle, and set the parameters accordingly.

For very long term monitoring, use the Weeks protocol. This sets the RAD7 to run indefinitely, with 2-hour cycles. The internal memory capacity, of 1,000 cycles, will last nearly 12 weeks. If data is periodically downloaded to a PC, and erased from the RAD7, there is no limit to the measurement duration. With the laboratory drying unit used to dry the sampled air, the desiccant will have to be replaced every 7 to 14 days, depending on the humidity. The RAD7 needs external power for indefinite operation, but can survive, without loss of data, an interruption of power lasting up to 50 hours, or more, depending on the condition of the batteries.

For any other measurement period, you will need to set the parameters yourself. The cycle time, times the number of recycles, gives the duration of the total measurement. In almost every case, for continuous monitoring, choose `[Mode Auto]`, `[Thoron Off]`, and `[Pump Auto]`.

Once the RAD7 switches (after three hours) to NORMAL mode, the counts are included from Window C, which come from Po-214 atoms. These were once radon atoms, that entered the measurement chamber as much as an hour or more beforehand. Therefore, in NORMAL mode, the RAD7 is averaging the radon concentration from less than 20 minutes ago (Po-218) with the radon concentration from less than three hours ago (Po-214). So, for a long test in NORMAL mode, the cycle time should be set to one hour, or more.

Where there is a requirement for a fast response and detailed time resolution, the cycle time may be set as short as half an hour, or even 20 minutes, but the Mode should then be set to Sniff, not Auto. Note however, that counting only Window A, and for such short periods, the number of counts per cycle will be less than for longer cycles in NORMAL mode, and so the individual readings will have more scatter. Note also that short cycle times will fill up the memory more quickly (the capacity is 1,000 cycles), use up the desiccant more quickly, and, if the printer is being used, produce more printout.

4.2.5 To Print Or Not To Print

It is not necessary to run the printer during a measurement as all data, except for the detailed spectra, are stored at the end of every cycle, and

are available for printing or downloading to a PC at any time. Furthermore, with no printer and the key pad locked, it is impossible for any unauthorized snooper to read the radon concentration during the run. On the other hand, use of the printer gives a convenient and informative hard copy of the results.

For routine continuous monitoring, it is usual to set the printer format to short (`Setup`, `Format`, `Short`, `[ENTER]`).

Place the printer on the face plate and switch on. Switch the RAD7 off, then on again. Information about the RAD7, and the setup, will print out. Data will be printed at the end of every cycle, and a summary, bar chart and cumulative spectrum will print at the end of the run.

4.2.6 Running the Test

When everything is ready, start the test (`Test`, `Start`, `[ENTER]`). The pump will start running and the LCD display will go to the first status window.

The house should remain in closed condition for the duration of the run. At any time, the status windows can be viewed. The relative humidity, temperature and battery voltage are all parameters that are worth observing. Rising relative humidity may indicate that the desiccant is exhausted, or that there is a leak in the sample path. The temperature reading gives a base for future reference, see below. A dropping battery voltage may indicate that the power is not connected.

4.2.7 Security and Quality Control

For a good measurement, it is essential that the RAD7 (or any measurement device, for that matter) remain in its place, and the house remain closed, throughout the run.

Anti-tampering tapes are available for the windows and doors. A soft, plastic adhesive, such as Blue-Tack, HOLDIT or Tac'N Stik, under the RAD7, will stick better the first time than in subsequent placings. An experienced hand can tell if the RAD7 has been moved. But perhaps the best anti-tampering defense is the data itself. With the time resolution in the data provided by the RAD7, anomalies are clearly revealed. A sudden change in radon concentration and in air temperature, during the measurement, is a strong indication of tampering, either by moving the instrument, or by opening windows. The key-pad lock prevents tamperers from looking at the data, or interfering with the measurement.

A detailed and systematic quality control protocol must be established by any user seeking certification. This should include a description of the measurement process, and the steps taken to ensure that the readings are reproducible.

The RAD7 is too accurate for any procedure in the field to be able to verify that it is working within specifications. However, it is good practice, on a regular basis, to compare the RAD7 readings with some other device, such as a passive charcoal collector. The two devices should be placed close together, with the RAD7 sampling point near to, but not touching, the charcoal collector. The measurements should also cover the same time period. The charcoal reading may then be compared with the RAD7 mean for the period. Remember, however, that some charcoal devices, and labs, may give readings which are in error by as much as 25%. If the RAD7 and the charcoal device differ by more than 10%, repeat the comparison as soon as possible, preferably with a different charcoal device, from a different lab. Look at the RAD7 cumulative spectrum, printed out at the end of a run, to see if it appears normal. If the RAD7 mean is consistently, significantly different from the readings of other devices in side-by-side tests, or if the spectrum looks abnormal, please call , or email, DURRIDGE for advice. In any case, we recommend that the RAD7 be returned to DURRIDGE Company, for recalibration, annually.

An excellent quality test, for the RAD7, is simply an examination of the cumulative spectrum printed out at the end of every run. If the spectrum looks normal, and the humidity, temperature, and battery voltage are within normal range, then that is very strong evidence that the RAD7 is working properly, and the readings are reliable.

4.2.8 Finishing the Run

Even if no printout has been made at the end of every cycle, it is still useful to have a printout at

the end of the run. If the RAD7 can be accessed before the run is finished, simply place the printer in position on the face plate and switch it on. After the last cycle is completed, the RAD7 will print the run summary, including the mean value, the bar chart of all the readings, and the cumulative spectrum. If the instrument cannot be accessed before the end of the run, the summary can be printed out later, but without the cumulative spectrum.

Switch off the printer and the RAD7. Disconnect the tubing from the desiccant and replace the plastic caps over the hose connectors. If the caps have been lost, a single piece of tubing may be attached between the two connectors, thus providing a seal to keep the desiccant dry.

Remove the inlet filter from the RAD7. It is good practice to leave the inlet filter attached to the plastic tubing. Replace the short piece of tubing connecting the inlet to the outlet. Putting the jumper between the inlet and outlet keeps the internal space of the instrument sealed, and thus dry, while still allowing air flow should the pump start running.

When moving the RAD7, please treat it with respect. It is rugged, but it is still an electronic instrument. Please avoid hard knocks and very harsh environments.

4.2.9 Examining the Data

In addition to the printout, data may be examined on the LCD, during or after a run. The records may also be downloaded to a PC, where they are then available for creating graphs and tables for printed reports.

On reviewing a set of data, first check that the relative humidity in the instrument stayed below 10% throughout the measurement. If it rose above 10%, it suggests that the desiccant was either removed, or became depleted. The RAD7 reads low if the internal RH rises above 10%.

The temperature during the measurement should remain fairly steady. Sudden changes of temperature in the record suggest that either the windows were opened, or the RAD7 was moved from its location.

If the house was not properly closed up until the measurement was started, you may expect to see a rising radon concentration during the first few hours of the run. If that is the case, any very low, early readings should be discarded in the calculation of the mean value for the house. That would mean manual calculation of the average, from the good readings. EPA protocols require at least 48 hours of continuous good data. If the house was not closed up beforehand, a 3-day test could satisfy the EPA requirement.

If the air sampling point was changed for a while, or some windows opened, during the run, you may expect to see a change in air temperature, and change in radon concentration, during that period. Simultaneous changes of these two parameters is an indicator of tampering.

4.2.10 Very Short Term Monitoring

Some Home Inspectors choose to use the RAD7 for a short-term test, just during the home inspection. This means that they have full control over the test, and they can take the RAD7 with them, when they leave, on completion of the home inspection.

They close up the house, set up the RAD7 in the basement, choose a half-hour cycle time and a total run length (recycles) of, typically, four or five cycles. At the end of the run, the RAD7 prints out a bar chart of the increasing radon concentration, at half-hour intervals. The data gives the Home Inspector, and his client, a good indication of the radon situation. Adding 50% to the final half-hour reading gives an estimate of what would be the average radon level, for closed house conditions. If, during those two hours of the test, the radon concentration climbs towards, or over, the 4 pCi/L mark, then they can be confident that, with a full, EPA protocol test, covering 2 days, or more, the result would surely exceed the 4 pCi/L action level.

4.3 Sniffing

4.3.1 Why Sniff?

There are two main reasons for sniffing. One is to obtain a quick, spot reading of radon concentration, as a simpler substitute for grab

sampling, and the other is to locate radon entry points. For each application, the method will be slightly different.

4.3.2 Locating Radon Entry Points

There is a very good chance that thoron will be present in the soil gas entering the building. It will, however, be detectable only close to the entry points. Thoron, therefore, if it is in the soil gas, can be considered as a tracer for fresh radon gas. Sniffing to locate radon entry points may, therefore, be focused on detecting thoron, if it is there, to speed, and simplify, the process. The same procedure will also give radon concentrations, provided that the sampling point is kept at one spot for at least 15 minutes.

4.3.3 Preparation

Detailed instructions are given in Chapter 1.5. Choose Thoron in the Setup Protocol menu, and set the Tone to Geiger. Employ a small drying tube and, preferably, just a yard of tubing to the inlet filter.

4.3.4 Purging

While it is always good practice to purge the instrument before using it, there is less necessity before sniffing. In SNIFF protocol, the pump runs continuously, so the air sample will be flushed through every minute or two, and the measurement chamber will quickly dry out, even if the relative humidity starts above 10%.

To bring the humidity in the instrument down without wasting desiccant, the RAD7 outlet may be connected to the open end of the drying tube, making a closed loop, during the purge cycle.

After detecting high concentrations of radon and/or thoron, it is good practice to purge the instrument immediately after use.

4.3.5 Running the Test

With the RAD7 strap over one shoulder, holding the small drying tube as a wand, start the test. The first status window will be displayed in the LCD. Push the right arrow five times, to reach the B window status screen. This will show the cpm for thoron. You may also listen to the beeps, which have a different pitch for different windows. Thoron has a high-pitched beep.

Floor/wall, wall/wall and split-level seams are common locations for radon entry points. So are sumps, wells, beam pockets and utility conduits, entering the building from below ground level. It is useful, before starting the sweep, to have a sketch map of the area, with the likely culprits marked, on which to write down the readings. While making this sketch map, the RAD7 can be taking a benchmark radon measurement in the center of the room. Take at least four 5-minute-cycle readings. Later radon readings, at likely entry points, can then be compared with this benchmark.

To start the sweep, hold the small drying tube as a wand, with the open end either in, or as close as possible to, the most likely radon entry point. Keep it there for at least five minutes. If the thoron count, in window B, during this time, exceeds 2 cpm, say, then you know a) that you were right in your suspicion, and that you are, indeed, close to a radon entry point, and b) that thoron is present in the soil gas, so you can concentrate on thoron for the rest of the survey. Move the wand a foot or so in any direction to see if the window B cpm changes appreciably, in the next cycle.

If there are few or no counts in window B, then either the location is not a radon entry point, or there is no appreciable thoron in the soil gas. You must, then, keep the wand in that position for another 10 minutes, or until the counts in window A start to rise rapidly. If, after fifteen minutes, there are still only a few counts in window A, and the radon concentration, displayed at the end of the third 5-minute cycle, is still very low, then you can be confident that the position is not a radon entry point. On the other hand, a high radon concentration, without thoron, does not necessarily indicate a radon entry point if the whole basement is high. In either case, you need to note the reading on your sketch map, and move to another likely point to repeat the process, first looking for thoron.

If no thoron is found at any time, then the map of radon concentrations, will help to identify entry points. Once thoron has been detected, the whole search is made much easier. Reset the cycle time to two minutes. Spend one complete cycle at

each suspected radon entry point, observing the counts in window B, or listening for the characteristic thoron beeps. You will quickly determine the location and relative strengths of the radon entry points, from the cpm in window B, for the different locations. Note that, in this procedure, you must ignore the counts in window A, because they refer to radon that entered the measurement chamber as much as 10 minutes previous to the observed counts.

Even if thoron is present at some points, there is still a possibility that there may be a radon entry point showing little or no thoron. This could occur if the path taken by the soil gas was very long, or the flow was slow. Conduit for a utility service, or a path up a hidden shaft in a wall, could delay the entry of the soil gas by several minutes. Each minute's delay halves the concentration of thoron.

4.3.6 Drilled Sampling Points

Some mitigators drill a number of test holes through the concrete slab, to sniff the soil gas beneath and to test the communication between different areas of the slab. They then install the suction points of the mitigation system where the sub-slab radon readings are highest. This approach is complementary to the search for actual radon entry points, as described above. Both methods are likely to result in a similar, final configuration of the mitigation system, though locating the entry points can also indicate where additional sealing is required.

4.3.7 Spot Readings

A spot reading may be accepted only as a rough indicator of the radon level at any location. This is not only because a short-term reading is less precise, but also because it does not average out the fluctuations in radon level through a typical day. The EPA protocol calls for a measurement to cover at least two days. Quite often, the indoor radon concentration tends to be higher in the early morning, after a cold night, and lower at the end of a warm day.

Furthermore, the radon concentration, typically, takes hours to recover from open doors and windows so, unless the house was closed up tight for many hours beforehand, the spot-reading radon level will be significantly lower than an average, taken over several days, in closed house conditions.

For this spot reading, the sampling point should be away from walls and floor. Thoron is not an issue in this measurement, so the larger, laboratory drying unit may be used, instead of a small drying tube. The cycle time may be left at five minutes. At least four, better six, cycles should be taken, of which the first two should be ignored. Alternatively, increase the cycle time to 10 minutes, or more, and ignore the first reading.

To measure a radon level of 4 pCi/L, with a standard deviation of no more than 10%, needs a run of one hour (six cycles of ten minutes, say).

4.4 Grab Sampling

4.4.1 Applicability

The ability of the RAD7 to "grab" a collected sample is useful when it is not possible to take the RAD7 to the location to be tested, or when the RAD7 is pre-occupied with continuous monitoring and will not be available until later. The Grab functionality is also useful when many samples must be gathered from different rooms of a building within a short timeframe.

However, if the RAD7 is available and can be taken to the test location, then data quality is much improved by a) monitoring the radon level over an extended period of time, such as 1-day, or, if that is not a possibility, b) making a short-term measurement such as described in Chapter 4.2.10, or else just sniffing for a spot reading, as described above.

Grab samples have the same shortcomings as spot readings. The radon concentration 'grabbed' is unlikely to be representative of the EPA average level at the location of the sample. The precision of the reading is also limited by the short time for counting.

4.4.2 Preparation

It is important that the RAD7 be well dried out prior to accepting the grab sample. First, purge the unit with fresh, dry air for five minutes. Then connect the laboratory drying unit in a closed loop

with the RAD7 so that air from the outlet passes through the desiccant and back into the inlet. Note that air should always flow the same way through the desiccant. Purge for ten minutes then check the relative humidity (push [MENU] [ENTER][ENTER], then [➔][➔]). If the RH is not below 8%, repeat the process. Keep the pump running until ready to take the grab sample.

4.4.3 Protocol

Choose the Setup, Protocol, Grab menu selection, and push [ENTER]. This will set up all the measurement parameters correctly. For the printout, choose Setup, Format, Short.

4.4.4 Taking the Sample

If the RAD7 is at the location, simply start the test ([MENU][ENTER][➔] [ENTER]).

Alternatively, samples may be taken in tedlar air sampling bags. Samples of at least five liters are required.. Any sampling pump may be used. Even the RAD7 could be used as a sampling pump, but remember to purge the instrument of old air first.

These bagged samples may be connected to the RAD7 and analyzed later. Make sure there is active desiccant and the inlet filter in place, between the sample bag and the RAD7.

4.4.5 Analysis

With the grab sample source connected to the RAD7, start the test ([MENU][ENTER][➔] [ENTER]). The pump will run for five minutes, flushing the measurement chamber, and then stop. The RAD7 will wait for five more minutes, and then count for four 5-minute cycles. At the end of the run, the RAD7 will print out a summary, including the average radon concentration, a bar chart of the four cycles counted, and a cumulative spectrum. The measurement process takes 30 minutes.

If the analysis is made more than an hour after the sample was taken, a correction must be applied for the decay of radon in the sample.

4.5 Thoron Measurement

4.5.1 Thoron and Radon

Thoron is an isotope of the element radon having an atomic mass of 220, so it is also known as radon-220. The word "radon" without a mass number almost always refers to radon-222. Thoron and radon have very similar properties. They are both chemically inert radioactive gases that occur naturally from the decay of radioactive elements in soils and minerals. Both thoron and radon are members of decay chains, or long sequences of radioactive decay.

While radon results from the decay of natural uranium, thoron results from the decay of natural thorium. Both uranium and thorium are commonly found in soils and minerals, sometimes separately, sometimes together. The radioactive gases radon and thoron that are produced in these soils and minerals can diffuse out of the material and travel long distances before they themselves decay. Both radon and thoron decay into radioactive decay products, or progeny, of polonium, lead, and bismuth before finally reaching stable forms as lead.

Thoron and radon and their respective progeny differ very significantly in their half-lives and in the energies of their radiations. While radon has a half-life of nearly 4 days, thoron has a half-life of only 55 seconds. Since thoron is so short lived, it cannot travel as far from its source as radon can before it decays. It is commonly observed that compared to that of radon gas, a much smaller fraction of the thoron gas in soil ever reaches the interior of a building. Even so, thoron can still be a hazard since its progeny include lead-212 which has a half-life of 10.6 hours, more than long enough to accumulate to significant levels in breathable air.

4.5.2 Thoron Measurement Issues

Many difficulties impede the accurate measurement of thoron gas. The presence of radon gas (often found together with thoron) can interfere with a measurement. The short half-life of thoron gas makes some aspects of the measurement easier, but makes sampling method a critical issue. Thoron concentration can vary greatly through a space, depending on the speed

and direction of air movement as well as turbulence. The position of the sample intake can strongly affect the results.

For many instruments, radon and thoron interfere with each other. Generally speaking, it is difficult to measure one isotope accurately in the presence of the other. But compared to other instruments, the RAD7 is much less susceptible to radon-thoron interference due to its ability to distinguish the isotopes by their unique alpha particle energies. The RAD7 separates radon and thoron signals and counts the two isotopes at the same time with little interference from one to the other.

Some issues of concern in measuring radon do not apply to thoron. The short half-lives of thoron (55 seconds) and its first decay product (Po-216 - 0.15 seconds) mean that thoron measurements can be made quickly and in rapid succession, since there is little concern with growth and decay delays. The RAD7 responds virtually instantly to the presence of thoron; its time constant for response to thoron is less than 1 minute. The chief limit on the thoron response speed is the pump's ability to fill the internal cell. And the RAD7 clears just as rapidly when you purge the instrument with thoron-free air. In fact, you need not purge the instrument at all as thoron's short half-life ensures that it will be gone in a few minutes.

In thoron measurement the sample pump must run in a continuous fashion, at a steady consistent flow rate. If the flow rate of the sampling pump changes, then the RAD7 thoron result will also change. Flow rate affects the amount of thoron in the internal cell, since a significant fraction of the thoron decays in the sample intake system as well as within the instrument. For the most accurate thoron measurements we recommend that you use a consistent sample intake system (always use the same hose and filter arrangement) and pay special attention to air flow rate. Be sure the filters, hoses, and RAD7 inlet and outlet ports remain free from obstruction. Use a flow meter (rotameter or "floating ball" type) to check that the flow remains consistent. Note that the flow rate affects the thoron reading, but not radon due to its much longer half-life.

The RAD7 measures thoron concentration in the air at the point of sample intake. Since thoron varies from place to place depending on the motion of the air, the instrument operator may find it necessary to make measurements in several locations to properly assess a thoron situation. Fortunately, rapid-fire thoron measurements are very easy to do with the RAD7.

4.5.3 Calculation and Interference Correction

The RAD7 calculates thoron concentration on the basis of the count rate in spectrum window B which is centered on the 6.78 MeV alpha line of Po-216, the first decay product of thoron gas. To further avoid interference from radon, the RAD7 applies a correction to the thoron count rate to compensate for a small percentage of "spillover" from window C.

If the spill from window C to window B is too great relative to the base amount in window B, it becomes impossible to calculate thoron concentrations with sufficient certainty. This situation can be avoided by purging the RAD7 with fresh air and waiting with the unit turned off for two hours prior to testing for thoron. This provides enough time for the peak in window C to decay to one tenth of its original value.

As of firmware version 2.5, the RAD7 calculates radon concentration from the count rate in window A (SNIFF mode) or windows A plus C (NORMAL mode). The RAD7 compensates for interference from the long-lived progeny of thoron (10.6 hours) by applying a correction to the radon count rate in both SNIFF and NORMAL modes. The correction is based on a fixed fraction of the count rate in the D window (around the 8.78 MeV peak of Po-212) which predicts the amount of thoron progeny activity in the A window (due to the 6.05 and 6.09 MeV peaks of Bi-212). Note that the uncertainty figures given with each reading include the effect of these corrections.

4.5.4 Avoiding Longer Lived Decay Products

Although the RAD7 now corrects for the buildup of the long-lived thoron progeny (10.6 hour), we recommend that you avoid unnecessary exposure of the instrument to high levels of thoron for long periods of time. The presence of these long-lived progeny can make low level radon measurements somewhat less accurate than would otherwise be possible. But if you err, the 10.6 hour half-life of

the thoron progeny makes for a temporary inconvenience of a few days at worst.

4.5.5 Decay Correction, Flow Rate, and Thoron Calibration

As discussed above, thoron's rapid decay causes the intake path and the air flow rate to become important factors in calibration. The RAD7 factory calibration for thoron is based on a standard RAD7 inlet filter, a standard 3-foot long, 3/16 inch inner diameter vinyl hose, and a standard small (6 inch) drying tube. Deviation from this arrangement can change your thoron results. For example, if you were to use a very long hose for thoron sampling, then the sample might decay significantly before it ever reached the instrument inlet. The same thing might happen if you substituted the small drying tube with the large drying column. If you were to use a non-recommended inlet filter, the flow might be restricted enough to greatly lower the result.

4.5.6 Calculating Sample Decay

The thoron concentration at the inlet of the RAD7, C1, can be expressed mathematically as

$$C1 = C0 * \exp(-L * V1 / q)$$

where C0 is the original sample concentration, V1 is the volume of the sample tube + drying tube + filter (around 50 mL), q is the flow rate (around 650 mL/min), and L is the decay constant for thoron (.756 /min). A typical value for C1/C0 is then

$$C1/C0 = \exp(-.756 * 50 / 650) = .943 = 94.3\%$$

This is the number DURRIDGE assumes in the factory calibration. Adding a few extra feet of hose will not matter much (about 0.5% per foot), but if we were to use a 100 foot hose instead (V1 is around 580 mL) then the same calculation would give .509 or 50.9%, a significant reduction from 94.3%!

4.5.7 Calculating Internal Cell Concentration

The sample decays slightly in going from the RAD7 inlet to the internal cell, due to internal hose and filter volumes. This decay can be calculated in a similar fashion to the above, giving the internal cell inlet concentration, C2, about 95.5% of C1. Within the RAD7 internal cell, the equilibrium thoron concentration, C3, will be determined by the following formula:

$$C3 = C2 / (1 + L * V2 / q)$$

where L and q are as above, and V2 is the volume of the internal cell (around 750 mL). Typical values then give C3/C2 as

$$C3/C2 = 1/(1+.756 * 750/650) = .534 = 53.4\%$$

Multiplying this result by the sample decay factors calculated above, we obtain an overall concentration in the internal cell of 48.1% of the original sample. Recognizing the uncertainty of several of the inputs to these formulas, particularly the flow rate, we will round the overall result to 50%.

4.5.8 Internal Cell Thoron Sensitivity Calibration

Preliminary investigations have shown that the RAD7's internal cell thoron sensitivity in cpm/(pCi/L) is identical to its radon SNIFF mode sensitivity, to within 25%. We have no reason to expect any sizable difference between the thoron and radon SNIFF mode sensitivity values, so we are presently assuming that the two values are indeed nearly equal, and claim an uncalibrated thoron precision of +/- 30%.

With calibration against a thoron standard assessed by gamma spectrometry we are able to state the thoron sensitivity with much higher certainty. This thoron calibration is offered as an option and for this we claim an overall accuracy of +/- 20%. Otherwise we estimate the overall thoron sensitivity to be 50% of the radon Sniff sensitivity to account for sample decay in the intake and internal cell. The RAD7 has a typical radon Sniff sensitivity of .25 cpm/(pCi/L), so we estimate the typical thoron sensitivity to be around .125 cpm/(pCi/L).

4.5.9 Setting up a Thoron Measurement

Sniffing for thoron is much the same as sniffing for radon, except it tends to be a little faster. If you are just "prospecting", you probably will not be very interested in getting the most accurate results possible, so technique is not critical. But if

you are trying to make an accurate measurement, technique is of great importance.

For accurate thoron measurement, always use the same sample taking arrangement. Keep the sample tubing short: no more than 6 feet (2 meters) total length. Use one of the small drying tubes supplied with the instrument, positioned vertically and filled with fresh (blue) desiccant. Always use an inlet filter, free from flow restrictions or clogs. Avoid obstructing the intake of the sample tube. The recommended configuration is pictured below. For the most accurate results, check the flow rate with a flow gauge to be sure it is consistent from measurement to measurement. Use the RAD7's Setup Protocol command to choose Thoron protocol for a 5 minute repeating cycle. Be sure the instrument has been "dried out" before making a measurement. Position the sample tube intake and start the test.

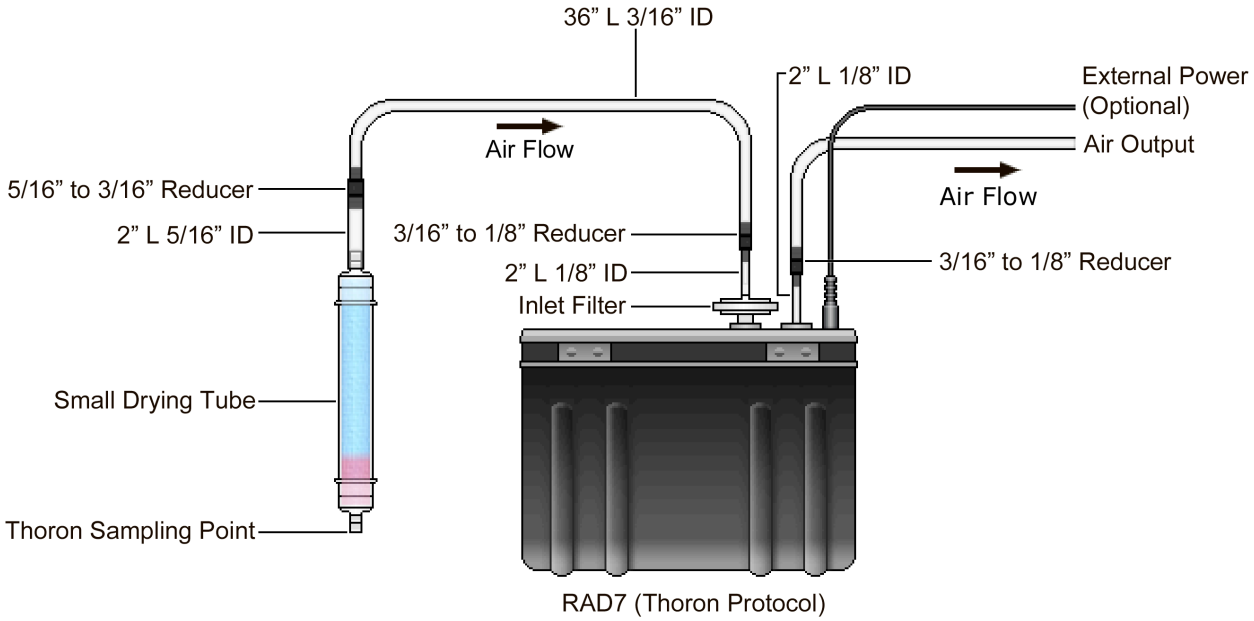
4.5.10 Thoron Mode

Thoron mode causes the RAD7 to print both thoron and radon concentrations (in pCi/L or Bq/m3) in continuous data logging or in subsequent printing of data. Thoron mode also directs the automatic pump setting to continuous pump operation to assure a fresh sample.

The setup parameter "Setup Thoron" allows you to select Thoron mode On/Off, for configuring a particular test to perform thoron readings.

The protocol "Protocol: Thoron" provides a standard test for sniffing both radon and thoron in 5 minute cycles.

Recommended RAD7 Thoron Configuration



4.6 Managing Background

A major concern in radon testing is background. The RAD7 has a number of features that help to keep short and long-term background under control. These are discussed in Chapter 3.11. Following a few simple rules will help to keep background to a minimum.

Short term background is activity left in the detector after the air sample has been flushed from the measurement chamber. The higher the radon concentration and the longer the sample is held in the cell, the more daughter activity it leaves behind. So, to avoid background, when you see high radon readings, finish your measurement, and purge the sample cell promptly. Take the instrument somewhere with little radon, such as outdoors. Make sure the drying tube is connected, and select `>Test Purge`. Let the RAD7 purge for 5 to 10 minutes, or longer if the sample was exceptionally "hot".

The two alpha peaks decay at different rates. The polonium-218 peak, in window A, decays with a 3.05 minute half-life. So in 10 minutes it will be down to about one-tenth of its original count rate. The peak in window C, however, will take over two hours to get down to one-tenth its count rate.

Rather than wait around for hours, you can start the next radon test in SNIFF mode, which ignores window C. In fact, the preset, one and two-day, monitoring protocols, in the RAD7, use AUTO mode, which starts a measurement in SNIFF mode and automatically changes to NORMAL mode after three hours. This takes care of all but extreme exposure to very high radon.

You can always measure the short-term background, with 5-minute SNIFF mode tests. Run a few to see that the background is low.

4.7 Harsh and Hazardous Environments

4.7.1 Splashing Water

Extra care should be taken to prevent water from splashing onto the RAD7 face plate or entering the instrument through the RAD7 inlet. Either situation can cause malfunctions and corrosion. If the RAD7 is to be operated in a harsh environment, such as a cave or mine, where water may splash around, the RAD7 may be protected in two ways:

a) A thin plastic film may be stretched over the face plate and down the sides of the case. It can be pushed down around the hose connectors and plugs can be pushed into data and power sockets, pushing the plastic film down around the pins. The result is to make the instrument almost waterproof.

b) The RAD7 can be enclosed in a large transparent plastic bag with the opening gathered, and held with an elastic band, around the incoming air-sample tubing.

c) The dry air from the RAD7 outlet may be exhausted to the interior of the bag, so ensuring that the RAD7 is operating in a clean and dry environment.

If water ever enters the RAD7, immediate steps should be taken to minimize the impact on the instrument. For detailed instruction see Section 8.4, Water Catastrophe.

4.7.2 Dusty Environment

Dust may contaminate the desiccant and cause elevated radon background due to radon emitted by trace amounts of radium deposited in the desiccant by the contaminating dust. To prevent this, a dust filter should be attached to the tubing at the sampling point, upstream of everything.

A suitable dust filter is supplied with every RAD7. The filter should be replaced when it becomes soiled. Replacements may be purchased from a car-parts supplier as 1960's VW Beetle in-line gasoline filters, part number 803-201-511C, or FRAM G4164, or from DURRIDGE Company.

Please note that any restriction to air flow, including a plugged dust filter, upstream of a passive DRYSTIK will reduce the effectiveness of the DRYSTIK. In a dusty environment, with a dust filter in place, an Active DRYSTIK will continue to work well even if the dust filter becomes partially blocked.

4.7.3 Radiation Hazard

If the RAD7 is to be placed in a position hazardous to the health of individuals, remote communication may be established either through the a wireless network or over telephone lines. Please see Chapter 6 and the CAPTURE user's manual for details.

5. USING *RAD7* ACCESSORIES: TESTING FOR RADON IN THE GROUND AND WATER

5.1 Introduction

With the addition of various accessories offered by DURRIDGE, the RAD7 can acquire the ability to detect radon in water samples, flowing water, soil gas, hard and soft surfaces, and collected objects. These applications and the accessories required for each are described below.

The accessories discussed here are not included with the RAD7. For full details on the usage of a given accessory, please see its user manual. All product manuals are available in print form, and on the DURRIDGE website (www.durridge.com) in PDF format.

5.2 Radon in Water

5.2.1 The RAD H_2O Accessory

The RAD H_2O is an accessory for the RAD7 that enables you to measure collected water samples to detect radon with high accuracy over a wide range of concentrations, obtaining your reading within an hour of taking the sample. It is particularly suited for well water testing, where immediate results are often required.

The RAD H_2O uses a standard, pre-calibrated degassing system and pre-set protocols, built into the RAD7, which give a direct reading of the radon concentration in the water sample itself. The method is in fact a special variation of the grab sampling method described in the previous chapter.

The most widely supported sample sizes are 40mL and 250mL, as these correspond to the RAD7's built-in Wat-40 and Wat250 protocols. Large water samples of up to 2.5L may be sampled using the Big Bottle RAD H_2O System, with radon concentrations being calculated using the provided CAPTURE software for Windows and Mac OS X.

The RAD H_2O comes with a detailed manual, to which you are referred for further information.

The RAD H_2O Accessory

The RAD AQUA Accessory

5.2.2 The RAD AQUA Accessory

The RAD AQUA accessory handles the continuous monitoring of radon in water, offering accurate results in as little as half an hour. Applications for the RAD AQUA include testing water from running faucets and water being pumped from the bottom of a lake. In addition to its rapid response time, the RAD AQUA offers a high degree of sensitivity.

The RAD AQUA functions by bringing air into equilibrium with water passing through an exchanger in a closed loop. During this process, the RAD7 is set to operate in continuous mode, as described in Chapter 4.2.

Since the equilibrium ratio of radon in air to radon in water is affected by temperature, a temperature probe is used to collect water temperature data, and DURRIDGE CAPTURE software for Windows and Mac OS X later accesses the RAD7 data and the water temperature data and calculates the final radon in water readings.

Users are encouraged to refer to the RAD AQUA manual for further details.

5.2.3 The WATER PROBE Accessory

The Water Probe is used to collect radon samples from large bodies of water. The probe consists of a semi-permeable membrane tube mounted on an open wire frame. The tube is placed in a closed loop with the RAD7.

When the probe is lowered into water, radon passes through the membrane until the radon concentration of the air in the loop is in equilibrium with that of the water. As with the RAD AQUA, the RAD7 data and water temperature data are collected simultaneously and accessed by CAPTURE to determine the final result.

As compared to the RAD AQUA, the Water Probe takes longer to make a spot measurement. However it does not require a pump, so power requirements are reduced.

5.3 Soil Gas Sampling

5.3.1 Application

The radon concentration in the soil gas surrounding a house is one of many parameters that impact radon health risk. The construction of the house, the porosity of the soil, the height of the water table, and several other factors are all important. Even if there is no radon in the surrounding soil, the house may still be at risk if it has a well in the basement, or is built on rock, over a fissure. Regardless, it is often of interest to determine the radon concentration in soil gas.

Thoron is usually associated with radon in the soil. When measuring soil gas, it is therefore particularly useful to determine the thoron content as well as the radon content. Should there be significant thoron, it may be used as a tracer, to find radon entry points inside the house. See Chapter 4.3.2 for details.

5.3.2 The Soil Gas Probe Accessory

The cost and complexity of a soil gas probe increases with the depth to which it can be inserted. A variety of probes are available from DURRIDGE, the simplest of which will penetrate to a depth of 3 feet.

5.3.3 Soil Gas Probe Preparation

For full details on using a soil gas probe, please refer to the appropriate user's manual found at the DURRIDGE website (www.durridge.com). The basic procedure can be summarized as follows.

Insert the soil probe. Make sure that there is a reasonable seal between the probe shaft and the surrounding soil, so that ambient air does not descend around the probe and dilute the soil gas sample.

Between the probe and the RAD7, connect the included water trap (which could be just a jar with two air-tight hose connectors in the lid). Then connect the laboratory drying unit, and the inlet filter. A water trap is included in the package when the DURRIDGE soil gas probe is purchased.

Set the protocol to Sniff. Soil gas is normally so high in radon that it is not necessary to use long cycle times to gain precision. Five minute cycle times are sufficient.

5.3.4 Running the Test

Start the test. (`Test, Start, [ENTER]`). On the LCD screen you will see the first status window. Push the right arrow twice and the screen will display the temperature, relative humidity, battery voltage and pump current. Pay particular attention to the relative humidity and pump current. The humidity should gradually drop down to below 10%, and stay there.

If the pump current starts to rise much above 100 mA, it suggests that the soil is not porous, in which case it may be that a good soil gas sample cannot be drawn, no matter how powerful the pump is. With the RAD7 pump current above 100 mA, the air flow rate will be significantly reduced from the nominal 1L/min. This will not affect the radon reading, but will reduce the effective sensitivity to thoron, as more of the thoron will decay en route to the RAD7. If desired, an additional pump may be used, but it should be placed upstream of the RAD7, so that the RAD7 is operating at normal pressure. In fact, with an external sampling pump in use, the RAD7 pump can even be switched off altogether.

5.3.5 Interpreting the Data

As with any Sniff test, the first two 5-minute cycles should be ignored. The next one or two cycles should be averaged, to arrive at the radon concentration of the soil gas.

For thoron, some estimate has to be made of the time taken for the sample, after it has left the soil, to reach the RAD7. This requires an estimate of the volume of the sample path, including the probe, water trap, tubing and drying unit, and an estimate, or measurement, of the flow rate. For example, if the total volume of the sample path is 2L, and the flow rate is 0.5 L/min, then the sample delay is about 4 minutes. If the thoron decays by half every minute, then after four minutes the concentration will be just 1/16th of the concentration in the ground. So, the thoron concentration measured by the RAD7 would be multiplied by 16.

5.4 Emission Measurements

5.4.1 Application

With its internal pump, sealed sample path, and inlet and outlet connectors, the RAD7 is well suited to the measurement of radon emissions from objects and surfaces. Furthermore, the ability to count only the polonium-218 decays means that dynamic measurements are clean, and not complicated by long-half-life events.

5.4.2 Open or Closed Loop Configurations

Emissions may be sampled from collected objects using DURRIDGE's Bulk Emission Chamber. It is also possible to analyze emissions from soft or hard surfaces, with the aid of a DURRIDGE Surface Emission Chamber, which consists of a plate-like enclosure capable of forming a tight seal around the surface in question. In both cases, the RAD7 draws air from within the enclosed space, through the desiccant and inlet filter, and into the measurement chamber. The air may then be returned to the enclosure from the RAD7 outlet, to form a closed loop. Alternatively, in an open loop configuration the air being drawn from the enclosure may be replaced with 'zero' air from a cylinder, or with ambient air, which should have a low but known radon concentration.

With the closed-loop configuration, the system is first purged. Then once it has been sealed, the radon concentration within the loop is monitored in SNIFF mode, with short, e.g. 15 min., cycle times, for a few hours. It is necessary to know the total volume of the closed-loop system. For this purpose, the volume inside the RAD7 may be taken as 1L. The initial rate of increase in radon concentration (neglecting the first 15-min cycle), multiplied by the volume, gives the rate of emission of radon. A reduction in the slope, as the radon level builds up, may be due to leaks in the system, or to a reduction in the net emission.

With the open loop configuration, a steady and known flow rate must be established. If a cylinder of 'zero' air, or nitrogen, is used, then the RAD7 internal pump may be set to Off, and a pressure reduction valve may be used to control the flow rate. With ambient air, the internal pump may be set to On, for a continuos flow. In both cases, a flow meter is required.

A steady state should be achieved and a long-term measurement may be made. The rate of emission will equal the radon concentration times the flow rate. The precision will depend on the concentration and the duration of the measurement.

5.4.3 Bulk Emissions

The DURRIDGE Bulk Emission Chamber is an airtight box with two well separated hose connectors. The material to be tested is placed in the chamber, which is then connected to the laboratory drying unit, and thence to the inlet filter on the RAD7. The other box connector has tubing attached, which is either connected to the RAD7 outlet for closed-loop operation, or to a cylinder of zero gas or ambient air.

Note that bulk emissions are affected by pressure fluctuations and by temperature and humidity. All these parameters can and should be controlled in both the closed-loop and open-loop configurations. Radon emission is also dependent on the grain size of loose materials, and the porosity of any bulk material.

In addition to radon, thoron can also be measured in the Bulk Emission Chamber. In the open loop mode, a correction is required for the decay of the thoron during the time between its emission and measurement in the RAD7. In closed loop mode, another correction must be made for the portion of thoron that gets fed back to the enclosure. Note that for thoron, both the closed loop and open loop modes are steady-state measurements.

5.4.4 Surface Emission

DURRIDGE offers two surface emission chambers, one for solid hard surfaces, and another for soft soil surfaces. Each consists of an circular plate which is sealed against the surface under investigation. The Solid Surface Emission Chamber accomplishes this using a rubber seal, while the Soil Surface Emission Chamber uses a penetrating metal rim.

The measurement procedure is similar to that of the Bulk Emission Chamber described above. Once the total emission rate within the enclosure has been calculated, it may be divided by the area of the surface within the sealed boundary, to determine the emission per unit area.

The Bulk Emission Chamber

The Surface Emission Chamber

5.5 *Supporting Accessories*

5.5.1 Overview

DURRIDGE offers additional RAD7 accessories which improve the accuracy of radon and thoron reporting by optimizing operating conditions.

The RAD7 is able to detect radon in concentrations of up to 20,000 pCi/L (750,000 Bq/m^3). For applications involving higher concentrations of radon, DURRIDGE offers the Range Extender, a device which removes 90% of the radon from the air sample entering the RAD7, giving the instrument the ability to operate in conditions under which it would otherwise be unable to cope. A final concentration figure is attained by multiplying the reported result by ten.

Another limitation of the RAD7 is that it loses reporting accuracy under high humidity conditions. The use of desiccant ensures that the air entering the RAD7 inlet is not too humid, but since desiccant is expended quickly when exposed to very moist air, DURRIDGE offers the DRYSTIK, an instrument which removes moisture from the air entering the RAD7 without removing the radon itself. The premium DRYSTIK model is capable of reducing the humidity of a typical air sample to 4% in under 20 minutes, greatly prolonging the life of the desiccant, or eliminating the need for it altogether.

The Range Extender and DRYSTIK are described in more detail below. For full documentation on each, please refer to the Range Extender and DRYSTIK user manuals, available in PDF format at the DURRIDGE Website (www.durridge.com).

5.5.2 The Range Extender

The Range Extender mixes fresh air with the air being sampled, reducing the concentration of radon entering the RAD7 by a factor of ten. This greatly increases the instrument's effective range.

The Range Extender consists of two parallel capillary tubes joined at one end to an outlet hose connector. Fresh air is fed to the input of one tube while the incident radon sample is fed to the other. A differential pressure sensor across the two tube inputs, with a needle valve for adjustment, is used to ensure that both capillary tubes have the same pressure drop across them.

With this system the radon concentration delivered to the RAD7 is reduced by an order of magnitude, regardless of the strength and flow velocity of the RAD7's internal pump. The RAD7 pump can cycle on and off without affecting the reduction factor.

The Range Extender can be used for the measurement of very high radon concentrations in air, in soil gas, and in water. It can also be used with any other instrument that has its own pump, for any gas. If used to extend the range of thoron measurement, care must be taken to assess and correct for the additional decay of the thoron due to sample acquisition delay.

The Range Extender

5.5.3 The DRYSTIK

The DRYSTIK reduces the humidity of the air entering the RAD7 by transferring moisture from the sample about to enter the RAD7 to the air being pumped out of the instrument. As the air enters the desiccant in the drying unit (which is not included with the DRYSTIK) on its way to the RAD7, it will have already lost most of its moisture, greatly extending the life of the desiccant in the drying unit. In certain cases the need for desiccant is eliminated altogether.

The DRYSTIK has at its heart a Nafion humidity exchanger with diaphragm pump, fixed and

variable flow limiters, and a built-in Duty Cycle Controller. These are all contained in a compact, portable enclosure. The DRYSTIK's pump compresses the sample air inside the membrane tubing, initiating the transfer of water molecules to the outer purge flow, drying the incoming air as it moves through the device.

The DRYSTIK is available in three variants, based on the length of Nafion tubing used. The premium 144-ADS model is capable of bringing the relative humidity of air flowing at 0.15 L/min down below 10% in less than four hours, and maintaining the RH below 6% indefinitely without any desiccant. This allows a RAD7 to operate under optimum conditions with the highest sensitivity and lowest operating cost. At a higher flow rate of 1.2 L/min, the DRYSTIK can bring the RH down below 12%, which is sufficient for enhanced-sensitivity thoron measurement.

For soil gas measurement, the DRYSTIK provides a high flow capability, supporting the detection of short-lived thoron. For radon, the ability to lower the flow with the built-in Duty Cycle Controller means that continuous soil gas readings may be made indefinitely, without any risk of fresh air diluting the soil gas sample by diffusing from the surface down to the extraction point. Given its versatility, the DRYSTIK is effective for a wide range of applications.

The DRYSTIK (Model ADS-3R)

6. PC Connectivity

6.1 PC Connectivity Basics

The RAD7's built-in serial port allows you to transfer radon data to your personal computer and to configure the device remotely. DURRIDGE provides a free software utility for Windows and OS X, *CAPTURE*, which makes it easy to perform these actions, as well as to monitor the RAD7 status, graph radon and thoron data, correct for environmental factors, and export the results.

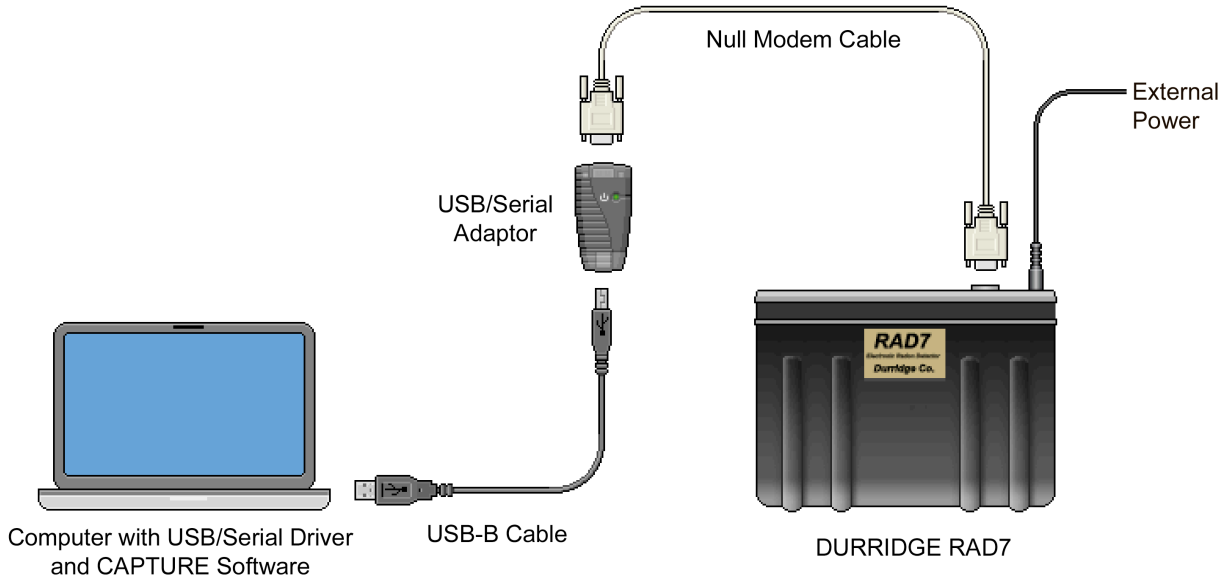
It is also possible to use a terminal emulator program to interface with the RAD7, and to write your own RAD7 communications software using the protocol documented later in this chapter.

The RAD7 serial port connects to a computer using the included null modem cable. Since newer computers lack serial ports, a USB to RS-232 adaptor and required drivers are provided standard with the RAD7.

The recommended configuration involves the null modem cable, USB to RS-232 adaptor, and a USB-B cable, as shown in the diagram below. If a null modem cable is not available, it is possible to use a standard modem cable, along with a null modem adapter. It is recommended that the RAD7 remain plugged into external power to prevent its battery from dying while it is connected to the computer.

The latest version of the CAPTURE software may be downloaded from the DURRIDGE website (www.durridge.com). An overview of CAPTURE is provided in Chapter 6.2, and the full documentation is available at www.durridge.com/capturehelp/. It is also accessible from CAPTURE application, inside the Help menu.

Following the section on CAPTURE, the remainder of this chapter contains technical information which will be of interest to advanced users who intend to communicate with the RAD7 via a terminal window and those who wish to write their own software for communicating with the RAD7.

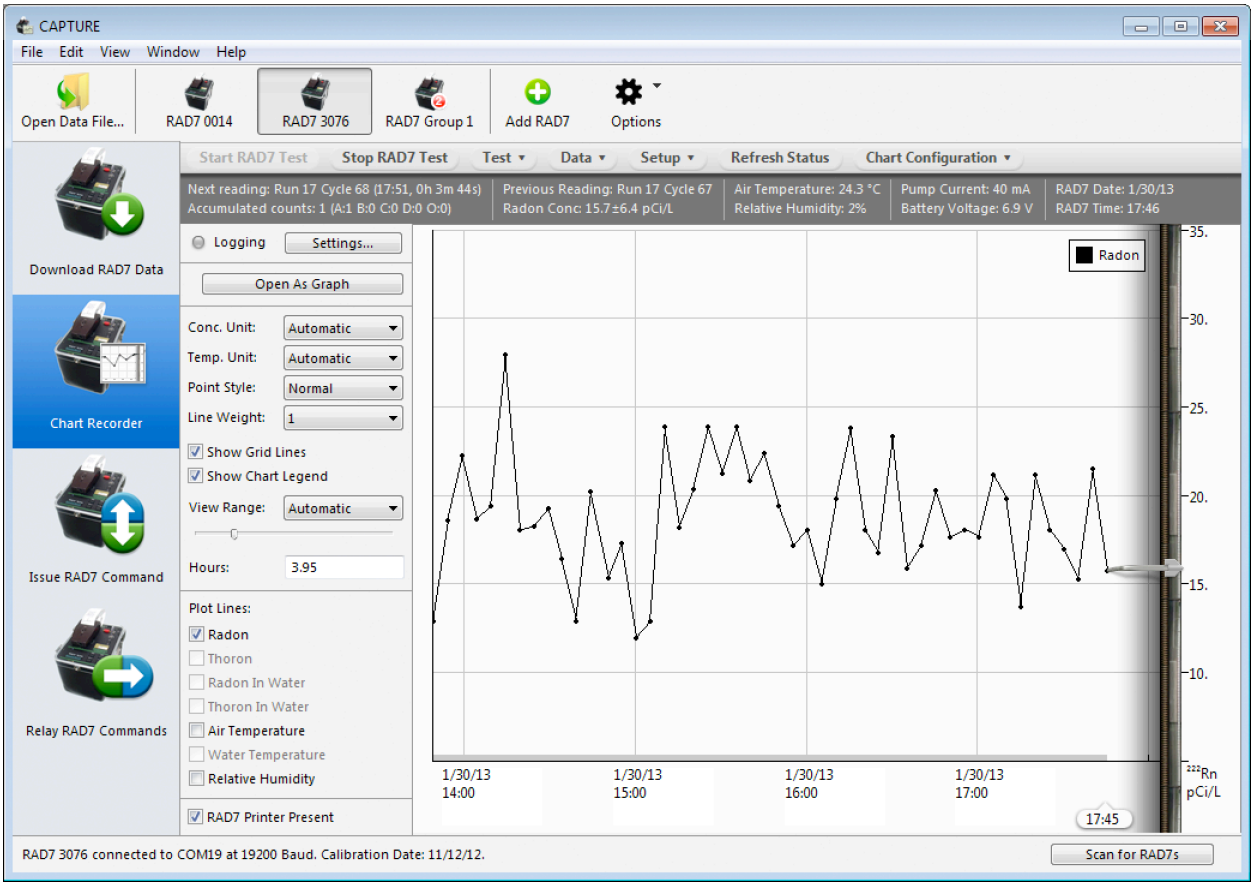


Connecting the RAD7 to a computer

6.2 *CAPTURE Software*

CAPTURE is intended to simplify the transfer of data from the RAD7 to a computer. It also provides a wealth of graphing and data analysis options, and offers the ability to export data to other programs for further review. The software is available for Windows XP/Vista/7, and Macintosh OS X. The latest version of CAPTURE can be downloaded from the DURRIDGE website (www.durridge.com) at no charge.

This chapter serves as a brief introduction to the CAPTURE software. It is recommended that RAD7 users examine the complete CAPTURE documentation which is available within the program's Help menu. This information may also be found on the DURRIDGE website, at www.durridge.com/capturehelp/.



CAPTURE Software running in Windows 7

6.2.1 CAPTURE Installation

Download the appropriate version of CAPTURE (Windows or Macintosh) from the DURRIDGE website. In Windows an installer program will install the necessary components and place shortcuts in the Start Menu and on the desktop, if desired. To install CAPTURE for the Macintosh, open the downloaded .dmg file and drag the CAPTURE application into the Applications folder or to the location of your choice.

To operate CAPTURE on a computer without a serial port, it is necessary to install the Keyspan Serial to USB adaptor driver, which is included on the DURRIDGE Software CD, bundled with each

RAD7. This software is also available from the Tripplite website, (http://www.tripplite.com/). On the site, click the Keyspan Products link and look for the USA-19HS link to access the appropriate driver software.

For connecting more than one RAD7 to a computer, it is possible to use several USA-19HS adaptors simultaneously, with each plugged into a USB port on the computer (i.e. do not plug multiple adaptors into a single USB hub.) Alternatively, the Keyspan USA-49WG 4-Port Serial to USB adaptor may be used to connect to up to four RAD7s using a single USB port.

Other Serial to USB adaptors known to work with CAPTURE include those using the FTDI Chip driver, which is not included with the RAD7, but is available for several platforms. DURRIDGE recommends the Keyspan adaptor for most uses.

6.2.2 Feature Summary

CAPTURE's capabilities fall into three main categories: downloading RAD7 data, graphing and analysis, and real-time RAD7 monitoring. An overview of each is described below.

6.2.3 Downloading RAD7 Data

CAPTURE's original and primary function is to download RAD7 data. Once connected to a RAD7, the program can download all of the device's data, or a particular data run. For a more complete record set, supplementary output containing thoron concentration records may also be obtained. When a download operation is complete, the results are saved to disk in the format of the user's choice.

In addition to being able to download data from RAD7s connected directly to the computer, CAPTURE can obtain data from remote RAD7s, connected via a remote desktop software, a local network, or a modem.

6.2.4 Graphing and Analysis

Once RAD7 data has been downloaded and saved to disk, it may be displayed as a graph. CAPTURE's Graph Window allows for the display of radon, thoron, temperature, and humidity data. Navigation controls make it possible to select the data points within a specific date range and zoom in to that region for a closer look.

Accompanying the graph display is a statistics panel showing information about the point nearest to the cursor and the points within the selected region, as well as the points comprising the entire data set.

A synthesized spectrum display appears in another panel, providing an indication of the changes that occur within the RAD7 as a testing session progresses.

RAD7 Profiles based on device calibration data may be applied to graphs to improve the accuracy of the data shown. Data points may also be corrected for temperature, humidity, and other variables. Any problematic data records will be examined by CAPTURE's comprehensive error catching system and reported to the user.

CAPTURE supports the exporting of both raw RAD7 data and more complete error-corrected RAD7 data in a number of formats, for use in spreadsheets and other analysis tools. Summary reports may also be generated, providing general overviews of the collected data.

6.2.5 Real-Time RAD7 Monitoring

CAPTURE is capable of monitoring multiple local and remote RAD7s simultaneously in a Chart Recorder, displaying status details and plotting radon concentrations in real time as they are recorded. A statistics panel is automatically refreshed as new information arrives.

Besides tracking the sate of each connected RAD7, it is also possible to issue menu commands, performing such tasks as starting and stopping tests and setting the protocol. All of the functionality of the RAD7's physical controls are accessible from within CAPTURE's graphical interface.

As stated above, it is suggested that users examine the complete CAPTURE documentation, available from the www.durridge.com/ capturehelp/, and from within the program's Help menu.

6.3 RAD7 Communication Protocol

6.3.1 Communication Requirements

Although the CAPTURE software for Windows and OS X provides a complete solution for downloading RAD7 data and issuing RAD7 commands, it may be desirable to communicate with the device using a terminal window, or with custom communication tools designed to fulfill specific needs.

The RADLINK firmware, installed standard with every RAD7 sold, enables the RAD7 to respond to commands issued through its serial port. With RADLINK installed, all of the commands available through the RAD7 keypad will also be available via the serial port. From a computer you may, for example, change the RAD7's operating parameters, complete a test, and then download the accumulated data.

6.3.2 RAD7 Command Format

The format of commands issued to the RAD7 serial port match, as closely as possible, the format of the commands available to the user at the RAD7 keypad. For example, the command to change the cycle time to 1 hour is "`SETUP CYCLE 01:00`". The command to turn off the audio beeper is "`SETUP TONE OFF`". The command to send over the data from run number 3 in comma-delimited form is "`DATA COM 3`". (This particular command is described further in Chapter 6.3.3, Parsing RAD7 Data.)

Besides the ordinary RAD7 commands, additional commands have been implemented via RADLINK which add functionality and in some cases substitute for other commands. These commands all start with the word "SPECIAL". One such command is "`SPECIAL STATUS`", which gives information about the current status of the instrument. It is like "`TEST STATUS`", but does not continue to update the information every second; instead, it returns control to the user.

The third standard ASCII character, ETX, functions as a remote "menu" key that can be used to interrupt certain RAD7 activities and prepare it to accept a new command. The RAD7 replies with a prompt, the greater-than character "`>`", that tells you it is ready for a new command. When using a terminal emulator program, you will always type commands at the prompt.

All commands must be followed by a carriage return (the thirteenth standard ASCII character), denoted here as `<CR>`. No command will be activated until the `<CR>` goes through. Once you have typed a command, always end with a carriage return keystroke. This key may be marked "Enter" or "Return" on your keyboard.

If the RAD7 cannot understand your command, for example if you typed words in the wrong order or misspelled something, it will respond with

```
?ERROR
```

followed by a list of acceptable command words.

The case of the command does not matter, nor does the numeric format of numbers. In the last example, "`data com 03`", "`Data Com  3`", and "`dAtA coM 03.00`" all work equally well.

6.3.3 Parsing RAD7 Data

Stored RAD7 data can be obtained through the "`Data Com ##`" command. Specify the run number in the command line and finish with a carriage return. Alternatively, issue the "`Special ComAll`" command to download all runs from the RAD7.

Each cycle produces a record containing 23 fields. Carriage-return line-feeds separate the records, and within each record, commas separate the fields. Fields may have leading zeros, extra space characters, trailing decimals, etc., which may need to be trimmed. When the RAD7 responds to a Data Com or Special ComAll command, each line returned represents a different cycle. Here is an example of a single line:

```
009,99,10,29,04,18,4823.,337.8,45.4,
2.9,46.6,0.3, 2201,14, 23.7, 5, 7,
7.09, 00, 125, 28.32743, .8500846,
255<CRLF>
```

The meaning of each of these values is described in the table on the next page.

RAD7 Data Record Content:

ID	Field Name	Notes
1	Record Number	Ranges from 001 to 999
2	Year	2 digit value
3	Month	2 digit value
4	Day	2 digit value
5	Hour	2 digit value
6	Minute	2 digit value
7	Total Counts	Integer indicating total counts recorded during test
8	Live Time	Expressed in minutes
9	Percent of total counts in win. A	These 4 windows will not always add up to 100% since counts can come into channels below or above these windows.
10	Percent of total counts in win. B	
11	Percent of total counts in win. C	
12	Percent of total counts in win. D	
13	High Voltage Level	Ranges from 2200V to 2300V
14	High Voltage Duty Cycle	Ranges from 0-100%; typically 10-20%
15	Temperature	Measured in °C or °F depending on RAD7 setup
16	Relative humidity of sampled air	Should be kept below 10% for most accurate test
17	Leakage Current	Ranges from 0 to 255. Above 20 is cause for concern.
18	Battery Voltage	Below 6.00V is a discharged battery. Does not affect accuracy of test but indicates need for recharge.
19	Pump Current	Ranges from 0-260mA. Typically 40-80mA; Above 100mA possible clogged filter or obstruction.
20	Flags Byte	Bit 0 indicates whether pump is in TIMED mode Bit 1 indicates whether pump ON continuously Bit 2 is not defined Bit 3 indicates whether tone is in GEIGER mode Bit 4 indicates whether beeper is activated Bit 5 indicates if spectrum will print after each test Bit 6 indicates if there are multiple (recycle) tests Bit 7 indicates whether RAD7 is in SNIFF test mode.
21	Radon concentration	Expressed in pCi/l, Bq/m3, cpm, or # counts, depending on the units the RAD7 has been set to use.
22	Radon concentration uncertainty	Two-sigma uncertainty - of concentration in the SAME units as the base radon concentration (not %).
23	Units Byte	Bits 0 and 1 indicate the concentration unit: 00 = counts per minute 01 = number of counts 10 = Bq/m3 11 = pCi/L. Bit 2 through Bit 6 are not defined. Bit 7 indicates the temperature unit (0 = °F, 1 = °C)

6.3.4 Terminal Emulator Tips

If you are using a terminal emulator to interact with the RAD7, you can gain access to additional functionality by making sure the terminal has been set up to give ANSI standard escape codes for the function keys and cursor control keys. Set the terminal for either ANSI, VT-52, or VT-100 mode to get these functions. The function keys F1, F2, F3, and F4 act as a remote RAD7 keypad, corresponding to the RAD7 keys [MENU], [ENTER], [←], and [→]. The Control-C character also acts as the remote [MENU] key (ETX). The backspace/delete key on your keyboard allows you to correct misspelled commands before the carriage return. If this key does not work, then Control-H may handle the same function.

6.4 Serial Port Specifications

6.4.1 Communication Protocol

The RAD7 serial port follows RS-232C convention for signal levels. Positive voltage (+3V to +15V) indicates logic state 0 (SPACE), while negative voltage (-3V to -15V) indicates logic state 1 (MARK).

The connector pin-out follows the IBM PC convention for the 9 pin serial port. The handshaking lines (DTR, DSR, RTS, and CTS) are not fully implemented, and should be considered non-functional (NF), but X-on/X-off flow control can be used.

RAD7 Serial Port Pin Assignments

Pin	Function	Comment
1	Carrier Detect (CD)	NF
2	Receive Data (RD)	
3	Transmit Data (TD)	
4	Data Terminal Ready (DTR)	NF
5	Signal Ground (SG)	
6	Data Set Ready (DSR)	NF
7	Request To Send (RTS)	NF
8	Clear To Send (CTS)	NF
9	Ring Indicator (RI)	NF

The RAD7 serial port implements two-way communication at 300, 600, 1200, 2400, 4800, 9600, and 19200 bits per second (baud); these speeds are available through the 'Special' commands of the RADLINK remote control package. The default speed is 1200 bps.

RAD7 Communication Parameters

Default Rate	1200 bps
Maximum Rate	19200 bps
Recommended Rate	9600 bps
Data Bits	8 bits
Parity Bit	None
Stop Bits	1 bit

The RADLINK remote control software resides in the RAD7's non-volatile memory (NVRAM), but its presence does not decrease the amount of memory available for storing radon data.

6.4.2 Extending the RS-232 Range

The simple, direct serial port to serial port connection has a range limited to around 50 feet (15 meters) by the RS-232-C standard. Options for extending this range include RS-232 line boosters, current-loop and other types of interface converters, short-haul modems, and leased-line modems.

You may use standard data modems to communicate over the telephone system to one or more remote RAD7 monitors, so that when you want to get some data or start a new run, just "dial up" the instrument of your choice. The modem should be Hayes compatible and should be set to auto-answer.

The CAPTURE user's manual contains a section titled Long Distance Communication, detailing other strategies for communicating with distant RAD7s. These include the transmission of commends via Bluetooth, local area networks, and more.

7. Maintenance

Provided the RAD7 is treated with respect, the only maintenance required by the instrument is its regular recalibration. For this, it should be returned to DURRIDGE Company, who will check the health of the instrument, and who will incorporate the new calibration factors in the instrument firmware.

If the instrument is to be used in a harsh environment, where water and/or mud may be splashed on the face plate, the RAD7 should be put in a box or large transparent plastic bag. The air input may be brought into the container by a plastic tube from the sampling point. The air outlet should be left in the container, so that the RAD7 becomes surrounded by clean and dry air.

7.1 Accessories - Usage and Care

7.1.1 Desiccant

Two sizes of desiccant tubes are supplied. In the NORMAL mode, use the large 2" diameter tube (laboratory drying unit). This unit will last for days under continuous operation at high humidity before it needs regeneration.

When used as a Sniffer, the small desiccant tube is recommended. It will last for several hours before replacement or refilling of the tube is necessary. To regenerate the desiccant, the granules should be removed from the tube and spread evenly in a thin layer on a metal or Pyrex glass tray. Heat at about 200°C (400°F) for at least two hours or until granules turn uniformly blue. Allow the desiccant to cool in a closed, but not airtight, container before refilling the acrylic laboratory drying unit or small drying tube.

How long will the desiccant last? This is a common question, and the following information should be helpful.

7.1.2 Laboratory Drying Unit

The column holds approximately 500 grams of Drierite desiccant. This desiccant can adsorb at least 10% of its weight in water, so the water capacity of the column is at least 50 grams. The RAD7 pump develops a flow rate of about 1 liter per minute. With the RAD7 set for continuous monitoring with timed pump operation, the pump operates 20 to 30% of the time. We will assume an average flow rate of 0.3 liters per minute.

The following table shows the moisture content of air at various conditions of temperature and humidity, and the expected lifetime of a charge of desiccant in the Laboratory Drying Unit.

RH	Deg. C	Deg. F	Column Life Days
30%	20	68	23.1
30%	35	95	9.8
50%	20	68	13.3
50%	25	77	10
90%	10	50	13.7
90%	15	59	10
90%	20	68	7.4
90%	25	77	5.5
90%	30	86	4.2

7.1.3 Small Drying Tube (small tube)

The small drying tubes each contain 30 grams of Drierite desiccant. The water capacity of each tube is 3 grams. We will assume that the RAD7 pump operates continuously, for an average flow rate of 1.0 liter per minute. The table shows the expected lifetime of a small drying tube under various humidity conditions.

RH	Deg. C	Deg. F	Tube Life Hours
30%	20	68	10
30%	35	95	4.2
50%	20	68	5.7
50%	25	77	4.3
90%	10	50	5.9
90%	15	59	4.3
90%	20	68	3.2
90%	25	77	2.4
90%	30	86	1.8

7.1.4 Cascading Drying Tubes

To extend the time before desiccant depletion, you may cascade several drying tubes in series. Two factors limit the number of drying tubes you can use. First, each additional drying tube or column adds a small amount of resistance to the air flow, so the pump will have to work a little harder. But the resistance added by a drying tube is much less than the resistance of the inlet filter, so you should be able to cascade several without severely restricting the air flow. Second, each additional tube adds a time lag between sample intake and instrument response.

For continuous monitoring, a 10- to 20-minute lag may be perfectly acceptable, but for sniffing it may not be. You can conservatively estimate the time lag by taking four times the volume of the drying system and dividing by the average flow rate. Consider a continuous monitor application using a laboratory drying column of volume 0.8 liter with the pump in timed operation, giving an average flow rate of 0.2 liters per minute. Four times the volume divided by the flow rate gives 16 minutes for the estimated lag time. This would be perfectly acceptable for continuous monitoring. For radon sniffing, you will usually use the small drying tubes (volume .032 liter), which create negligible delays of less than a minute, even at low flow rates. You can cascade several small drying tubes without trouble.

Do not cascade drying tubes when sniffing for thoron, since thoron's 56-second half-life necessitates that you keep delays to an absolute minimum. For thoron sniffing, use a single small drying tube, and set the pump for continuous (on) operation. Keep hose length to 6 feet (1.8 meter) or less.

7.1.5 Filters

Inlet filters are supplied that fit the metal inlet fitting (male Luer type). These filters block ultra fine dust particles and all radon daughters from entering the RAD7 test chamber.

The filters are manufactured in various pore sizes by several companies, including Millipore and SRI. We favor pore sizes of 1.0 microns or less; pore sizes as small as 0.4 microns can be used with the RAD7 pump.

The filter should be replaced when it has become noticeably discolored or has clogged enough to impede the flow of air. If you cannot suck air easily through the filter yourself, it's time to change the filter.

When you operate the RAD7 in construction areas or basements, dust can quickly build up in sampling hoses, drying tubes, and inlet filters. This dust will slowly clog the filter, restrict air flow, and create strain on the pump. You will have to replace the inlet filter. To greatly slow the buildup of dust, we recommend that you attach a "prefilter" to the intake of the sampling hose, to prevent coarse dust particles from entering. Then, the inlet filter will remove the ultra-fine dust particles that pass through the prefilter and drying system.

We find that automotive gasoline filters can serve as convenient and inexpensive prefilters. A particular filter, intended for Volkswagens, is a small, disposable, clear-plastic capsule containing a pleated paper filter. This filter effectively removes most dust from the air stream, greatly extending the life of the inlet filter. You can buy this type of filter in almost any auto parts store for around $3.

7.1.6 Batteries

Your RAD7 has enough battery capacity to go for two to three days without any external power source. Electronic circuits control the charging and discharging of the battery, avoiding overcharge or destructive discharge. If you maintain the batteries according to the following directions, you can expect to get two to five years of heavy service from them.

Keep the batteries fully charged as much as possible. Try to recharge promptly after use. The RAD7 batteries charge whenever the unit has DC power. With the power cord plugged in and the RAD7 measuring radon, the batteries will charge slowly. Full recharge takes about 48 hours.

With the power cord plugged in and the RAD7 in fast charge mode (not measuring radon), the batteries will charge more quickly. Full recharge takes about 24 hours. The battery voltage indicator on the display (go to Status Window 1) will reach 7.10 to 7.20V when the batteries are

fully charged and the power cord is still plugged in.

If the batteries are deeply discharged, to the threshold of battery damage, an electronic circuit will completely disconnect them to avoid further discharge. The circuit will then not allow battery operation until they are completely recharged. If this occurs, you may still be able to operate the ***RAD7*** from DC power until the batteries recharge. Expect the recharge to take 48 hours.

Never store the RAD7 without first recharging the batteries. If you intend to store the RAD7 for a long period of time, you must recharge the batteries at least every four months, as they can be damaged by self-discharge on the shelf. Otherwise, you may have to replace the batteries before you can use your instrument again.

Battery voltage can be read from the Status display, and appears on printed output. A fully charged battery will rest at 6.40 to 6.50V. As the battery discharges, its voltage drops steadily to 6V. If the battery voltage ever goes below 6.00V, it is fully discharged and should be recharged as soon as possible. As the battery charges, its voltage rises steadily until it goes above 7V. Consider the battery fully charged if it charges at or above 7V.

7.1.7 Real-time Clock and Non-volatile Memory

The RAD7's Real-Time-Clock (RTC) and Non-Volatile Memory unit (NVRAM) allows the RAD7 operator to switch power off without losing data or disrupting the clock time and date. These functions are powered by a lithium cell with an expected lifetime of ten years.

7.1.8 Printer and Adapter

The printer is manufactured by Chamjin I&C. It comes with its own manual, and you should familiarize yourself with its operation. Specifically, you should be aware that it operates through an infrared optical link and should be positioned on the top of the RAD7 to match the data link on the detector. It runs on its own batteries.

7.2 Operating ranges

Parameter	Minimum Value	Maximum Value
Temperature	0°C (32°F)	40°C (104°F)
Relative Humidity, external (*Must be non-condensing)*	0%	95%
Relative Humidity, internal	0%	10%
Battery Voltage	6.00V	7.20V
Pump Current *(pump off)*	0mA	10mA
Pump Current *(pump on)*	30mA	90mA
High Voltage	2100V	2400V
HV Duty Cycle	8%	20%
Leakage Current *(room temp.)*	0	20
Leakage Current *(max. temp.)*	5	80
Signal voltage level	0.15V	0.30V

Table 7.2 RAD7 Operating Ranges

7.3 Service and Repair

7.3.1 Calibration

DURRIDGE maintains a radon calibration facility that includes a controlled, standard source of radon gas, and a controlled-temperature environmental chamber. All RAD7 alignment and calibration is done here, as well as basic testing and quality assurance. We determine calibration factors by direct comparison to "master" RAD7's, which were themselves compared with EPA and DOE instruments, and which have participated in international inter-comparisons of radon instrumentation. The calibration accuracy is independently verified by direct determination of the radon chamber level from the calibrated activity and emission of the standard radon source. In addition, we periodically intercompare with other radon chambers. We generally achieve a reproducibility of better than 2% with our standard RAD7 calibration. Overall calibration accuracy is in the range of 5%.

The EPA recommends (and we agree) that all continuous radon monitors be calibrated at least every six months in a radon calibration chamber, although most RAD7 users are satisfied with annual recalibration. DURRIDGE's standard RAD7 calibration requires four to five working days from the receipt of the instrument. As a preliminary to recalibration, we give every RAD7 a brief inspection, and test one or two critical parts. If additional service is required, this may delay the return of the instrument.

We recommend that you arrange for your calibration ahead of time, to avoid possible delays. When sending your RAD7 for calibration, please send the instrument only, without the accessories, and please pack it well, with at least an inch of packing all round.

At present, only DURRIDGE can make adjustments to your instrument's alignment and calibration factors. If you determine, on the basis of an independent intercomparison (e.g., another calibration chamber) that you would like to adjust your RAD7's calibration by a known amount, we can generally perform this service and send back your instrument within one day. Requested calibration adjustments of more than 10% are considered highly unusual and require the written permission of the instrument's owner.

7.3.2 Repair

If you discover that your RAD7 is malfunctioning, we recommend that you first call DURRIDGE and talk to a technician. A surprising number of minor "disasters" can be avoided by long-distance consultation. The next step, if consultation fails, usually is to send your instrument in for evaluation and repair. Please send any documentation of the problem that you might have (notes, printouts, etc.) and a short note describing the problem. Be sure that you put your name and telephone number on the note. Within 48 hours of our receipt of the instrument, we will call you to give a prognosis.

Bear in mind that a repaired instrument often requires complete re-calibration, so a one-week turn-around may be the best we can do. If you absolutely need an instrument during the repair time we can sometimes arrange to send you a "loaner" instrument.

7.3.3 Shipping

The RAD7 is shipped to you in a plastic bag, packed in a box with styrofoam peanuts, and finally packed inside another box that also holds all the accessories. The inner box, by itself, is too small for the return trip, when you need a calibration or repair job. You need to find a bigger box, with space for one inch packing all round the RAD7. A 14" cube box is fine. Pack and seal the box carefully.

Please do not ship any accessories, unless they are relevant to the problem.

All return shipments to DURRIDGE must be prepaid, and unless you instruct us otherwise, we'll return it to you via the same shipping method you used to get it to us - from "slow boat" to "next day air", freight collect.

7.3.4 Upgrades

Whenever you send your RAD7 in for repair or calibration, you have the option of having the latest available software installed. Most RAD7's can be upgraded to the latest hardware configuration as well. You will be informed

periodically of whatever new features are available for your RAD7. Please advise us if you want to have an upgrade made. We intend to keep our RAD7 customers happy by keeping their instruments up-to-date, state-of-the-art.

7.4 RAD7 Quality Assurance

While the annual inspection and calibration, carried out by DURRIDGE Company, is the most effective quality assurance, and the prime requirement of EPA, there are other tests and observations that may be made that will give assurance of good performance throughout the year.

7.4.1 Spectrum

At least once a month, the spectrum printed by the IR printer should be observed. The cumulative spectrum, printed at the end of a run, has the most data points and is, therefore, the most useful for this purpose. All that is required is that the printer be placed on the face plate at the end of a 1-day or 2-day run. It doesn't matter what format is chosen, the summary printed at the end of the run will conclude with a cumulative spectrum, after the bar chart.

Alternatively, the RAD7 will print a spectrum at the end of every cycle if the format is set to LONG. However, this will include only the counts during that cycle. For the spectrum to be useful it should have at least 100 counts. There should be clearly defined peaks and little or no noise across the spectrum. The peaks should be located in the middle of the windows. A clean spectrum is indicative of an instrument in perfect working order, and hence of reliable and accurate readings.

7.4.2 Spill Factor

Due to the occasional alpha particle emitted, from a polonium atom on the detector surface, at grazing incidence to the surface, there is always a small, low-energy tail to the peaks. This may be observed in the printed spectra. There is thus a spill of 214-Po counts from window C into window B. It is normally around 1% to 1.5% in a current production RAD7. The actual value is measured during the calibration process and the spill factor used to compensate for this phenomenon when measuring thoron in the presence of radon.

If the detector becomes contaminated in use, or either electronic or detector failure causes noise in the system, thus making the low-energy tail thicker, or the peaks broader, then this spill factor will increase. The value can be calculated from any reading, provided that it is known for sure that there was no thoron in the chamber. The percentage of counts in windows B and C is given in fields 10 and 11 of each record in memory (see Chapter 6.3.3). The spill factor is simply the ratio of the values in those two fields.

It is recommended that the spill factor be noted every month. Any sudden change is cause for further study of the instrument, and an examination of the spectrum.

8. TROUBLESHOOTING

8.1 Display

8.1.1 Blank Display

If the unit is switched on, the most likely cause of a blank display is discharged batteries. Please see Chapter 7.1.6.

Make sure the RAD7 is properly plugged in to an external power source and is switched on.

If the instrument has been run on the batteries and not recharged, or if it has been left untouched for a lengthy period, the batteries may be completely flat. In that case, the instrument should be left plugged in and switched on for many hours, preferably 24 hours or more. If this fails to restore the display, the RAD7 should be returned to DURRIDGE Company for service.

8.1.2 Frozen Display

If the display shows "DURRIDGE RAD7" and does not respond to key strokes, the key pad has been locked. Hold down the ENTER and two arrow keys until you hear a beep, release the three keys and immediately push MENU. You should then be rewarded by "Test" on the display. If the tone was set to OFF, then you will not hear the beep, so hold the three keys down for three to four seconds, before releasing them and pushing MENU, - try hold-down times a little longer, or shorter, if at first you do not succeed. Please refer to paragraph 2.2.6.

8.1.3 Incomplete Or Garbage Characters

Incomplete or garbage characters may indicate a faulty LCD display. Please return RAD7 to DURRIDGE Company for service.

8.2 Readings

8.2.1 No Counts

The total number of counts so far in any cycle is displayed in the bottom righthand corner of Status Window 1. If, near the end of a cycle, there are no counts, or less than 10, say, it probably means the cycle length is too short. Increase the cycle length to increase the number of counts in a cycle and to improve the precision of the individual readings (`>Setup Cycle`, `HH.MM [ENTER]`).

If, with a cycle time of one hour or more, the total count near the end of a cycle continues to be zero and it is known that there is radon in the sample, then either the sample path is blocked or there is a fault with the RAD7 and it should be returned to DURRIDGE Company. Check that air is flowing using any of the following measures:

a) Feel the air exiting the outlet when the pump is running.
b) Stop the outlet of the RAD7 and feel the buildup of pressure.
c) Clamp the sample input tubing, hear the change in pump sound and see the change in pump current (third status window).
d) Feel the suction at the sampling point.

8.2.2 Excessive Uncertainty In Reading

If the uncertainty in the reading is greater than the base concentration value or if there is a large scatter in the readings, the cycle length is too short for the radon concentration being measured.

Increase the cycle time to reduce the scatter. Four times the cycle time will produce half the scatter and half the uncertainty. For past data, use CAPTURE to graph the data and use "Smoothing" to smooth out the statistical scatter in the data.

8.2.3 Run/Cycle Number 0000

A Run/Cycle number of `0000` indicates that the RAD7's memory is full. Download the RAD7's contents to a computer using CAPTURE. Then erase the RAD7 data using `>Data Erase`. The memory will be emptied and the data structure reset.

8.3 Relative Humidity high

Relative humidity (displayed in the third status window) normally starts high unless the instrument has been well purged just before

starting the run. Depending on how long it has been since the last measurement, it may take an hour or more of measurement to bring the relative humidity down to below 10%.

If it takes too long to bring down the relative humidity, check the following:

a) The desiccant is used up. Replace it.
b) The desiccant insufficiently regenerated. Follow the instructions in Chapter 7.1.1.
c) There is a leak in the drying unit. Clean the O-ring and seating before replacing the desiccant. Be sure to draw the air sample from the end furthest from the screw cap.
d) There is a leak in the connection to RAD7.
e) There is a blockage in the air path. Squeeze the inlet tubing and note any change in the sound of the pump. Feel for suction at the sampling point.

If none of the above succeed in lowering the relative humidity, there may be a problem with the humidity sensor. Measure the relative humidity of the air leaving the RAD7. If no humidity sensor is available, another RAD7, if one is available, would do. The two RAD7s can be connected in series. Set the downstream RAD7 pump to OFF (Setup, Pump, Off [ENTER]). If the downstream RAD7 reads a lower relative humidity than the upstream one, then the upstream humidity sensor is wrong and should be replaced. Return the RAD7 to DURRIDGE Company for service.

If none of these solutions are applicable, measurements made at high humidity can be corrected automatically using CAPTURE. See Chapter 3.12.2.

8.4 Water Catastrophe

If water ever enters the RAD7, or if the RAD7 ever goes swimming in the water, it will probably cease to operate and immediate steps should be taken to minimize the impact on the instrument.

Keep the RAD7 upright. This will prevent water from touching the detector, which is close to the face plate at the top of the dome. Put a piece of tubing on the RAD7 outlet with the other end in a sink. Use the RAD7 pump if it still works or, otherwise, an external pump into the inlet, to blow air through the instrument. When water ceases to be blown out of the outlet, put desiccant upstream of the RAD7 to dry out the air path. When the air path is fully dry (after dry air has been blown through it for approximately one hour), remove the face plate from the case, empty the water out of the case and blow dry the case and the RAD7 electronics.

Once there is no visible water in or on the instrument, it can be put in an oven at 50°C for a few hours to dry out completely. Additionally, desiccated air can be passed through the air path until the air leaving the RAD7 drops below 10% RH. After this treatment further corrosion will be prevented, and the RAD7 will boot once more and you can use the internal RH sensor to measure how dry the air path is. At this point the instrument should be returned to DURRIDGE for service.

8.5 Battery Voltage Low

Keep the RAD7 plugged into external power and switched on until the battery voltage (Status Window 3) recovers to about 7.1V. The RAD7 may safely be left charging all night.

8.6 Pathological Values and Error Messages

A Bad Offset Voltage error message, a 100% duty cycle, or leakage (L) above 15 (Status Window 4) all indicate faults in the RAD7, which should be returned to DURRIDGE Company without delay.

Appendix: RAD7 Specifications

Specifications for the RAD7 exceed those of all radon gas monitors made in North America, as well as those in its price range world-wide. This is a partial list of specifications that make the RAD7 so highly regarded in the field.

Part 1 Functionality

Modes of Operation	SNIFF Rapid response and rapid recovery radon measurement THORON Radon and thoron measured simultaneously and independently NORMAL High sensitivity AUTO Automatic switch from SNIFF to NORMAL after three hours run GRAB Analysis of grab samples WAT Automatic analysis of water samples with RAD H_2O accessory
Measurements	Radon in air with Sniff protocol for quick, spot reading Thoron protocol for searching for radon entry points Radon in air 1-day, 2-day or weeks protocol for long term measurement Radon in water batch samples with RAD H_2O and Big Bottle RAD H_2O Continuous radon in water with RAD AQUA and Radon-in-Water Probe Radon in soil gas with Soil Gas Probe and Active DRYSTIK Radon emission from soil and hard surfaces with surface emission chamber Bulk radon emission from bulk materials and objects
Data Storage	1,000 records, each with 23 fields of data Log of printer output also stored
Sample Pumping	Built-in pump draws sample from chosen sampling point Flow rate typically 800mL/min
Print Output	Short, medium or long format data printed after each cycle Run summary printed at end of run, including averages and spectrum
PC Connectivity	RS232 serial port, full remote control implemented in CAPTURE Software
Audio Output	GEIGER Tone beeps for radon and thoron counts CHIME Chime only at the end of each cycle, otherwise silent OFF No sound
Tamper Resistance	TEST LOCK command locks keypad to secure against tampering

Part 2 Technical Specifications

Principle of Operation	Electrostatic collection of alpha-emitters with spectral analysis Passivated Ion-implanted Planar Silicon detector SNIFF mode counts polonium-218 decays NORMAL mode counts both polonium 218 and polonium 214 decays
Built-In Air Pump	Nominal 1 liter/minute flow rate Inlet and outlet Luer connectors
Connectivity	RS-232 port up to 19,200 baud rate USB adaptor is included with every RAD7
Measurement Accuracy	+/-5% absolute accuracy, 0% - 100% RH

Nominal Sensitivity	SNIFF mode, 0.25 cpm/(pCi/L), 0.0067 cpm/(Bq/m^3) NORMAL mode, 0.5 cpm/(pCi/L), 0.013 cpm/(Bq/m^3)
Radon Concentration Range	0.1 - 20,000 pCi/L (4.0 - 750,000 Bq/m^3)
Intrinsic Background	0.005 pCi/L (0.2 Bq/m^3) or less, for the life of the instrument
Recovery Time	Residual activity in Sniff mode drops by factor of 1,000 in 30 minutes
Operating Ranges	Temperature: 32° - 113°F (0° - 45° C) Humidity: 0% - 100%, non-condensing
Cycle Range	User controllable number of cycles, from 1 to 99 to unlimited, per run User controllable cycle time, from 2 minutes to 24 hours
CAPTURE Software	Compatible with Microsoft Windows XP and 7, and Mac OS X Automatic RAD7 location, connection and data download Graphs radon, thoron, temperature and humidity over time Automatic humidity correction Statistical analysis tools track concentration averages and uncertainties Chart Recorder mode provides real-time RAD7 status monitoring Control RAD7 operations from computer via direct or remote connection Automatic calculation and display of radon in water for RAD AQUA Automatic combination of multiple RAD7 data

Part 3 Physical Specifications

Dimensions	11.5" x 8.5" x 11" (29.5 cm x 21.5 cm x 27.9 cm)
Weight	9.6 pounds (4.35 kg)
LCD Display Output	2 line x 16 character, alpha-numeric display
Case Material	High density polyethylene
Infrared Printer	Chamjin NewHandy 700 Wireless Infrared Printer included
Power Supply	11-15V DC (12V nominal) @ 1.25A, center pin positive, or internal rechargeable batteries (5Ah)
Battery Longevity	24 hours in SNIFF mode; 72 hours in Monitor mode

Attachment L-2

Example Job Safety Analysis

TETRA TECH

Safety Excellence

JOB/TASK DESCRIPTION	Soil Borrow Investigations
JOB TITLE:	**Excavations and Trenches**

DATE:	2/8/2010	NEW ☑	REVISED ☐
ANALYSIS BY: (NAMES/TITLES)	Ed Muller	REQUIRED AND/OR RECOMMENDED PPE:	Hard Hat, Safety Glasses with side-shields, Steel-toe safety boots, leather gloves, hearing protection, high-visibility vest
REVIEWED BY:(NAME/TITLE)			

SEQUENCE OF BASIC JOB STEPS	POTENTIAL HAZARDS	RECOMMENDED ACTION OR PROCEDURE
Determine location of underground/overhead utilities.	Electrocution, explosion resulting in injuries. Disruption of utility services	Request and obtain from DMC results of underground utility locate. Watch for overhead lines while moving or operating vehicle.
Working near excavation equipment	Struck by swinging excavator, run over, pinned between vehicles and site walls or other equipment	Wear bright, protective clothing. Keep clear of moving equipment. Keep an eye out for moving equipment at all times. Never assume the operator knows where you are or where you're going-make eye or verbal contact with operator so operator is aware of your location. Watch out for and stay clear of pinch points. If you must walk around a piece of heavy equipment, alert the operator to stop the machine before going by. Avoid walking behind a piece of equipment that's backing up.
Entering and working in trench	Caving, engulfment, crushed or struck from falling debris	Do not enter a trench that is greater than four feet deep or one that has unstable walls. Excavated or other materials or equipment that could pose a hazard by falling or rolling into the excavation shall be kept at a safe distance from trench. The nearest edge of a spoils pile shall be placed a minimum of 2 feet from the edge of the excavation to prevent or minimize the potential of loose rock or soil falling onto workers. Wear hard hat and steel toed boots while in trench.
Working at edge of open trench	Falling	If employees are required to work at the edge of an excavation deeper than 6 feet, they must be protected from falling by guardrail, fences, barricades, berms, warning lines, or other fall protection system, when the excavation is not easily visible.
Sampling from Excavator Bucket	Struck by swinging excavator, pinned between bucket and site walls or other equipment	Only sample from an excavator bucket that has been lowered to the ground. Establish communication (eye contact or verbal) with operator prior to approaching the bucket.

Reviewed By:	Date:	Reviewed By:	Date:	Reviewed By:	Date:

Attachment L-3

Safety Compliance Form and Accident Report Form

MIDNITE MINE

EMPLOYEE SAFETY COMPLIANCE AGREEMENT

I,_____(print name) have received a copy of the Health and Safety Plan for the Midnite Mine Project. I have read the plan, understand it, and agree to comply with all of the health and safety requirements. I understand that I may be prohibited from working on the project for violating any of the requirements.

Signature_____Date_____

ACCIDENT REPORT		
Site description		Project description
Report date	Accident date	Preparer's name
Name and affiliation of injured person		Social security number
		Age
		Years of service/experience
		Time present on Site
		Title/classification

Severity of injury

□ no medical attention □ medical attention □ non-disabling □ disabling □ fatality

Classification of injury

□ fractures	□ bites	□ toxic respiratory exposure	□ faint/dizziness
□ dislocations	□ heat burns	□ toxic ingestion	□ dermal allergy
□ sprains	□ chemical burns	□ cold exposure	
□ abrasions	□ concussion	□ frostbite	
□ lacerations	□ bruises	□ heat stroke	
□ punctures	□ blisters	□ heat exhaustion	

Part of body affected	Degree if disability
Data medical care was received	Place where medical care was received

Location of accident

Causative agent most directly related to accident (e.g., object, substance, material, machinery, equipment conditions)

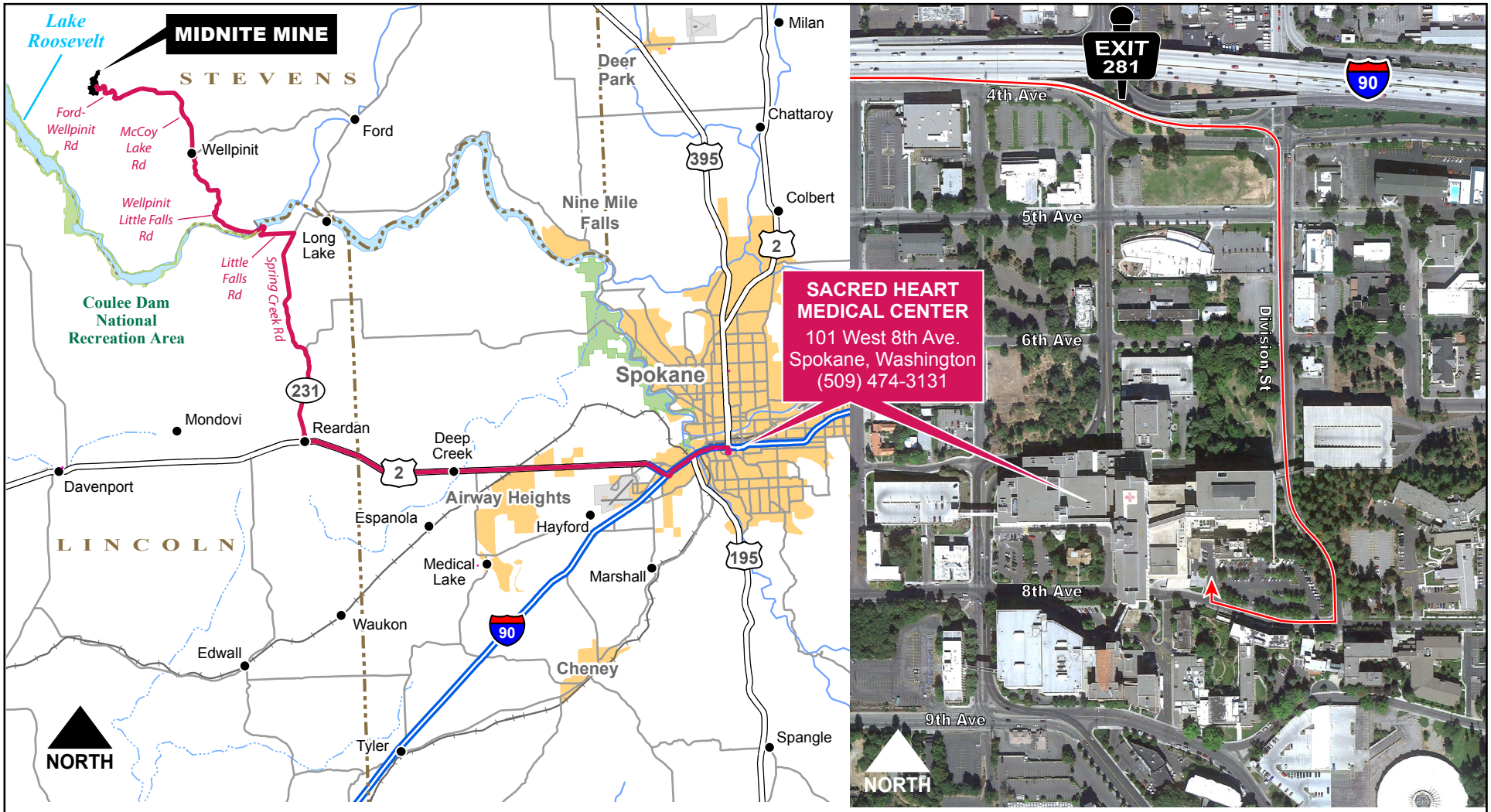
Was weather a factor?
□ YES
□ NO

Unsafe mechanical/physical/environmental conditions at the time of the accident (be specific)

ACCIDENT REPORT (continued)	
Unsafe act by injured and/or others contributing to the accident (be specific)	
Personal factors (e.g., improper attitude, lack of knowledge or skill, slow reaction, fatigue)	
Level of personal protective equipment required in the site-specific health and safety plan for this activity	
What can be done to prevent the reoccurrence of this type of injury?	
Witnesses to accident	Preparer's signature
	Health and Safety Officer's signature
DETAILED NARRATIVE DESCRIPTION OF ACCIDENT (How and why did the accident happen? What tools, circumstances or assigned duties contributed to the accident? Be specific. Use additional sheets if necessary).	

Attachment L-4

Hospital Route Map



1. Head **southwest**	go 0.2 mi	9. Turn left onto **E Broadway Ave**	go 0.4 mi
2. Turn right toward **Spokane Lookout Rd**	go 1.9 mi	10. Continue onto **US-2 E/E Broadway S Ave**	go 18.6 mi
3. Turn right onto **Spokane Lookout Rd**	go 2.7 mi	Continue to follow US-2 E	
4. Turn left onto **Ford Wellpinit Rd/McCoy Lake Rd/Wellpinit-Westend Rd**	go 6.3 mi	11. Keep left at the fork, follow signs for **Interstate 90 E/Spokane/U.S. 2** and merge onto I-**90 E/US-2 E**	go 3.7 mi
5. Turn right onto **Wellpinit Little Falls Rd**	go 2.6 mi	12. Take exit **281** for **Division St** toward **US-2 E/US-395 N/Newport/Colville**	go 0.2 mi
6. Turn right to stay on **Wellpinit Little Falls Rd**	go 4.2 mi	13. Keep right at the fork, follow signs for **Division St S**	go 190 ft
7. Slight right onto **Little Falls Rd/Little Falls Longlake Rd**	go 2.7 mi	14. Turn right onto **S Division St**	go 0.3 mi
Continue to follow Little Falls Rd		15. Turn right onto **E 8th Ave**	go 469 ft
8. Turn right onto **WA-231 S/Spring Creek Rd**	go 11.6 mi		
Continue to follow WA-231 S			

TOTAL 55.5 MILES, 1 HOUR 30 MINUTES

Hospital Route Map

Midnite Mine Superfund Site
100 Percent Design

Appendix M – Regulatory Requirements Documentation

June 2015

Prepared for:

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and

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Table of Contents

M1.0 INTRODUCTION 1
M2.0 PROJECT AREAS 1
M3.0 REGULATORY REQUIREMENTS 23
M3.1 Clean Water Act (33 USC 1251 et seq.) 43
M3.1.1 Section 304 – Water Quality Standards 43
M3.1.2 Section 402 – National Pollution Discharge Elimination System (33 USC § 1342) 43
M3.1.3 Section 404 – Discharge of Dredge or Fill into Waters of the U.S. (33 USC § 1344) 45
M3.2 Protection of Wetlands – Executive Order 11990 49
M3.3 Rivers and Harbors Act (33 USC § 403) 49
M3.3.1 Section 10 – Navigable Waters 49
M3.4 Section 401 – Water Quality Certification (33 USC § 1341) 50
M3.5 Spokane Tribe of Indians Surface Water Quality Standards Resolution 2010-173, February 25, 2010 50
M3.6 Safe Drinking Water Act (42 USC § 300F ET SEQ.) 51
M3.7 Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR Part 192, ... 52
M3.7.1 Subpart A – Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites, Table 1: Maximum Concentrations of Constituents for Groundwater Protection 52
M3.7.2 Subpart B – Clean-up of Land and Buildings Contaminated with Residual Radioactive Materials 52
M3.8 Spokane Tribe of Indians Hazardous Substances Control Act (HSCA, Resolution 2004-085) 53
M3.9 National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Uranium Mill Tailings Disposal Sites (40 CFR Part 61, Subpart T) 53
M3.10 Resource Conservation and Recovery Act, Subtitle D (40 CFR PARTS 257, Subpart A) 54
M3.11 Licensing Requirements for Land Disposal of Radioactive Waste (40 CFR Part 61) 54
M3.12 Endangered Species Act (7 USC § 136, 16 USC § 1531 ET SEQ.) 55
M3.12.1Section 7 – Consultation 55
M3.13 Fish and Wildlife Coordination Act (16 USC § 661 et seq.) 56
M3.14 Migratory Bird Treaty Act (16 USC §§ 703–712) 57
M3.15 Protection of Floodplains – Executive Order 11988 57
M3.16 Native American Graves Protection and Repatriation Act (25 USC § 3001 et seq.) 58
M3.17 American Indian Religious Freedom Act (42 USC § 1996) (PL 95-341) 58
M3.18 National Historic Preservation Act (16 USC § 470 et seq.) (PL 89-668) Section 106 Consultation (16 USC § 470f) 59
M3.19 Office of Solid Waste and Emergency Response (OSWER) 60
M3.19.1OSWER Directive No. 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (August 2, 1997) 60

M3.19.2OSWER Directive No. 9200.4-25, Use of Soil Clean-up Criteria 40 CFR Part 192 as Remediation Goals for CERCLA Sites (February 2, 1998) 60
M3.20 Spill Prevention, Countermeasures and Control Rule (40 CFR Part 112.6)..... 60
M3.21 Clean Air Act (42 USC §7401 ET SEQ.) 61
M3.21.1Introduction..... 61
M3.21.2Overview of the CAA and EPA's implementing regulations 61
M3.21.3AIR EMISSIONS INVENTORY..... 66
M3.21.4ANALYSIS..... 71
M3.21.5AIR EMISSIONS CONTROL TECHNOLOGY..... 73
M3.21.6AIR MONITORING PROGRAM..... 76
M3.22 NUCLEAR ENERGY AND RADIATION CONTROL ACT (RCW 70.98 AND WAC 246-220 AND 246-255)..... 76
M3.23 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA) (PUBLIC LAW 91-596 84 STAT. 1590) 76
M3.24 HAZARDOUS MATERIALS TRANSPORTATION ACT (49 CFR 105-180) 77
M3.25 Bald and Golden Eagle Protection Act (16 USC § 668-668c) 77
M3.26 Paleontological Resources Protection Act (16 USC § 470aaa(4)) 78
M3.27 Indian Affairs Manual, Environmental and Cultural Resources Management, Paleontological Resources..... 78
M3.28 Archaeological Resources Protection Act of 1979 (93 STAT. 721; 16 USC § 470 AA et seq.) (PL 96-95)..... 78
M3.29 Invasive Species – Executive Order 13112..... 79
M3.30 Integrated Resource Management Plan for the Spokane Indian Reservation 79
M3.31 Stevens County 83
M3.31.1Administrative Conditional Use Permit (3.03.090)..... 83
M3.32 State Environmental Policy Act (RCW 43.21) 84
M3.33 Forest Practices Permit (RCW 76.09, RCW 6.13 RCW, AND WAC 222-16-010)84
M3.34 Surface Mining Reclamation Permit (WAC 332-18 AND 78.44)..... 84
M3.35 Sanitation Standards for General Industry (29 CFR 1910.141 (a)(2))..... 85
M4.0 REFERENCES 86

Table of Tables

Table M-1. Project Areas and Jurisdiction..... 2
Table M-2. Environmental Requirements by Project Components..... 8
Table M-3. Permit/Coordination Schedule..... 19
Table M-4. Summary of Regulatory Requirements 24
Table M-5. National Ambient Air Quality Standards 62
Table M-6. Tribal NSR Rule Thresholds for Attainment Areas. 63
Table M-7. Midnite Mine Stationary Emission Sources (existing and anticipated). 66
Table M-8. Potential to Emit Emissions (TPY)..... 69
Table M-9. Estimated Actual Emissions (TPY)..... 69
Table M-10. Estimated Actual HAPs emissions (TPY), including fugitive sources..... 70

Table of Figures

Figure M-1. Project Area Locations 20
Figure M-2. Midnite Mine Project Areas 21
Figure M-3. Ford Borrow Area. 22

Attachments

Attachment M-1. Wetland Delineation, Midnite Mine – Revision 2 (placeholder)
Attachment M-2. Biological Assessment, Midnite Mine – Revision 2
Attachment M-3. Air Emissions Inventory Calculations, Midnite Mine

LIST OF ACRONYMS

ARAR - Applicable Relevant and Appropriate Requirements
ARD – Acid Rock Drainage

BODR - Basis of Design Report
BOR - U.S. Bureau of Reclamation

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of
CFR - Code of Federal Regulations
COCs – Contaminants of Concern

EPA - U.S. Environmental Protection Agency
ESA - Endangered Species Act

FR - Federal Regulation
FARR - Federal Air Rules for Reservations
FWS - U.S. Fish and Wildlife Service

Haul Roads – Eastern and Western Haul Roads
HSCA - Spokane Tribe of Indians Hazardous Substances Control Act

LRNRA - Lake Roosevelt National Recreation Area
LSA - Low Specific Activity Group

NA - Not applicable
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEPA - National Environmental Policy Act of 1969
NHPA - National Historic Preservation Act
NMFS - National Marine Fisheries Service
NOC - Notice of Construction
NPDES - National Pollutant Discharge Elimination System
NPS - National Park Service
NWP - Nationwide Permit

OSHA - Occupational Safety and Health Administration

RA - Remedial Action
RCRA - Resource Conservation and Recovery Act
RCW - Revised Code of Washington
RDWP - Remedial Design Work Plan

SEPA - State Environmental Policy Act
SHPO - State Historic Preservation Officer
SWMP - Stormwater Management Plan

THPO - Spokane Tribe of Indians Tribal Heritage Protection Officer

LIST OF ACRONYMS, cont.

USC - United States Code
USGS - U.S. Geological Survey

WA - Washington
WAC - Washington Administrative Code
WCA – Waste Containment Area
WTP - Water Treatment Plant

M1.0 INTRODUCTION

This document describes the compliance with substantive environmental requirements and permitting as part of the Midnite Mine Final Basis of Design Report (BODR). This appendix has been updated for the 100 percent design submittal and has been updated to address comments with the 90 percent BODR and the current status of ongoing regulatory compliance and permitting requirements. As stated in the Remedial Design Work Plan (RDWP), this section of the BODR in the final design report includes a list of known or anticipated compliance obligation with substantive requirements and off-site permits. This document also discusses the project areas and components, regulatory framework, project applicability, and a permitting and compliance strategy. Although the remedial design is at the 100 percent design level, there are regulatory compliance and permitting requirements that are still ongoing. These requirements are described below, specifically NPDES, 404 CWA, CAA, Section 106, and other permits for off-site activities at the Rhoads Borrow Area.

M2.0 PROJECT AREAS

The Midnite Mine Superfund Remediation Project is comprised of a number of distinct work areas. The main remediation will generally occur inside the Midnite Mine fence at the Mined Area. Other areas of the remediation project include the Haul Road Clean-up (eastern and western haul roads), Mine Drainage Clean-up (Western, Central, and Eastern drainages), Whitetail Drainage Clean-up, New Access Road construction, and Blue Creek Pipeline.

The EPA has determined that all of these areas are considered to be on-site under CERCLA and are exempt from permit requirements. Areas determined to be off-site and not covered under CERCLA include the borrow areas (e.g., Rhoads Borrow Area or Ford Borrow Area). Section 121(e) of CERCLA, 42 U.S.C. § 9621(e) and 40 CFR § 300.400(e) of the NCP states:

> *(1) No federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA Sections 104, 106, 120, 121, or 122. The term on-site means the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action.*

Other agencies that have jurisdictions or regulatory authority over portions of this project include Spokane Tribe of Indians (Spokane Tribe), Stevens County, and Washington State. Table M-1 shows the project areas and the regulatory jurisdiction associated with each. Table M-2 shows a summary of the applicable regulatory requirements by project area. The regulatory requirements for the Remedial Action are discussed below by project area and are summarized in Table M-3. Figure M-1 show the project locations, Figure M-2 shows the Midnite Mine project areas and Rhoads Borrow Area, and Figure M-3 shows the Ford Borrow Area option.

Table M-1. Project Areas and Jurisdiction

	Mines Areas	Eastern and Western Haul Road Clean-up	Mine Drainage Clean-up	New Access Road	Blue Creek Pipeline (including discharge and mixing zone)	Rhoads Borrow Area[2]	Ford Borrow Area[3]
CERCLA On-Site	●	●	●	●	●	●[1]	
Spokane Indian Reservation	●	●	●	●	●	●	
Stevens County Fee Land						●	●
Washington State						●[2]	●

[1] *Whitetail Drainage Clean-up, an ephemeral drainage in the Rhoads Borrow Area, and the effluent pipeline are considered on-site.*
[2] *Meetings with Stevens County and State resource agencies have identified that Washington State Department of Natural Resources will require Surface Mine Reclamation Permit and Forest Practices Permit for the portion of the Rhoads Borrow Area that is off-site.*
[3] *Only one borrow area will be developed with the Rhoads Borrow Area being the preferred site. The Ford Borrow Area will only be developed if access to the Rhoads Borrow Area cannot be obtained.*

The following project area and components make up the remedial action discussed in this appendix.

On-Site Areas

Mined Areas (507 acres)

- Sediment and stormwater control installation
- Site preparation and clearing
- Decontamination area construction
- Construction support facilities area preparation development
- Drain material processing and Area 5 stockpiling
- Hillside waste rock pile processing for Pit 4 drain rock
- Mine waste rock excavation
- Pit 4 backfilling
- South Pond construction
- Water treatment plant and associated ponds construction
- Water treatment plant effluent pipeline and diffuser construction (Blue Creek pipeline)
- Alluvial groundwater controls installation
- Pit 3 backfilling
- Hillside waste rock processing for Pit 3 drain rock
- Area 5 re-grading
- Backfilled Pit Area remediation
- Existing WTP Building demolition
- West Pond construction
- Pollution Control Pond removal

- South Pond removal
- South Waste Rock Pile remediation
- Central Drainage sediment remediation
- West Pond removal
- Permanent influent pipelines, site maintenance roads, and fencing construction
- Waste rock surface contouring
- Waste rock cap cover construction
- Cap and other mined area reclamation
- Pit water, seeps, and groundwater treatment
- Stormwater and sediment control installation/maintenance
- Site reclamation/revegetation
- Clean runoff diversion away from Waste Rock Containment Area
- Long-term monitoring

Blue Creek Pipeline (including discharge and mixing zone) (5 acres)

- Sediment and stormwater control installation
- Impeding tree removal
- Wellpinit – Westend Road traffic control
- Effluent pipeline installation in existing Blue Creek Road
- Effluent pipeline installation in dry portion of Lake Roosevelt
- Outfall diffuser Installation
- Effluent pipeline submersion in inundated portion of Lake Roosevelt
- Site reclamation/revegetation
- Long-term monitoring

Mine Road Remediation (Eastern and Western Haul Road Clean-up) (17 acres)

- Sediment and stormwater control installation
- Road base and sediment excavation
- Site reclamation/revegetation

Mine Drainage Clean-up (Western, Central, and Eastern Drainages) (>3 acres)

- Sediment and stormwater control installation
- Sediment excavation
- Groundwater collection trench installation
- Flood attenuation berm installation
- Site reclamation/revegetation

New Access Road (1 acre)

- New access road clearing, grading, and paving

Off-Site Areas

Borrow Areas

Rhoads Borrow Area (67 acres)

- Sediment and stormwater control installation
- Site access development
- Haul road construction
- Borrow area development
- Timber harvest
- Slash and stump removal
- Topsoil salvage
- Borrow material extraction
- Site re-contour
- Topsoil placement
- Site revegetation

Ford Borrow Area (30 acres) (if used, Rhoads Borrow is the primary source)

- Sediment and stormwater control installation
- Site access development
- Haul road construction
- Timber harvest
- Slash and stump removal
- Topsoil salvage
- Borrow material extraction and transport to Midnite Mine
- Site re-contour
- Topsoil placement
- Site revegetation
- Commercial purchase and delivery of 200,000 cu. yds. of topsoil from Lane Mountain to Midnite Mine.

	On Reservation						Off Reservation
	CERCLA On-Site Areas					CERCLA Off-Site Areas	
	Federal Land					Stevens County Fee Land	Stevens County Fee Land
	Mined Areas	Haul Road Clean-up	Drainage Clean-up	New Access Road	Blue Creek Pipeline (including discharge and mixing zone)	Rhoads Borrow Area	Ford Borrow Area/ Lane Mountain
Clean Water Act							
304 Federal Ambient Water Quality (304(a) of CWA)	C				C		
NPDES - Point Source Discharge					P		
NPDES - Stormwater	C	C	C	C	C	P	P
404 – Dredge and Fill of WofUS		C	C		C		
Executive Order 11990 - Wetlands Protection		C	C		C		
Rivers and Harbors Act							
Section 10 - Navigable Waters					C		
401 Certification					P	P	
STI Surface Water Quality Standards Resolution	C	C	C	C	C	C	
Safe Drinking Water Act	C				C		
Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings							
Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites: Maximum Concentration of Constituents from Groundwater Protection	C	C	C				
Clean-up of Land and Buildings Contaminated with Residual Radioactive Materials	C	C	C				
STI Hazardous Substances Control Act	C	C	C	C	C	C	
National Emission Standards for Hazardous Air Pollutants for Uranium Mill Tailings Disposal Sites (NESHAPs)	C	C	C				
Resource Conservation and Recovery Act							

	On Reservation						Off Reservation
	CERCLA On-Site Areas					CERCLA Off-Site Areas	
	Federal Land					Stevens County Fee Land	Stevens County Fee Land
	Mined Areas	Haul Road Clean-up	Drainage Clean-up	New Access Road	Blue Creek Pipeline (including discharge and mixing zone)	Rhoads Borrow Area	Ford Borrow Area/ Lane Mountain
RCRA Subtitle D Regulations, Criteria for Classification of Solid Waste Disposal Facilities and Practices	C	C	C				
Licensing Requirements for Land Disposal of Radioactive Waste	C						
Endangered Species Act							
Biological Assessment	C	C	C	C	C		
Section 7 Consultation	C	C	C	C	C		
Fish and Wildlife Coordination Act	C	C	C	C	C		
Migratory Bird Treaty Act	C	C	C	C	C	C	
Executive Order 11988 - Floodplains Protection			C		C		
Native American Graves Protection and Repatriation Act (NAGPRA)	C	C	C	C	C	C	
American Indian Religious Freedom Act	C	C	C	C	C	C	
National Historic Preservation Act	C	C	C	C	C	C	
Office of Solid Waste and Emergency Response (OSWER), Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination	C	C	C				
OSWER, Use of Soil Cleanup Criteria as Remediation Goals for CERCLA Sites	C	C	C				
Oil Pollution Prevention (SPCC)	C	C	C	C	C	C	
Clean Air Act							
Federal Air Rules for Reservations (FARR)	C	C	C	C	C	C	
WA State Air Quality Requirements (WAC173-400-040(4))							C
Nuclear Energy and Radiation Control Act	C						
Occupational Safety and Health Act (OSHA)	C	C	C	C	C	C	
Hazardous Materials Transportation Act	C	C	C		C		

	On Reservation						Off Reservation
	CERCLA On-Site Areas					CERCLA Off-Site Areas	
	Federal Land					Stevens County Fee Land	Stevens County Fee Land
	Mined Areas	Haul Road Clean-up	Drainage Clean-up	New Access Road	Blue Creek Pipeline (including discharge and mixing zone)	Rhoads Borrow Area	Ford Borrow Area/ Lane Mountain
Health Protection Standard for Uranium and Thorium Mill Tailings	C	C	C				
Bald and Golden Eagle Protection Act	C	C	C	C	C		
Paleontological Resources Protection Act							
Indian Affairs Manual, Environmental and Cultural Resources Management, Paleontological Resources	C	C	C	C	C		
Archaeological Resources Protection Act	C	C	C	C	C	C	
Executive Order 13112 - Invasive Weeds	C	C	C	C	C	C	
Spokane Tribe of Indians							
STI Integrated Resource Management Plan	C	C	C	C	C	C	
Stevens County							
Administrative Conditional Use Permit						P	P
Washington State							
State Environmental Policy Act						P	P
Forest Practices Permit						P	P
Surface Mining Reclamation Permit						P	P
Radiological Criteria for Unrestricted Use	C	C	C				
1960 Federal Radiation Council Radiation Protection Guidance	C	C	C				
National Council of Radiation Protection and Measurements	C	C	C				

P – Permit

C - Compliance

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
Drainage Clean-up	Executive Order 11990 - Protection of Wetlands	E.O. - Requires federal agencies to minimized the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands for projects that they have approval or permitting authority over.	• Impacts to wetlands associated with the sediment clean-up in the drainages will be avoided and minimized where practicable and unavoidable impacts mitigated. Decision on avoiding and minimizing impacts to wetlands will be made as access and the extent of the cleanup of contaminated sediments is determined in the field.
Blue Creek Pipeline	Executive Order 11990 - Protection of Wetlands	E.O. - Requires federal agencies to minimized the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands for projects that they have approval or permitting authority over.	• Impacts to wetlands associated with the installation of the Blue Creek Pipeline along the margins of Lake Roosevelt will be avoided and minimized and unavoidable impacts will be mitigated.
Eastern Haul Road Clean-up	Executive Order 11990 - Protection of Wetlands	E.O. - Requires federal agencies to minimized the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands for projects that they have approval or permitting authority over.	• Impacts to wetlands associated with the Eastern Haul Road Clean-up along the Northern and Eastern Drainage will be avoided and minimized and unavoidable impacts will be mitigated.
Vegetation Clearing Throughout	Migratory Bird Treaty Act	50 CFR 10.13 - Avoid the "taking" of migratory birds including active nests and feathers.	• Vegetation clearing during the nesting season (March-July) will be avoided where possible. • If vegetation clearing is required during the nesting season, conduct nesting bird surveys and avoid active nests until young have fledged.
WTP Effluent Discharge	National Pollution Discharge Elimination System	40 CFR 122 - Requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States"	• An NPDES permit from EPA will be obtained for discharge into Lake Roosevelt. Permit is in process and pending approval.
Grading and Construction Activities On-Site	National Pollution Discharge Elimination System - Stormwater	40 CFR 122.26 - Requires permits for stormwater discharges from industrial activities such as construction activities consisting of clearing, grading, excavating, and stockpiling that disturb one or more acres are regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program.	• The permit conditions provided at http://www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf will be complied with. • The proposed pH limits of less than 6.0 or greater than 8.5,turbidity limit of 25 NTU and with other non-numeric effluent limitations requirement for erosion and sediment control, soil stabilization, dewatering, pollution prevention measures, prohibited discharges, and surface outlets (40 CFR 450.21) will be complied with regular monitoring. • The concepts and use of BMPs from the Stormwater Management Manual for Eastern Washington have been incorporated into the design. • The EPA approved Spokane Tribe's Water Quality Standards will be achieved through implementation of the RA. • Compliance with Endangered Species Act and Section 106 of the National Historic Preservation Act will be demonstrated through the preparation of a Biological Assessment and pre-construction surveys for eligible cultural resources.
Rhoads Borrow Area	National Pollution Discharge Elimination System - Stormwater	40 CFR 122.26 - Requires permits for stormwater discharges from industrial activities such as construction activities consisting of clearing, grading, excavating, and stockpiling that disturb one or more acres are regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program. The Construction General Permit (CGP) is issued by EPA within Reservation lands.	• The Construction General Permit (CGP) from EPA (eNOI) will be obtained for construction related stormwater discharges at the Rhoads Borrow Area. • The permit conditions provided at http://www.epa.gov/npdes/pubs/cgp2012_finalpermit.pdf will be complied with. • The proposed pH limits of less than 6.0 or greater than 8.5,turbidity limit of 25 NTU and with other non-numeric effluent limitations requirement for erosion and sediment control, soil stabilization, dewatering, pollution prevention measures, prohibited discharges, and surface outlets (40 CFR 450.21) will be complied with regular monitoring. • The concepts and use of BMPs from the Stormwater Management Manual for Eastern Washington will be incorporated into the design. • The EPA approved Spokane Tribe's Water Quality Standards will be achieved through implementation of the RA. • Compliance with Endangered Species Act and Section 106 of the National Historic Preservation Act will be demonstrated through the preparation of a Biological Assessment and pre-construction surveys for eligible cultural resources. • A Section 401 water quality certification will be obtained from the Spokane Tribe for the CGP at the Rhoads Borrow Area.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
Ford Borrow Area	National Pollution Discharge Elimination System - Stormwater	40 CFR 122.26 - Requires permits for stormwater discharges from industrial activities such as construction activities consisting of clearing, grading, excavating, and stockpiling that disturb one or more acres are regulated under the National Pollutant Discharge Elimination System (NPDES) stormwater program. The stormwater NPDES permit is administered by Washington Department of Ecology in areas off Reservation lands.	● A Sand and Gravel Permit will be obtained from Washington Department of Ecology for stormwater discharges at the Ford Borrow Area. ● Permit conditions provided at http://www.ecy.wa.gov/programs/wq/stormwater/construction/permitdocs/cswgppermit120110.pdf will be complied with. ● The proposed pH limits of less than 6.0 or greater than 8.5,turbidity limit of 25 NTU and with other non-numeric effluent limitations requirement for erosion and sediment control, soil stabilization, dewatering, pollution prevention measures, prohibited discharges, and surface outlets (40 CFR 450.21) with be complied with through regular monitoring. ● The concepts and use of BMPs from Stormwater Management Manual for Eastern Washington will be incorporated into the design. ● Compliance with Endangered Species Act and Section 106 of the National Historic Preservation Act will be demonstrated through the preparation of a Biological Assessment and pre-construction surveys for eligible cultural resources.
Blue Creek Pipeline	Rivers and Harbors Act	33- CFR 320-332 - Prohibits unauthorized obstruction or alteration of any navigable water of the U.S. unless permitted by the U.S. Army Corps of Engineers	● The design and construction of the Blue Creek Pipeline in Lake Roosevelt will be coordinated with U.S. Army Corps of Engineers and U.S. Bureau of Reclamation.
Mine Area Clean-up	Section 304 - Water Quality Standards	40 CFR 131 - Requires EPA to develop, publish, and revise criteria for water quality accurately reflecting the latest scientific knowledge on all identifiable effects on health and welfare.	● The cleanup standards were developed for surface water and groundwater and provided in Tables 8-1 and 8-2 of the ROD, respectively. ● Once areas are remediated, surface water will be allowed to drain down gradient to the natural drainages. ● The water management systems, leak detection monitoring of storage ponds, and site-wide monitoring of surface water down gradient of the MA will be inspected and monitored during and following RA construction as described in the OM&M Plan BODR Appendix P and the Site-Wide Monitoring Plan in BODR Appendix Q.
WTP Effluent Discharge	Section 401 Water Quality Certification	40 CFR 121 - Requires certification for water quality from state or Tribe for federal Clean Water Act Permits.	● A Section 401 Water Quality Certification will be obtained from Spokane Tribe for the NPDES Permit for the WTP effluent discharge.
Rhoads Borrow Area	Section 401 Water Quality Certification	40 CFR 121 - Requires certification for water quality from state or Tribe for federal Clean Water Act Permits.	● A Section 401 Water Quality Certification will be obtained from Spokane Tribe for the stormwater NPDES for the Rhoads Borrow Area.
Drainage Clean-up	Section 404 of Clean Water Act - Discharge of Dredge or Fill	33 CFR 320.3 - Requires a section 404 permit for the discharge of dredge or fill material into waters of the U.S.	● Impacts to wetlands will be avoided and minimized, and unavoidable impacts to wetlands and streams in the Western, Central, and Eastern Drainages will be mitigated. ● Applicable conditions associated with NWP 38 including, compliance with Section 404 of the CWA, Section 106 of the National Historic Preservation Act, Endangered Species Act, and Executive Orders 11990 for wetlands and 11988 for floodplains will be complied with. ● Impacts to wetlands will be mitigated at the ratios specified in EPA's interagency Mitigation Guidance document in Washington State. ● Wetland mitigation opportunities will be identified and evaluated or credits will be purchased at an accredited mitigation bank. ● A Compensatory Mitigation Plan consistent with Section 404(b)(1) requirements will be prepared and implemented.
Blue Creek Pipeline	Section 404 of Clean Water Act - Discharge of Dredge or Fill	33 CFR 320.3 - Requires a section 404 permit for the discharge of dredge or fill material into waters of the U.S.	● Impacts to wetlands will be avoided and minimized, and unavoidable impacts to wetlands and streams adjacent to Blue Creek and Lake Roosevelt with be mitigated. ● Applicable conditions associated with NWP 38 including, compliance with Section 404 of the CWA, Section 106 of the National Historic Preservation Act, Endangered Species Act, and Executive Orders 11990 for wetlands and 11988 for floodplains will be complied with. ● Impacts to wetlands will be mitigated at the ratios specified in EPA's interagency Mitigation Guidance document in Washington State. ● Wetland mitigation opportunities will be identified and evaluated or credits will be purchased at an accredited mitigation bank. ● A Compensatory Mitigation Plan consistent with Section 404(b)(1) requirements will be prepared and implemented.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
Eastern Haul Road Clean-up	Section 404 of Clean Water Act - Discharge of Dredge or Fill	33 CFR 320.3 - Requires a section 404 permit for the discharge of dredge or fill material into waters of the U.S.	• Impacts to wetlands will be avoided and minimized and unavoidable impacts to wetlands and streams in the Northern and Eastern Drainages will be mitigated. • Applicable conditions associated with NWP 38 including, compliance with Section 404 of the CWA, Section 106 of the National Historic Preservation Act, Endangered Species Act, and Executive Orders 11990 for wetlands and 11988 for floodplains will be complied with. • Impacts to wetlands will be mitigated at the ratios specified in EPA's interagency Mitigation Guidance document in Washington State. • Wetland mitigation opportunities will be identified and evaluated or credits will be purchased at an accredited mitigation bank. • A Compensatory Mitigation Plan consistent with Section 404(b)(1) requirements will be prepared and implemented.
All Remediation Areas	Spokane Tribe of Indians Surface Water Quality Standards Resolution 2010-173	Spokane Tribe's surface water quality standards	• The 2010 Water Quality Standards were disapproved by EPA on December 19, 2013, specifically for mercury and thallium. It is unclear what the final standards for these constituents will be or when it will be resolved. However, the clean-up standards for surface water were established in Table 8-1 of the ROD based on background conditions and the RA is designed to meet those standards. • As the area is remediated, surface water will be allowed to drain down gradient into the natural drainages as described in the Technical Memorandum - Midnite Mine- Management of Stormwater Runoff from Remediated Areas - Revision 1 (WME, 2013a), included as Attachment O-1 of the SWMP. • Mine impacted water will be contained as described in the BODR Appendix E - Water Management Ponds and BODR Appendix F - Surface Water and Sediment Controls.
All Remediation Areas	Safe Drinking Water Act (SDWA)	40 CFR 141 - Protects drinking water sources	• The RA will consolidate the contaminated material in the WCA and will hydraulically isolate from surface and ground water. The groundwater will be pumped and treated at the WTP as described in the BODR Appendix D - Mine Waste Excavation and Containment. • The remedy has been designed to achieve the cleanup standards developed based on background conditions and established in the Table 8-2 of the ROD through natural attenuation. • Groundwater down gradient from the WCA will be monitored to demonstrate compliance with groundwater cleanup standards as described in the BODR Appendix Q - Site Wide Monitoring Plan. • Compliance with the SDWA will be documented in the Site Wide Monitoring. • A potable water system will be developed on site for workers consistent with Washington State Department of Health requirements for Group A, Non-Community, Non-Transient water systems.
All Remediation Areas	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites, for Groundwater Protection	40 CFR 192, Subpart A - Allows the use of background levels where background levels exceed the listed standards as is the case for U-234 and U-238 37 pCi/L and 35 pCi/L, respectively.	• The RA will rely on natural attenuation of groundwater following the natural flushing following source control through consolidation of mine wastes in the WCA and pumping water that accumulates to the WTP for treatment as described in the BODR Appendix D - Mine Waste Excavation and Containment. • The cleanup standard for groundwater was developed based on background conditions and established in Table 8-2 of the ROD. • Once remediated, surface water will be allowed to drain from remediated areas down gradient to natural drainages. • The Institutional Control Implementation and Assurance Plan (ICIAP) (MWH, 2014) will provide directions for institutional controls that will preclude assess to groundwater that does not meet the standards.
All Remediation Areas	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Clean-up of Land and Buildings Contaminated with Residual Radioactive Materials	40 CFR 192, Subpart B - Allows soil limits to be set at values great than background (i.e., 5 pCi/g radium above background).	• The RA limits for soil are set at background and therefore more restrictive than UMTRCA. • Soil clean-up levels are provided in Table 8-3 of the ROD and monitored using procedures in BODR Appendix S - Analytical Support and Verification Plan for Remediation of Surface Materials and Sediments. • Mine waste including soils and sediments will be consolidated, isolated, and covered in the WCA in excess of the clean-up standards as described in the BODR Appendix D - Mine Waste Excavation and Containment. • The clean-up standards for soils and sediments are provided in Tables 4-1 and 4-2 of the BODR. • The existing buildings on-site will be demolished and disposed of with the mine waste in the WCA. Buildings used during the RA will be either decontaminated to UMTRCA limits and taken off-site or disposed of on-site.
All Remediation Areas	Spokane Tribe of Indians Hazardous Substances Control Act, 2004-085	Spokane Tribe's standards for groundwater, surface water, and soil/sediment cleanup on lands within the Spokane Indian Reservation.	• The RA will include consolidating, isolating, and covering the mine waste in the WCAs as described in BODR Appendix D - Mine Waste Excavation and Containment using the cleanup standards for surface material and sediments in Tables 4-1 and 4-2 of the BODR, based on background conditions. • No hazardous waste (i.e., WTP residuals, construction/maintenance materials) will be disposed of on-site. • WTP residuals will be disposed of off-site at a licensed facility in accordance with the Residual Management Plan for the Midnite Mine Water Treatment Plant (the RMP) (WME, 2013).

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
WCA	National Emissions Standards for Hazardous Air Pollutants for Uranium Mill Tailings Disposal Sites	40 CFR 61, Subpart T - Requires that 20pCi/m^2/sec for radon-222 will be used as the standard to limit radon flux emissions to ambient air.	• The RA will consolidate, isolate, and cover the mine waste in the WCAs to limit radon flux as described in the BODR Appendix D - Mine Waste Excavation and Containment. • The cover system will consist of a synthetic geomembrane with a soil cover. The soil cover system alone is designed to limit radon flux to the UMTRCA standard of 20 pCi/m^2/sec. • Once the cover system is completed, radon flux levels will be measured to confirm the UMTRCA standards are achieved.
WTP	Resource Conservation and Recovery Act, Subtitle D	40 CFR 257, Subpart A - Provides siting requirements to limit the disposal of solid waste in floodplains, or in areas that would cause or contribute the "taking" of threatened or endangered species, or discharge pollutants into waters of the U.S. that violates the NPDES program.	• All WTP residuals will be disposed of off-site at a licensed facility. • The short-term management of WTP residuals will be in the WTP area and not be located in a floodplain and would not cause or contribute to the taking of threatened or endangered species as consistent with the Residuals Management Plan for the Midnite Mine Water Treatment Plant (the RMP) submitted to EPA on November 1, 2013 (WME, 2013b). • Compliance will be documented in the WTP design and in the Biological Assessment.

All Remediation Areas	Licensing Requirements for Land Disposal of Radioactive Waste	40 CFR 61 - Provides performance objectives and technical requirements for the Nuclear Regulatory Commission licensing of land disposal for radioactive wastes as well as the short term management of WTP residuals and rock containing uranium at levels that qualify the rock as source material.	• There will not be any on-site disposal of water treatment residual and waste rock and contaminated soil will be disposed of in compliance with the ROD and CD which is consistent with the following:
			  • Protection of releases to the general environment in groundwater, surface water, air, soil, plants, or animal would not result in an annual dose of radioactivity exceeding 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of members of the public;
			  • Protection of individuals from inadvertent intrusion;
			  • Protection of individuals during operation; and
			  • Stability of the disposal site after closure.

Blue Creek Pipeline and Lake Roosevelt Discharge	Endangered Species Act	50 CFR 17 - Provides regulatory protection and recovery mechanism for imperiled species and their habitat and makes it unlawful to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a federally listed species.	• A Biological Assessment has been prepared that analyzes the effects of the RA on federally listed threatened and endangered species. Bull trout are the only species that has the potential to occur within the RA. The BA determined that the project "may affect, but would not likely adversely affect" bull trout. The EPA submitted the BA to U.S. Fish and Wildlife Service on September 30, 2014. • BMPs will be implemented to control turbidity from stormwater runoff as described in the BODR - SWMP.
Blue Creek Pipeline and Lake Roosevelt Discharge	Fish and Wildlife Coordination Act	Requires federal agencies to coordinate and consult with federal and state wildlife agencies as appropriate.	• The U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Washington Department of Fish and Wildlife, Washington Natural Heritage Program, Spokane Tribe Department of Natural Resources were contacted for input into the preparation of the Biological Assessment.
Drainage Clean-up Blue Creek Pipeline	Executive Order 11988 - Protection of Floodplains	Requires federal agencies to protect floodplains by analyzing project effects and minimizing impacts to floodplains for projects that they have approval or permitting authority over.	• Impacts to floodplains will be minimized through the design such as minimizing any intrusions or obstructions into the floodplain that would impede floodplain volume or flow velocity. • The Attenuation Berms will be located in the floodplains of the Eastern and Central Drainages to attenuate peak flows. • All other areas within the floodplain will be regraded to pre-construction conditions as much as possible following construction.
All Remediation Areas	Native Graves Protection and Repatriation Act	43 CFR 10 - Provides protection of Native American graves including Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony.	• A Ground Disturbance Permit Application was submitted to the Spokane Tribe's Tribal Historic Preservation Officer (THPO) in 2013. The THPO recommended professional archaeological surveys and sub-surface testing and monitoring of ground disturbing activities. • The Spokane Tribe Archaeology & Preservation Office (Preservation Office) has conducted cultural resource surveys, literature search, interviews with former mine employees, and historical research to identify the potential for cultural resources prior to construction. No grave sites, funerary objects, sacred objects, or objects of cultural patrimony were identified during the surveys. A report summarizing the results of these surveys and research is expected in the fall of 2015. • A cultural resource monitor will be present during construction in areas with the potential for cultural resources. • Upon the discovery of grave sites, funerary objects, sacred objects, or objects of cultural patrimony, work in the area will cease and the THPO will be consulted to determine recovery and preservation options.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
All Remediation Areas	American Indian Religious Freedom Act	This act as amended directs federal agencies to evaluate their policies and procedures to protect and preserve Native American religious cultural rights and practices.	• A Ground Disturbance Permit Application was submitted to the Spokane Tribe's THPO in 2013. The THPO recommended professional archaeological surveys and sub-surface testing and monitoring ground disturbing activities. • The Spokane Tribe Archaeology & Preservation Office (Preservation Office) has conducted cultural resource surveys, literature search, interviews with former mine employees, and historical research to identify the potential for cultural resources prior to construction. No religious, ceremonial, or burial sites were identified during the pre-construction surveys. A report summarizing the results of these surveys and research is expected in the fall of 2015. • If any sites are identified during construction, work will cease in that area and the THPO will be consulted to determine recovery and preservation options.
All Remediation Areas	National Historic Preservation Act	36 CFR 800 - Requires federal agencies to consider effects of projects that they have approval or permitting authority over to protect historic properties and cultural resources.	• A Ground Disturbance Permit Application was submitted to the Spokane Tribe's THPO in 2013. The THPO recommended professional archaeological surveys and sub-surface testing and monitoring ground disturbing activities. • The Preservation Office has conducted a literature review, interviews with former mine employees, terrestrial field surveys, monitoring, historical research to determine if any listed or eligible sites are present within the RA area. No listed sites or sites eligible for listing on the National Register have been identified during the research or terrestrial survey and subsurface sampling. • The Preservation Office will prepare a report summarizing their finding, which is expected to be completed in the fall of 2015. • Construction specification require that care will be taken during construction to protect or mitigate impacts to listed sites or sites eligible for listing on the National Register of Historic Places. • The Preservation Office will monitoring ground disturbing activities, as needed. • If sites eligible for listing are identified, consultation with the THPO and other agencies will be initiated to evaluate alternatives for minimizing impacts and determine mitigation, if necessary.
All Remediation Areas	Office of Solid Waste and Emergency Response, Directive No. 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination	This Directive clarifies guidance for establishing clean-up levels for radioactive contamination at CERCLA sites for human health protection, specifically the appropriate risk exposure or dose levels range for radionuclides as a cancer risk range between 10^{-4} and 10^{-6}, cited in 40 CFR 300.430 (e)(2)(i)(A)(2), which are more protective than NRC's regulations.	• The RA will consolidate, isolate, and cover the mine waste, including all soils and sediments in excess of the cleanup standards in the WCAs as described in the BODR Appendix D - Mine Waste Excavation and Containment. • Cleanup standards for surface material and sediments are based on background levels and are provided in Tables 4-1 and 4-2 of the BODR.
All Remediation Areas	Office of Solid Waste and Emergency Response, Directive No. 9200.4-25, Use of Soil Clean-up Criteria as Remediation Goals for CERCLA Sites	This Directive clarifies the extent to which the soil clean-up criteria in 40 CFR Part 192, Subpart A were used when setting remediation goals for subsurface soils. Subpart A standards states that the control of residual radioactive materials and their listed constituents shall be designed so that there will not be more than two release rates exceeding an average of 20 $pCi/m^2/sec.$ for radon 222.	• The RA will include consolidating, isolating, and covering the mine waste including all soils and sediments in excess of the cleanup standards in the WCAs as described in the BODR Appendix D - Mine Waste Excavation and Containment. • The clean-up standards for surface material and sediments are based on background levels and are provided in Tables 4-1 and 4-2 of the BODR.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure

All Grading	Spill Prevention, Countermeasures and Control Rule	40 CFR Part 112.6 - Requires certain facilities to prepare and implement a Spill Prevention, Countermeasures, and Control (SPCC) Plan to prevent oil discharges into navigable waters and adjoining shorelines.	• A SPCC for the WTP is provided in the OM&M Plan in Appendix O.
			• A site-wide SPCC will be prepared by the selected contractor in accordance with good engineering practices and be certified by a Professional engineer and contain the following elements:
			  • Facility diagram and facility description;
			  • Oil discharge prediction;
			  • Secondary containment and diversion structures;
			  • Facility drainage;
			  • Bulk storage requirements- inspection, overfill and integrity;
			  • Transfer procedures and equipment;
			  • Qualified oil-filled operational equipment;
			  • Brittle fracture evaluation for above ground field containers;
			  • Personnel training and prevention briefings;
			  • Recordkeeping;
			  • Five year Plan review;
			  • Management approval; and
			  • Plan certification.
			• Inspection will be conducted in accordance with the OM&M Plan in BODR Appendix P and Site-Wide Monitoring Plan in BODR Appendix Q.
			• A SPCC will be prepared for the Rhoads Borrow Area or Ford Borrow Area and include the components specified above.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure

All Grading and Construction	Clean Air Act	40 CFR Parts 9 and 49 - Establishes air quality standards to protect public health and public welfare as well as protecting against decreased visibility and regulating emissions of hazardous air pollutants.
		
		40 CFR Part 49, Subpart M - Creates an implementation plan for tribes referred to as Federal Air Rules for Reservations (FARR).
		
		40 CFR § 49.124 - Establishes that visible emissions from air pollution sources may not exceed 20 percent opacity, averaged over six consecutive minutes, as measured by EPA Method 9.
		
		40 CFR § 61.140 *et seq*, Subpart M - National Emission Standards for Asbestos
		
		40 CFR § 61.220 *et seq*., Subpart T - National Emission Standards for Radon Emissions from the Disposal of Uranium Tailings
		
		40 CFR § 63.6580 *et seq*., Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
		
		40 CFR § 60.670 *et seq*., Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants
		
		40 CFR § 60.4200 *et seq*., Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
			• A site specific written plan will be prepared prior to commencing construction or demolition (40 CFR §49.126).
			• Asbestos NESHAP (40 CFR §160.145) work practices will be implemented during demolition and disposal, if asbestos material are encountered in the existing buildings.
			• Within 90 days after beginning operations, the facility will be registered with EPA under FARR requirements, and annually thereafter by February 15 of each year (40 CFR Part 49, Section 138). – EPA considers this an administrative requirement and is considered voluntary and not required under the CERCLA permit exemption.
			• The EPA confirmed that the RA will be a minor emission source and records will be maintained to demonstrate that actual emission remain below 50 percent of the PTE thresholds for Major Source status for purposes of Title V.
			• If necessary, prevent emissions from stationary sources from exceeding 100 TPY of NOx by limiting run-time for certain equipment, installing non-resettable runtime meters on the engines and calculating emissions on a rolling 12 month basis.
			• Implement Best Management Practices (BMPs) to control fugitive PM as described in the Storm Water Management Plan in BODR Appendix O.
			• .
			• Monitor visible emissions in accordance with EPA Method 9 and fugitive PM emissions with EPA Method 22 within 30 days of start of the operation and on an annual basis thereafter, during typical operating and weather conditions (40 CFR Part 49.124 and 49.126). The date, time, and results of the survey will be documented.
			  • If visible emissions from stationary sources exceed 20 percent opacity requirement, an action plan will be prepared to identified sources and actions to prevent exceedance.
			  • If fugitive PM emission is identified, measures will be taken to minimize fugitive emission.
			• Comply with the applicable requirements of 40 CFR § 60.4200 et seq. for stationary compression ignition internal combustion engines.
			  • All stationary engines will be certified to meet EPA required emission standards for the year manufactured.
			  • All stationary engines will be maintained and operated consistent with the manufacturer's recommendations. Records of conducted maintenance will be kept, consistent with a maintenance plan to demonstrate compliance and to maintain and operate the engine consistent with good air pollution control practice for minimizing emissions.
			  • Emergency stationary engines, will be operated for the purpose of maintenance checks and readiness tests, consistent with the manufacturer's recommendation, and will not exceed 100 hours per year.
			• Comply with the applicable requirements of 40 CFR § 63.6580 et seq. for stationary reciprocating internal combustion engines.
			  • Stationary combustion engines will comply with EPA Tier III or Tier IV emission standards, excluding the rock crusher equipment.
			• Comply with the applicable requirements of 40 CFR § 60.670 et seq. for sources at nonmetallic mineral processing facilities.
			  • If a bag house is used to control fugitive emissions on the rock crusher, quarterly monitoring using EPA Method 22 for will be conducted for 30 minutes to determine if fugitive PM emissions are being emitted from the baghouse (40 CFR §60.674). If fugitive PM emissions are identified, corrective actions will be initiated within 24 hours. Quarterly monitoring will be documented as required by 40 CFR §60.674.
			• Comply with the applicable requirements of 40 CFR §49.130 et seq. for rules for reducing sulfur in fuels.
			  • Ultra-low sulfur diesel fuel will be used for diesel engines re-fueled on-site.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure

All Grading and Construction, Cont'd.	Clean Air Act, Cont'd.		• Comply with the applicable requirements of 40 CFR §63.6580 et seq. for National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR).
			  • If the stationary engine for the rock crushers was manufactured prior to June 12, 2006, the non-emergency, non-black start CI stationary RICE ≤ 300 hp would:
			  ▪ Change oil and filter every 1,000 hours of operation or annually, whichever comes first;
			  ▪ Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary;
			  ▪ Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
			  • If the stationary engine for the rock crushers was greater than 300hp and manufactured prior to June 12, 2006, additional requirements would apply (Table 2d to Subpart ZZZZ of Part 63).
			• Monitor and document fugitive PM at the Rhoads Borrow Area as described above.

Ford Borrow Area	Clean Air Act	(WAC) 173-401 - Requires facilities with more than 100 tons per year of NO_x, VOC, CO, SO_2 and PM, 10 tons per year of any HAP or 25 tons per year of a combination of HAPs obtain an operating permit.	• Borrow operation at the Ford Borrow Area, if it is used, would not exceed 100 tons per year regulated National Ambient Air Quality Standards pollutants.
			• If the Ford Borrow Area is used, fugitive PM at the Ford Rhoads Borrow Area, BMPs will be implemented to control fugitive PM as described in the Storm Water Management Plan in BODR Appendix O.
			• Monitor visible emissions in accordance with EPA Method 9 and fugitive PM emissions with EPA Method 22 within 30 days of start of the operation and on an annual basis thereafter, during typical operating and weather conditions (40 CFR Part 49.124 and 49.126). The date, time, and results of the survey will be documented.
			  • If visible emissions from stationary sources exceed 20 percent opacity requirement, an action plan will be prepared to identified sources and actions to prevent exceedance.
			  • If fugitive PM emission is identified, measures will be taken to minimize fugitive emission.

WTP	Nuclear Energy and Radiation Control Act	RCW 70.98 AND WAC 246-220 AND 246-255 - Regulates sources of ionizing radiation for the protection of the occupation and public health and safety.	• The conditions of the terminated State radioactive materials license (WN I0390 1) will be continued to be complied with in the operation and management of the WTP and WTP sludge.
All Areas	Occupational Safety and Health Act	29 CFR Part 1910 - Provides requirements for safe and healthful workplaces by setting enforcing standards, and by providing training, outreach, education, and assistance.	• Implement OSHA and TOSHA requirements that have been incorporated into the Health and Safety Plan included in the BODR Appendix P - OM&M Plan.
Remediation Area	Hazardous Materials Transportation Act	49 CFR 105-180 - Requires Reportable Quantities of Hazardous Substances or Low Specific Activity Group I (LSA-1) be transported, packaged, and labeled in accordance with the procedures.	• Any Reportable Quantities of hazardous substances including LSA-I transported on public roads will be packaged, labeled, and transported in accordance with Hazardous Material Transportation Act requirements.
All Areas	Bald and Golden Eagle Protection Act	50 CFR 22 - Prohibits "taking" of bald and golden eagles, including their parts, nests, and eggs without a permit.	• Prior to construction, surveys for eagle nests will be conducted to identify active eagle nests. Restricted access within ¼ mile of active nests could be required from November 15 until the nest becomes unoccupied.
All Areas	Paleontological Resources Protection Act	This act provides protection for paleontological resources on Federal land with an explicit exemption on Indian land.	• The BIA and Spokane Tribe will be consulted if paleontological resources are discovered; however, the presence of fossils in the area is unlikely.
All Areas within the Reservation	Indian Affairs Manual, Environmental and Cultural Resources Management, Paleontological Resources	25 CFR 162.100 *et seq.* - Requires a permit prior to the excavation or removal of imbedded fossils from Indian lands.	• The BIA and Spokane Tribe will be consulted if paleontological resources are discovered; however, the presence of fossils in the area is unlikely.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
All Areas within the Reservation	Archaeological Resources Protection Act	43 CFR Part 7 - Protects archaeological resources including material remains of archaeological interest and cultural items from unnecessary removal on public lands and Indian lands.	• Upon the discovery of archaeological resources or grave sites, construction activities will immediately stop at that location and the THPO will be consulted and their instructions will be followed.
On-Site Areas	Executive Order 13112 - Invasive Species	This E.O. mandates federal agencies to prevent the introduction and spread of invasive species and rapidly control populations for project that they have approval or permitting authority over.	• Invasive species will be controlled when identified as described in the Noxious Weed Management Plan (NWMP) found in Appendix E of the Rhoads Property Plan of Operation and Reclamation (POOR) and will be applicable to on-site areas as well . Seed, mulch, and BMP materials will be certified as invasive free for revegetation and erosion control as described in the POOR and will be applicable to on-site areas as well. Temporary seeding of disturbed areas will also serve to minimize establishment of invasive species.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Requires adherence to NHPA and other cultural resources laws.	• A Ground Disturbing Permit was requested from the THPO in 2013 and recommended cultural resource studies and monitoring will be followed in accordance with the NHPA and other cultural resources requirements.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Survey of lands prior to any undertaking with Federal involvement.	• The Preservation Office conducted surveys in 2014 and 2015 and THPO's recommendations will be incorporated into the final design and implementation.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Protect cultural aesthetic values within 1 mile of mountain peaks.	• The remediation will occur within 0.5 miles of the Spokane Mountain; however, the final reclamation will improve the aesthetic values from its current condition following the final grade contours and establishment and maturity of native revegetation.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Discharges to comply with the Tribal Water Quality Standards and the Hazardous Substance Control Act.	• The Tribe's Water Quality Standard and Hazardous Substances Control Act are identified ARARs that have been considered in developing the clean-up standard. Cleanup standards are based on background conditions.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Obtain NPDES for point source discharges.	• An NPDES permit application was submitted to the EPA in March 2013.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Obtain 401 certification through the Tribe for federal CWA permits.	• A request will be made for a 401 certification once the NPDES permit obtained.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Comply with federal laws such as Clean Water Act and Safe Drinking Water Act.	• The project is being designed to comply with the Clean Water Act and Safe Drinking Water Act, including minimizing impacts to jurisdictional wetlands and other non-wetland waters of the U.S. and maintain wellhead protection areas as discussed above.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Implement BMPs for new construction.	• BMPs will be incorporated into the design and SWMP.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Follow water quality and hazardous substances standards.	• The Tribe's Water Quality Standard and Hazardous Substances Control Act are identified ARARs that have been considered in developing the clean-up standard. The cleanup standards are based on background levels.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	No new construction or excavation within 100 ft of riparian vegetated streams, lakes, and ponds	• The Blue Creek pipeline will be primarily constructed in the existing Blue Creek Road and the pipeline will be buried and will not affect existing riparian vegetation. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, pending resolution of NPDES permitting requirements. • The sediment in the Western, Central, Eastern, and Northern Drainages are contaminated and impacts to wetlands and riparian vegetation are necessary improve habitat and stream quality.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	No new construction or excavation within ½ mile of rivers and 1,310 ft elevation;	• The Blue Creek Pipeline and drainage clean-up are within the designated Riparian Zone. The pipeline will be buried and will not be visible once installed and no riparian vegetation will be impacted as part of the installation of the Blue Creek Pipeline. The Blue Creek Pipeline will cross a short section of upland grasses and shrubs between Blue Creek Road and Lake Roosevelt. The upland vegetation will be revegetated with native species once the pipeline is installed. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, pending resolution of NPDES permitting requirements. • BMPs will be implemented to minimize the transport of sediment into riparian and wetland communities.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	No pesticide (e.g., herbicide, insecticide, fungicide, and rodenticide) and fertilizer use within 500 ft.	• No pesticides will be used within the Riparian Zone corridor.

Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Prohibits development or consumptive or destructive uses within ½ mile from elevation 1,310 ft on Lake Roosevelt.	• The Blue Creek Pipeline will be within the Shoreline Recreation Zone at the Blue Creek Road and into Lake Roosevelt. However, the pipeline will be buried and primarily be located within the existing dirt road (Blue Creek Road). It crosses a small section of upland vegetation adjacent to Lake Roosevelt with native species and then crosses through the lake bed. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, pending resolution of NPDES permitting requirements.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	This section lists water source priorities for dust control which are in the following order: 1) Spokane River/Columbia River; 2) Little Falls & Bull Pasture irrigation valves; 3) Western Nuclear; 4) SiJohn Field; 5) Harris Well; 6) Tank Below Post Plant; 7) Turtle Lake ; 8) Mathews Lake1; and 9) Benjamin Lake1.	• It is currently planned that water from construction purposes will be obtained from on site. Treated water from the WTP will be used for dust control on contaminated materials. Water meeting MCLs will be used for off-site dust control and for use in the construction support zone as discussed in Appendix T to the BODR.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	No new construction or excavation within 500 ft. of community wells and Wellhead Protection Zone. No pesticide (e.g., herbicide, insecticide, fungicide, and rodenticide) and fertilizer use within 500 ft.	• The remediation is not within 500 ft of a Wellhead Protection Zone.
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Prohibits development on wildlife mitigation lands, as established by covenant. Tribe follows the federal Endangered Species Act.	• The remediation is not on wildlife mitigation lands. • A Biological Assessment has been prepared to determine if a formal Section 7 Consultation with the U.S. Fish and Wildlife service would be necessary. Only the bull trout has the potential to occur within the project area. No other Threatened or Endangered species are expected to occur within the project site. The Biologic Assessment concluded that the proposed remedial action "may affect, but would not likely adversely affect bull trout".
All Areas within the Reservation	Integrated Resource Management Plan for the Spokane Indian Reservation	Meet the National Ambient Air Quality Standards (NAAQS) and FARR.	• The Master SWMP in Appendix O and the Technical Specification in Appendix K of the BODR address limiting fugitive dust emissions. A more detailed site specific fugitive dust control plan will be prepared prior to the commencement of construction or demolition activities. • Any On-Reservation and Off-Site emission sources that meet the criteria will be registered under FARR. No rock crusher would be used off-site. • An AQMP has been submitted to EPA and the Tribe describing the proposed air quality monitoring. Comments on that plan were not received at the time of publication of this document.
Rhoads Borrow Area	Stevens County Administrative Conditional Use Permit	Stevens County regulates development activities on all fee land within Stevens County	• Stevens County granted an Administrative Conditional Use Permit for the Rhoads Borrow Area on July 30, 2015. Conditions of the permit will be followed.
Ford Borrow Area	Stevens County Administrative Conditional Use Permit	Stevens County regulates development activities on all fee land within Stevens County	• An Administrative Conditional Use Permit application package will be submitted to Stevens County for the Ford Borrow Area, if the Rhoads Borrow Area cannot be finalized, and included the application and SEPA checklist.
Borrow Area	Washington State Environmental Policy Act	RCW 43.2 - Requires decision makers to consider potential environmental impacts of the proposed action.	• Environmental impacts for the Rhoads Borrow Area were documented in the SEPA checklist as part of the Stevens County Administrative Conditional Use Permit application. Stevens County made a Determination of Nonsignificance (DNS) for the SEPA review of the Rhoads Borrow Area development (July 30, 2014). • If it is determined that the Ford Borrow Area will be used, a separate SEPA checklist will be submitted to Stevens County as part of the Administrative Conditional Use Permit.
Ford Borrow Area	Washington Forest Practices Act	RCW 76.09, RCW 6.13 RCW, AND WAC 222-16-010 - Washington Department of Natural Resources administers permits for timber harvest of fee land.	• The Forest Practices application will be submitted to WA DNR (approximately 18 months prior to development) to permit timber harvest on the Rhoads Borrow Area, or on the Ford Borrow Area if the alternative borrow area is required.
Borrow Areas	Washington Surface Mine Reclamation Permit	WAC 332-18 AND 78.44 - Requires surface mines greater than three acres of ground disturbance or has high walls greater than 30 ft and slopes steeper than 45 degrees be permitted.	• The Application for Reclamation Permit will be submitted to WA DNR (approximately 18 months prior to development) for the development of the borrow area at the Rhoads Borrow Area, or the Ford Borrow Area if the alternative borrow area is required.

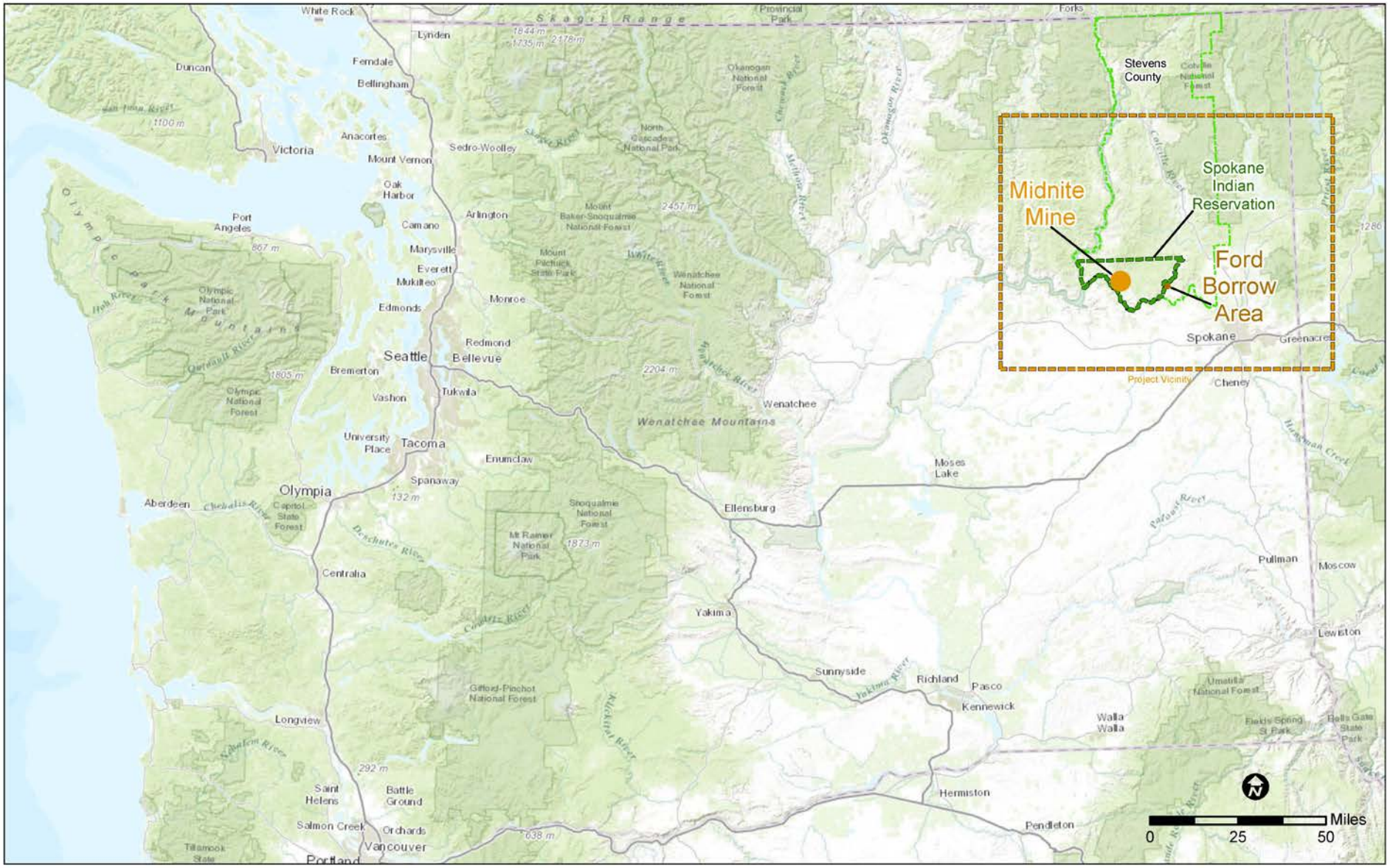
Table M-2. Environmental Requirements by Project Components

Activity	Act/Regulation	Requirement	Action/Measure
All Areas	Sanitation Standards for General Industry	29 CFR 1910.141 (a)(2) - Provides standards for potable water and septic systems and are implemented locally by both the Tribes Utility Services Department and the Northeast Tri-County Health District	• A potable water system will be developed On-Site for workers consistent with Washington State Department of Health requirements for Group A, Non-Community, Non-Transient water system. • Design and construct septic system consistent with the Northeast Tri-County Health District as described in the OM&M Plan located in BODR Appendix P. • Periodically test water system to ensure that standards are being achieved as described in the OM&M Plan located in BODR Appendix P.

There are a number of project permits and agency coordination that are required to implement this project. The schedule for those permits and coordination with agencies are provided in Table M-4.

Table M-3.Permit/Coordination Schedule

Permit/Coordination	Requirement	Schedule
EPA - Clean Air Act	Site Specific Fugitive Dust Plan	Prepare at least 30 days prior to construction
EPA - Clean Air Act	Air Quality Monitoring Plan (WME 2014a) Clean Air Act - Re-evaluation of equipment following the specification of equipment	Air Quality Monitoring Plan –Rev 1 submitted to EPA on 12/2/2014. Review by EPA and Tribe is ongoing. Once the stationary equipment is specified, reevaluate to determine if an updated New Source Review is warranted.
EPA - NPDES Permit	WTP NPDES	Submitted to EPA in March 2013. Processing by EPA is ongoing.
EPA - NPDES Permit	Rhoads Borrow Area Stormwater NPDES	The Rhoads Borrow Area development is planned for year four. The stormwater NPDES Permit takes approximately 14 days, but it will need to be filed in conjunction with the 401 certification which could take up to six months.
EPA - Section 404 of Clean Water Act	Wetland Delineation – Rev 4 (WME 2015a)	TBD, Revision 4 submitted on 5/8/2015 and review from EPA is ongoing.
EPA/USFWS - Endangered Species Act	Biological Assessment – Rev 2 (WME 2014b)	EPA submitted to USFWS on September 30, 2014.
Section 404 of Clean Water Act	Draft Conceptual Wetland and Stream Mitigation Approach	TBD, Conceptual Plan submitted to EPA on 3/16/2015 and review is ongoing.
Spill Prevention Countermeasures Rule	Preparation of SPCC	To be completed by the contractor prior to the commencement of work as part of the Remedial Action Work Plan.
Spokane Tribe - 401 Certification	WTP 401 Certification	TBD, submission of the 401 Certification request from the Spokane Tribe once the WTP NPDES permit requirements are advanced.
Spokane Tribe - 401 Certification	Rhoads Borrow Area 401 Certification	The Rhoads Borrow Area development is planned for year four. The 401 certification and stormwater NPDES permit will be requested approximately one year prior to planned borrow area development in year four. The 401 certification from the Tribe could take up to six months. The stormwater NPDES is expected to take 14 days.
Spokane Tribe - Integrated Resource Management Plan for the Spokane Indian Reservation	Coordinate with Spokane Tribe IDT for verification of IRMP consistency of Blue Creek Pipeline	TBD, once the pipeline design is advanced following the resolution of NPDES permit requirements.
Spokane Tribe THPO - National Historic Preservation Act and other cultural resource requirements	Cultural Resource Surveys	A Ground Disturbance Permitted in 2013 and the THPO's recommendations to have the Spokane Tribe Preservation Office conducted cultural resource surveys occurred in 2014 and 2015. Cultural resources monitoring will occur throughout the RA.
Stevens County - Administrative Conditional Use Permit	Rhoads Borrow Area	Stevens County authorized an Administrative Conditional Use Permit for the Rhoads Borrow Area development on 7/30/2014.
Stevens County - Administrative Conditional Use Permit	Ford Borrow Area	TBD, if Ford Borrow area is determined to be required.
U.S. Army Corps of Engineers - Section 10 of Rivers and Harbor Act	Coordination with U.S. Army Corps of Engineers	TBD once the pipeline design is advanced following the resolution of NPDES permit requirements
WA DNR	Forest Practices Permit	At least 120 to 180 days prior to timber harvest at the Borrow Area in year four, renew every three years
WA DNR	Mine Reclamation Permit	At least 18 months prior to the planned borrow activities in year four.



WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Figure M-1
Midnite Mine and Ford Borrow Project Locations

Date:	July 2014
Project:	Midnite Mine
File:	Project Vicinity.MXD

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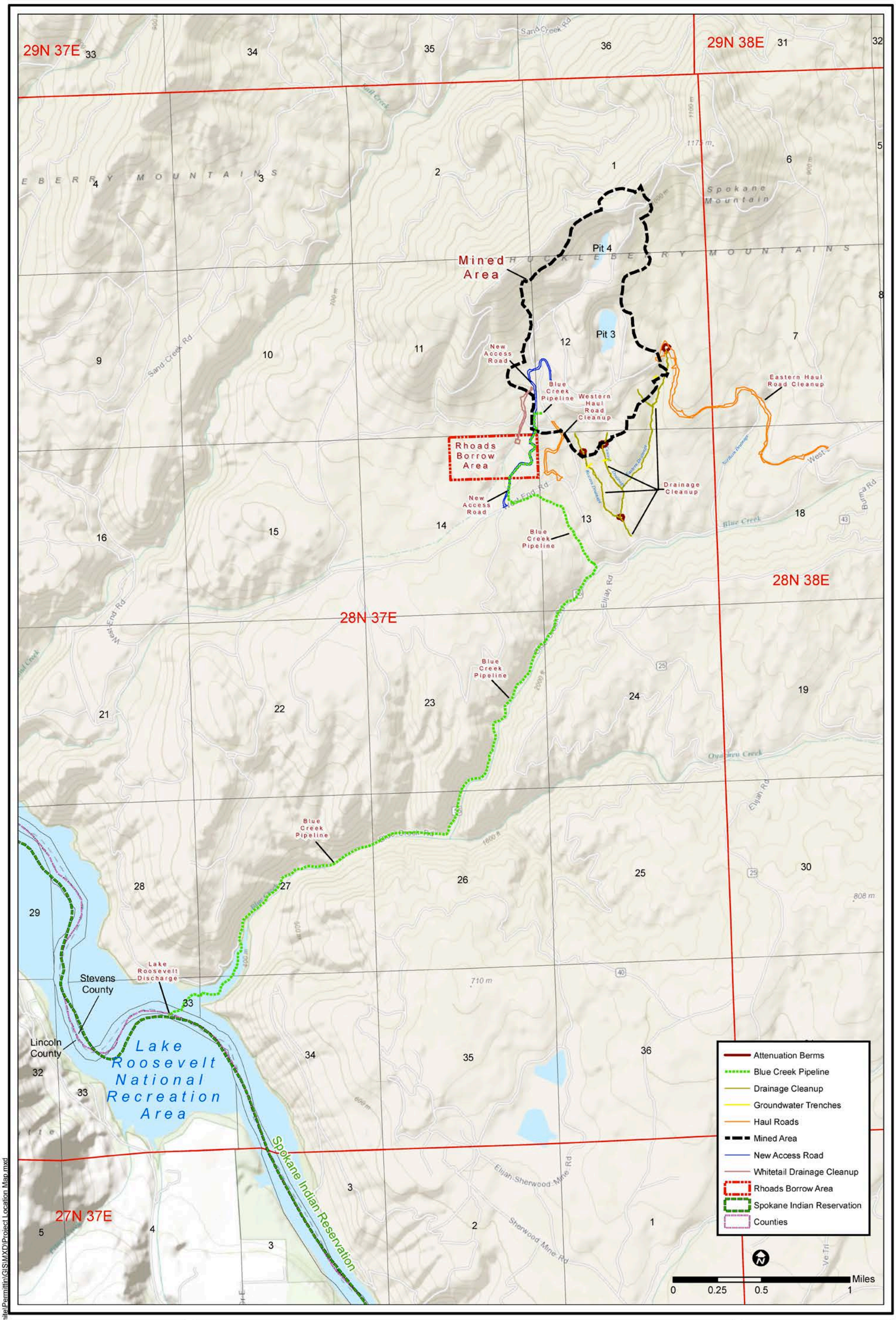

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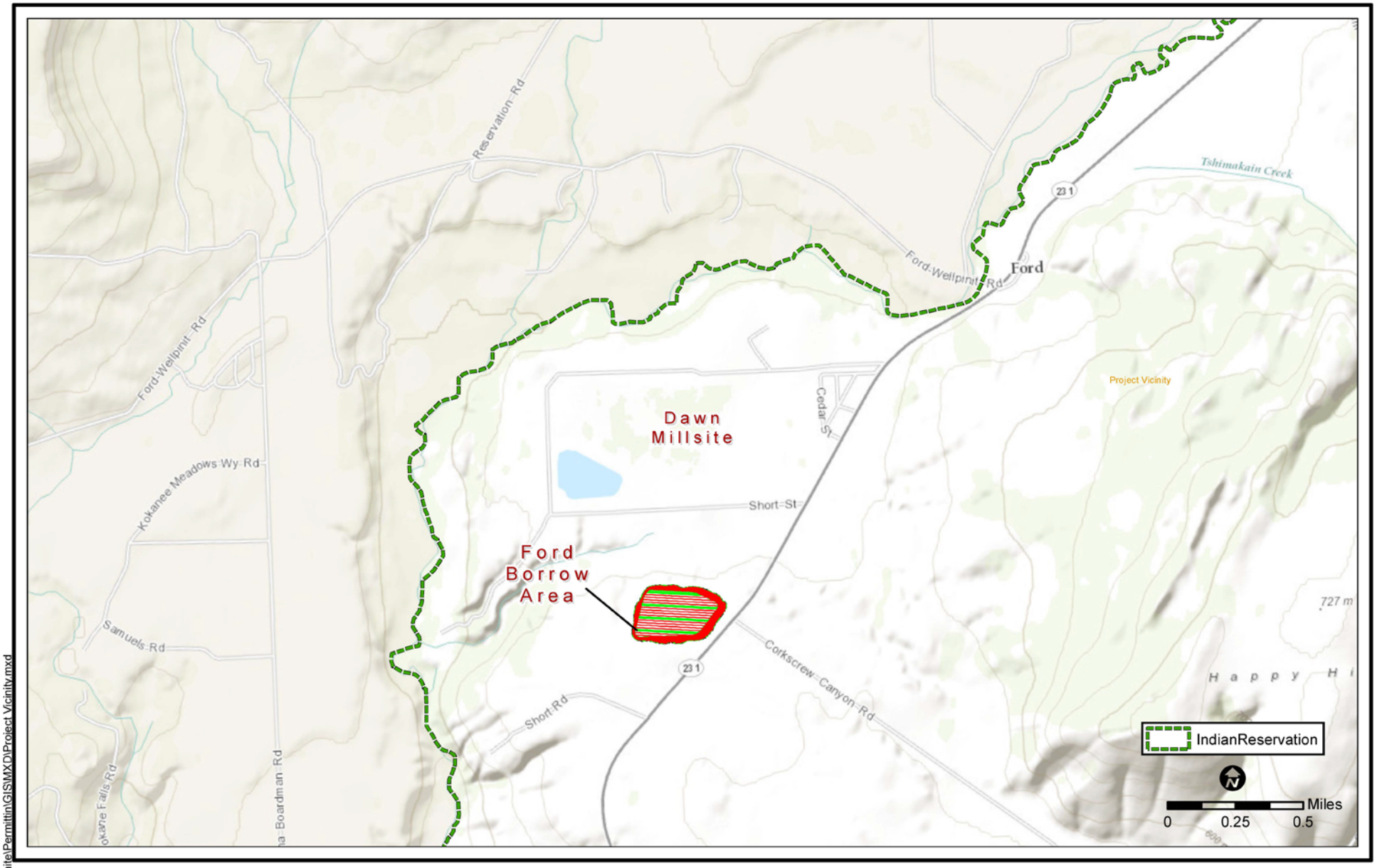
WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Figure M-2
Midnite Mine Project Areas

Date:	June 2015
Project:	Midnite Mine
File:	MMComponents.MXD



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ENVIRONMENTAL, LLC.

Figure M-3
Ford Borrow Area

Date:	July 2014
Project:	Midnite Mine
File:	Ford Borrow.MXD

M3.0 REGULATORY REQUIREMENTS

As described in the ROD (EPA, 2006), the Remedial Action is protective of human health and the environment, complies with applicable or relevant and appropriate requirements (ARARs), is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The Remedial Action also employs treatments that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element with a bias against off-site disposal of untreated wastes.

Under Section 121 of CERCLA and the NCP, the Remedial Action complies with all chemical-specific, action specific, and location specific ARARs with the exception of ARARs for water treatment discharge during interim action. As described in the ROD (EPA, 2006), the EPA has made the statutory determination that the Remedial Action protects human health and the environment as follows:

- Containment of mine waste under a soil cover will result in background levels of contaminants of concern (COCs) in surface materials and will result in protective surface radon and radiation levels in the containment area.
- Control of sources of acid rock drainage (ARD) and treatment of contaminated seeps and pit water will reduce contaminant loading to groundwater and surface water, allowing natural recovery to achieve background levels of COCs.
- Achievement of surface water, sediment, and soil cleanup levels will protect human and environmental receptors.
- Short-term and long-term institutional controls and access restrictions will limit human exposure to groundwater, surface water, sediments, and subsistence foods affected by these media pending achievement of cleanup levels.

Many of these requirements are incorporated into the design and specifications of the Remedial Action (RA) and do not require permits or consultation with agencies. These regulatory requirements have been organized in a similar manner as the ROD and are followed by other regulatory requirements that are to be considered.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Clean Water Act							
1	Federal Regulatory Requirement	Surface Water	Clean Water Act Section 304 – Federal Ambient Water Quality (National Recommended Water Quality Criteria, November 2002, and 67 Federal Register 79091-79095, December 27, 2002).	Section 304 of the Clean Water Act requires the EPA to develop, publish, and revise criteria for water quality accurately reflecting the latest scientific knowledge on all identifiable effects on health and welfare. The Midnite Mine (MM) Record of Decision (ROD) established cleanup levels for surface water (see BODR Table 4-3). The ROD acknowledges that contaminants of concern (COCs) in surface water are expected to exceed background and cleanup levels during, and for a period of time following the RA as natural flushing of water that previously contacted mine wastes occurs.	Throughout the Remedial Action (RA), all mine-impacted surface water within the Mined Area (MA) will be captured and treated at the operating WTP. As the RA progresses, surface water from areas that have been remediated will be allowed to drain to the natural drainages down gradient of the MA. The process for containing the mine-impacted water is described in BODR Appendix E – Water Management Ponds and Appendix F – Surface Water and Sediment Controls. Additional information regarding draining surface water from the remediated areas is presented in the technical memorandum titled *Midnite Mine – Management of Stormwater Runoff from Remediated Areas – Revision 1* (WME, 2013a), which is included as Attachment O-1 to the SWMP.	Compliance with the requirements of the CWA will be accomplished through routine OM&M inspections of the water management systems, and by site-wide monitoring of surface water down gradient of the MA during and following RA construction. The OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q.	NA
2	Federal Regulatory Requirement	Surface Water	Federal Water Pollution Control Act—National Pollution Discharge Elimination System (NPDES; Clean Water Act; 33 U.S.C. §1342, Section 402) and Implementing Regulations.	The NPDES program requires that permits be obtained for Part 440 point-source discharges of pollutants to surface water. **WTP** - A NPDES permit has been in place for the existing WTP since 1986. Permits are not required for any discharges that are onsite. The ROD requires a modified NPDES permit for the new WTP that will be constructed during the RA. **Stormwater Discharge** - The ROD requires compliance with the requirement of the general stormwater permit program for stormwater discharges associated with the RA. The discharge of stormwater from off-site areas such as the Rhoads Borrow Area requires a stormwater NPDES permit to ensure that any stormwater leaving the site meets surface water quality requirements.	**WTP -** An application for a modified NPDES permit for the new WTP (which will discharge to Lake Roosevelt) is under review by EPA. **Stormwater Discharge -** Stormwater will be managed in accordance with the Stormwater Management Plan (SWMP; located in BODR Appendix O), which has been prepared to comply with the *Stormwater Management Manual for Eastern Washington* (SMMEW; Washington Department of Ecology [WDOE], 2004). At least 14 days prior to the commencement of earthmoving activity at the Rhoads Borrow Area, a Notice of Intent will be submitted for a Construction General Permit (CGP) under the EPA's Stormwater NPDES Program, Permit No WAR12000I.	**WTP -** NPDES permit compliance will be accomplished through regular sampling of the WTP effluent and associated reporting in accordance with the existing permit requirements. **Stormwater Discharge –** Compliance with requirements will be demonstrated through regular inspections and monitoring as described in the SWMP to confirm that the stormwater controls are adequate and that the Best Management Practices (BMPs) are functioning as designed, or to determine if additional BMPs are necessary. Permit compliance with the CGP at the Rhoads Borrow Area will be accomplished through implementing the conditions of the permit and regular monitoring as described in the SWMP.	A modified NPDES permit application was submitted to the EPA on March 21, 2013 for the discharge of effluent from the new WTP. Additional studies will occur in summer 2015 to better understand additional polishing requirements for aluminum and arsenic. Discharge from the existing WTP will comply with the existing NPDES Permit No. WA-002572-1, effective October 30, 1995 until a modified permit becomes effective.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
3	Federal Regulatory Requirement	Wetlands	Clean Water Act, Section 404 – Dredge or Fill Requirements Regulations, 33 CFR Parts 320–330; 40 CFR Part 230. Protection of Wetlands, Executive Order 11990 (40 CFR Part 6, Appendix A). This executive order mandates that If RAs take place in wetlands, such as in certain areas along the Blue Creek and East Drainage riparian areas, these requirements will be applicable.	The Army Corps of Engineers implements the Section 404 permit program which provides guidelines for the identification of wetlands and implements protective requirements for actions involving wetlands. Executive Order 11990 requires that response actions taken by federal agencies must be designed to avoid long and short-term impacts to wetlands. If remediation activities are located near/in wetlands, the remediation activities must be designed to avoid adverse impact to the wetlands wherever possible, including minimizing wetlands destruction and preserving wetland values. A wetland delineation has been conducted throughout the project area and has identified jurisdictional wetlands in Blue Creek, Eastern Drainage, Central Drainage, Western Drainage, and Northern Drainage (Attachment M-1). Wetland impacts will likely occur in the Eastern, Central, Western, and Northern Drainages as part of the required drainage and haul road clean-up. Actual impacts will not be known until the design and construction has advanced to determine the type of equipment, equipment access and the disturbance required for clean-up. Access by construction equipment will be designed to avoid and minimize impacts to wetlands to the maximum extent practical. Diversion or collection of surface and ground water will reduce the amount of water available to support wetlands. Fill would also be placed in non-wetland waters of the U.S. in Lake Roosevelt; however, impacts would be negligible on the unvegetated lake bottom. All impacts to jurisdictional wetlands and waters of the U.S. will occur on-site and no permits are required.	Jurisdictional wetlands and non-wetland waters of the U.S. have been identified in the Wetland Delineation (WME 2015a). Impacts to wetlands will be avoided and minimize to the extent practical. Unavoidable impacts to wetlands will be mitigated consistent with EPA's interagency Wetland Mitigation Guidelines in Washington State. Discussions with EPA regarding stream mitigation requirements are ongoing. Prepare and implement a Compensatory Mitigation Plan consistent with Section 404(b)(1) requirements. Regrade drainage to a natural stable state using existing instream material; install BMPs; revegetate impacted areas with native wetland, riparian and upland species; maintain and monitor restoration until performance standards are achieved, as described in the Conceptual Wetland and Stream Mitigation Approach. A more comprehensive mitigation plan will be submitted following EPA's review and further discussions including the "Water Budget Workshop". If wetland restoration on-site is not successful, alternative off-site locations within the Spokane Indian Reservation will be identified and pursued, or the purchase into the Meadowcroft Wetland Mitigation Bank.	Compliance with the requirements of Section 404 of the CWA and E.O. 11990 will be accomplished by documenting unavoidable impacts to jurisdictional wetlands and waters of the U.S. associated with the drainage cleanup. Unavoidable impacts to wetlands will be mitigated consistent with EPA's interagency Wetland Mitigation Guidance. A Conceptual Wetland and Stream Mitigation Approach (WME 2015b) was submitted to EPA on 3/16/2015 and is under review. Wetlands Restoration will be monitored annually by a Restoration Scientist until established and the performance standards are achieved. The results will be included in an annual monitoring report as described in the Site-Wide Monitoring Plan is included in BODR Appendix Q.	The latest version of the Wetland Delineation (WME 2015a) was updated and submitted to EPA on 5/8/2015 following an EPA site visit and the Conceptual Wetland and Stream Restoration Approach (WME 2015b) was submitted on 3/16/2015. The two reports responded to EPA's request for additional information including estimated impacts based on the latest design iteration and identification of potential mitigation opportunities. EPA's review of these documents is ongoing.
4	Federal Regulatory Requirement	Water	Rivers and Harbors Act (33 USC §403).	Section 10 of the Harbor and Rivers Act requires that any obstruction or alteration of any navigable water of the U.S. be permitted by the U.S. Army Corps of Engineers. Lake Roosevelt is classified as a navigable water of the U.S.	The construction of the Blue Creek Pipeline is considered to be on-site under CERCLA and no permits are required. However, DMC will consult with the U.S. of Army Corps of Engineers on the design and construction of the pipeline in Lake Roosevelt once the design progresses further. The pipeline design has been delayed pending resolution of NPDES permitting requirements	Compliance with the requirements of the Harbors and River Act will be accomplished by documenting coordination with U.S. Army Corps of Engineers.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
5	Federal Regulatory Requirement	Water	Section 401 – Water Quality Certification (33 USC §1341).	Section 401 of the Water Quality Certification Program requires states (or authorized tribes) to certify federally permitted discharge into waters of the U.S. to protect state water quality standards. The Spokane Tribe is an authorized certification authority under "Treatment As a State" (TAS) designation. The 401 certification process ensures that the Spokane Tribe's 2010 Surface Water Quality Standards are being met for federal Clean Water Act permitted projects on lands within the Reservation. The 401 Water Quality Certification Program is applicable for activities that require a CWA permit. However, on December 19, 2013, the EPA disapproved the Tribe's 2010 proposed Water Quality Standards, specifically the proposed mercury and thallium standards. It is unclear what the final standards for these constituents will be.	A 401 Water Quality Certification for the point source NPDES permit in Lake Roosevelt and the Rhoads Borrow Area stormwater NPDES will be applied for from the Spokane Tribe Water Control Board through the Tribe's Department of Natural Resources (DNR) in accordance with Tribal Resolution 30-2.04. The 401 Water Quality Certification application requires the demonstration that discharge from the WTP into Lake Roosevelt and stormwater discharge at the Rhoads property meet the Tribe's surface water quality standards.	Compliance with permits will be accomplished through implementing the conditions of the NPDES permit and 401 Certification and regular monitoring as described in the SWMP and OM&M Plan, Appendix P.	Brian Crossley of Spokane Tribe DNR was consulted regarding the 401 requirements on 9/5/2013. 401 Certifications will be requested pending resolution of NPDES permitting requirements.
6	Tribal Resolution	Surface Water	Spokane Tribe of Indians Surface Water Quality Standards Resolution 2003-259, March 7, 2003.	This resolution establishes surface water quality standards for protection of human health and aquatic life for surface waters on tribal lands. These standards are applicable to surface water at the Site. EPA approved the Tribe's standards on April 22, 2003, in accordance with the CWA "Treatment As a State" (TAS) procedures. In addition, EPA has stated in the preamble to the NPC (55 Federal Register 8741, March 8, 1990) that it is appropriate to treat Indian tribes as states for the purpose of identifying ARARs under Section 121(d)(2) of CERCLA. Further, EPA has determined that the Tribe's water quality standards are appropriate standards to be considered in establishing cleanup levels. On December 19, 2013, the EPA disapproved the Tribe's 2010 proposed Water Quality Standards, specifically the proposed mercury and thallium standards. It is unclear what the final standards for these constituents will be. The Midnite Mine (MM) Record of Decision (ROD) established cleanup levels for surface water (see BODR Table 4-3). The ROD acknowledges that contaminants of concern (COCs) in surface water are expected to exceed background and cleanup levels during, and for a period of time following the RA as natural flushing of water from previously contacted mine wastes occurs.	Throughout the Remedial Action (RA), all mine-impacted surface water within the Mined Area (MA) will be captured and treated at the operating WTP. As the RA progresses, surface water in the remediated areas will be allowed to drain from cover soils to the natural drainages down gradient of the MA. The process for containing the mine-impacted water is described in BODR Appendix E – Water Management Ponds and Appendix F – Surface Water and Sediment Controls. Additional information regarding draining clean water from the remediated areas is presented in the technical memorandum titled *Midnite Mine – Management of Stormwater Runoff from Remediated Areas – Revision 1* (WME, 2013a), which is included as Attachment O-1 to the SWMP.	Compliance with the requirements of the CWA will be accomplished through routine OM&M inspections of the water management systems, and by site-wide monitoring of surface water down gradient of the MA during and following RA construction. The OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Safe Drinking Water Act							
7	Federal Regulatory Requirement	Public Drinking Water	National Primary Drinking Water Regulations (40 CFR Part 141) listed under the Safe Drinking Water Act (SDWA).	These regulations protect the quality of public drinking water supplies through regulation of chemical parameters and constituent concentrations as maximum contaminant levels (MCLs). The MCLs are relevant and appropriate for human health COCs in groundwater outside waste management areas. For purposes of this ARAR, the waste management areas include WCA, all adjacent areas, and the oxidized zones adjacent to the former pit wall. Groundwater within these areas is not required to meet these standards. The MCLs are also relevant and appropriate for human health COCs in surface water at the Site. For surface water and groundwater outside the waste management areas, an exception is made for COCs which background is higher than the MCL. For such COCs, the MCL is relevant but not appropriate. The MM ROD established cleanup levels for groundwater (see BODR Table 4-4). The ROD acknowledges that contaminants of concern (COCs) in groundwater are expected to exceed background and cleanup levels during and for a period of time following the RA as natural flushing of water from previously contacted mine wastes occurs.	The RA will include consolidating the mine wastes into WCA. Water that accumulates in the WCA will be hydraulically isolated by pumping, and the pumped water will be treated at the operating WTP. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. Groundwater down gradient from the WCAs will be monitored to demonstrate compliance with the groundwater cleanup levels as described in BODR Appendix Q – Site Wide Monitoring Plan (SMP). Institutional controls as developed in the Midnite Superfund Site, Institutional Control Implementation and Assurance Plan, Revision 1 (ICIAP) (MWH 2014) will control access to areas with unacceptable water quality.	Monitoring will be conducted to determine when and where compliance with the requirements of the SDWA will be accomplished as the Remedy takes effect. The Site-Wide Monitoring Plan is included in BODR Appendix Q. The ICIAP (MWH 2014) will provide institutional controls as needed and will be modified as areas meet standards. There will likely be areas where the groundwater will never meet SDWA requirements either due to background or RA conditions and institutional controls will be required in perpetuity in these areas.	NA
Health and Environmental Protection Standards							
8	Federal Regulatory Requirement	Groundwater	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR Part 192, Subpart A – Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites, Table 1: Maximum Concentrations of Constituents for Groundwater Protection.	These standards were developed under the Uranium Mill Tailings Radiation Control Act (UMTRCA) and are relevant and appropriate to groundwater at the Site. UMTRCA allows the use of background levels where background levels exceed the listed standards, as is the case for U-234 and U-238. The MM ROD established cleanup levels for U-234 and U-238 in groundwater (see BODR Table 4-4). The ROD acknowledges that contaminants of concern (COCs) in groundwater are expected to exceed background and cleanup levels during, and for a period of time following the RA as natural flushing of water that previously contacted mine wastes occurs.	The RA will include consolidating the mine wastes into a WCA. Water that accumulates in the WCA will be pumped to the operating WTP and treated. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. As the RA progresses, surface water in the remediated areas will be allowed to drain from cover soils to the natural drainages down gradient of the MA.	Compliance with the groundwater cleanup levels prescribed in the ROD will be accomplished via O&M of the WCA cover systems and dewatering wells; and by site-wide monitoring of groundwater down gradient of the WCAs. The OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q. The ICIAP (MWH, 2014) will provide institutional controls as needed.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
9	Federal Regulatory Requirement	Surface Material and Mine Waste	Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR Part 192, Subpart B – Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials.	These standards were developed under UMTRCA to govern the stabilization, disposal, and control of uranium and thorium mill tailings on land and buildings that are part of a uranium or thorium processing site. Portions of the regulations are relevant and appropriate to remedial actions at the Site. The 40 CFR Part 192 Subpart B standards require that remedial actions at designated processing sites be conducted in such a manner to provide assurance that residual radioactive materials are controlled as follows: Concentrations of radium-226 in land averaged over 100 square meters shall not exceed background by more than: • 5 pCi/g averaged over first 15 cm of soil below surface, and • 15 pCi/g averaged over 15 cm thick layers of soil more than 15 cm below surface. The UMTRCA soil standards above are relevant and appropriate to surface soils within and outside the WCA. 40 CFR Part 192 Subpart E states that the 5 pCi/g and 15 pCi/g standards are suitable for remediation of radium-228 at certain sites. When used in this manner, the standards apply to the combined level of radium-226 and radium-228 contamination. The standards also apply to the combined level of thorium-230 and thorium-232 contamination, parent isotopes of radium-226 and radium-228. The MM ROD established cleanup levels for surface material and sediments (see BODR Table 4-1 and 4-2). The ROD acknowledges that contaminants of concern (COCs) in surface material and sediment are expected to exceed background.	The RA will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the cleanup standards in the WCAs. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR. These values are based on background levels. The UMTRCA standards are values above background. By cleaning up to background levels in soil and sediment, concentrations will be less than allowable by the UMTRCA limits.	Compliance with the requirements of the cleanup standards will be accomplished via verification sampling of the remediated areas and OM&M of the WCA cover systems. The Verification Plan is included in BODR Appendix S and the OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Hazardous Substances Control							
10	Spokane Tribal Council Resolution	Hazardous Substances	Spokane Tribe of Indians (STOI) Hazardous Substances Control Act (HSCA, Resolution 2004-085, December 22, 2003).	The Tribe has established cleanup standards that are applicable to groundwater, surface water, and soil/sediment on the reservation. EPA has stated in the preamble to the NCP (55 Federal Register 8741, March 8, 1990) that it is appropriate to treat Indian tribes as states for the purpose of identifying ARARs under Section 121(d)(2) of CERCLA. The Tribe's implementation of these cleanup standards on its reservation is similar to a state's implementation of its state standards within such state. Since this cleanup is within the Spokane Reservation, STOI HSCA, instead of state law, is applicable. Further, EPA has determined that HSCA is an appropriate regulatory requirement to be considered in establishing cleanup levels for this Site. The HSCA also set forth siting parameters of new permanent and temporary disposal facilities for hazardous substances.	The RA will include consolidating, hydraulically isolating, and covering the mine wastes. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR and are based on background conditions. No hazardous waste (i.e., WTP residuals, construction/maintenance materials) will be disposed of on-site.	Compliance with the requirements of the cleanup standards will be accomplished via verification sampling of the remediated areas and OM&M of the WCA cover systems. The Verification Plan is included in BODR Appendix S and the OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q.	NA
11	Federal Regulatory Requirement	Hazardous Substances	National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Uranium Mill Tailings Disposal Sites (40 CFR Part 61, Subpart T).	These standards, also found at 40 CFR Part 192, Subpart A, limit radon-222 flux emissions to ambient air from inactive uranium mill tailings piles to 20 pCi/m^2/sec. Under 40 CFR Part 192, Subpart A, the standard is an average applied over the entire disposal site surface for a period of at least one-year period. It applies only to emissions from residual radioactive materials to the atmosphere (i.e., it is in addition to the radon flux that originates in the cover material). These standards are relevant and appropriate in WCAs under the Selected Remedy for the Site.	The RA will consolidate the mine waste into the WCAs and radon flux will be contained by the cover system, presented in the Mine Waste Excavation and Containment included in Appendix D of the BODR. The cover system will consist of a synthetic Polyvinyl Chloride (PVC) geomembrane overlain by a soil cover. The soil cover was designed to limit radon flux to the standard of 20 pCi/m^2/sec assuming the geomembrane layer was not present.	Radon flux shall be measured using standard NRC techniques presented in 40 CFR Part 61, Appendix B, Method 115 to ensure that the average radon flux from the cover is less than 20 pCi/m^2/sec. as required in Appendix Q of the BODR.	NA
12	Federal Regulatory Requirement	Hazardous Substances	Resource Conservation and Recovery Act Subtitle D Regulations, Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR Part 257, Subpart A.	These regulations are primarily siting requirements that limit the disposal of solid waste in certain locations such as floodplains or will not contribute to the taking of threatened or endangered species. The Selected Remedy does not include disposal or short term management of water treatment residuals or other solid wastes at the types locations described in the regulations.	Water treatment residuals will be disposed of off-site at a licensed facility in accordance with the Residuals Management Plan for the Midnite Mine Water Treatment Plant (the RMP) submitted to EPA on November 1, 2013 (WME, 2013b).	Compliance with the requirements of Subtitle D of RCRA will be accomplished by off-site disposal of the WTP residuals as described in the RMP.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
13	Federal Regulatory Requirement	Hazardous Substances	Licensing Requirements for Land Disposal of Radioactive Waste (40 CFR Part 61).	These regulations contain performance objectives and technical requirements for Nuclear Regulatory Commission (NRC) licensing of land disposal of radioactive wastes containing by-product, source, and special nuclear material received from other persons. These regulations are relevant and appropriate to short-term on-site management of water treatment residuals. Subpart C of the regulations provides the following performance objectives for radioactive waste disposal facilities: • Protection of the general population from releases of radioactivity (an annual dose not to exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ). • Protection of individuals from inadvertent intrusion. • Protection of individuals during operation. • Stability of the disposal site after closure. Subpart D provides technical requirements for near-surface disposal facilities, including disposal site suitability requirements, disposal site design, disposal site operation and closure, and environmental monitoring.	Water treatment residuals will continue to be disposed of off-site at a licensed facility in accordance with the Residuals Management Plan for the Midnite Mine Water Treatment Plant (the RMP) submitted to EPA on November 1, 2013 (WME, 2013b) consistent with the technical requirements of the ROD (EPA 2006). No onsite storage of residuals except as necessary to accumulate residuals for transportation. A fence with appropriate signage has been established at the perimeter of the site's restricted area and to prevent inadvertent intrusion. Individuals will be protected from exposure during construction remedy and following completion of the remedy through proper training and implementation of the Health and Safety Plan for the Phase IRD/RA: Interim Water Management for the Midnite Mine (Tetra Tech, 2009) (WTP Health and Safety Plan).	Compliance with the requirements of the NRC regulations will be accomplished through disposal of the WTP residuals in compliance with the Residuals Management plan, routine OM&M of the security fence, restricting access, and implementation of the WTP Health and Safety Plan.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Wildlife Acts							
14	Federal Regulatory Requirement	Wildlife	Endangered Species Act (ESA) Regulations, 50 CFR Parts 17, 402.	The ESA and implementing regulations make it unlawful to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any federally designated threatened or endangered species and/or its habitat. The requirements of the ESA and implementing regulations are applicable to remedial actions that could affect federally designated threatened or endangered species that may be present within the Midnite Mine Site area.	A Biological Assessment (BA) was prepared to analyze the effects of the RA on federally listed threatened and endangered species. Bull trout is the only listed species with the potential to occur within the RA area; however, no spawning habitat occurs in Lake Roosevelt. BMPs will be implemented to control turbidity from stormwater runoff as described in the SWMP, located in BODR Appendix O. The BA is attached to Appendix M of the BODR.	Compliance with the requirements of the ESA will be accomplished by installing BMPS (e.g., silt fence) for work in the dry lakebed. The Project Engineer will perform regular inspections and monitoring during the construction period as described in the SWMP to confirm that the stormwater controls are adequate and that the BMPs are functioning as designed, or to determine if additional BMPs are necessary.	Michelle Ames and Julie Campbell of U.S. Fish and Wildlife Service were contacted on 7/15/2013 and confirmed that the project is outside the currently known grizzly bear and Canada lynx range, and the presence of Utes ladies' tresses orchid. Isolated occurrences of bull trout have been recorded in Lake Roosevelt; however, no known spawning habitat occurs at the lake and that individual bull trout recorded in the lake are likely wash-over from Lake Coeur d'Alene. Other wildlife agencies were coordinated with, in accordance with the Fish and Wildlife Coordination Act describe below. EPA submitted the BA to USFWS on 9/29/2014.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
15	Federal Regulatory Requirement	Wildlife	Fish and Wildlife Coordination Act (16 USC 661 *et seq.*)	This statute requires federal agencies to consider the effect projects may have on fish and wildlife and to mitigate loss or damage to these resources. This statute is applicable to the Selected Remedy.	Consult State, federal, and tribal wildlife agencies in the development of the BA.	Compliance with the requirements of the Fish and Wildlife Coordination Act will be accomplished by consulting with state, federal, and tribal wildlife agencies in the preparation of the BA (attached). Results of the agency coordination are described in the BA.	Justin Yeager of U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NMFS) was contacted on 7/15/2013 and NMFS does not have jurisdiction above Chief Joseph Dam. Lori Guggenmos of Washington Department of Fish and Wildlife, Washington Natural Heritage Program was contacted on 4/23/2013 and GIS data shows Blue Creek being bull trout habitat. A follow up correspondence with Lori, and regional biologist Bill Baker determined this record was likely established at a mapping event and is not likely an actual record that needs to be considered. No other records of T&E species are in the area. EPA submitted the BA to USFWS on 9/29/2014.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
15, Cont.	Federal Regulatory Requirement	Wildlife	Fish and Wildlife Coordination Act (16 USC 661 *et seq.*)	This statute requires federal agencies to consider the effect projects may have on fish and wildlife and to mitigate loss or damage to these resources. This statute is applicable to the Selected Remedy.	Consult State, federal, and tribal wildlife agencies in the development of the BA.	Compliance with the requirements of the Fish and Wildlife Coordination Act will be accomplished by consulting with state, federal, and tribal wildlife agencies in the preparation of the BA (attached). Results of the agency coordination are described in the BA.	Jasa Holt of WA Natural Heritage Program was contacted on 5/6/2013 and no T&E plants are in the project area. Brian Crossley of the Spokane Tribe DNR was contacted on 4/23/2013 and Casey Flanagan of the Spokane Tribe DNR responded that there are no records of endangered Fish in and around the project area. He provided all the studies published to date. Brent Nichols of Spokane Tribe Department of Natural Resources was contacted on 1/21/2013 and said he does not have any records of bull trout in the area and provided a web links to the Columbia Basin Fish and Wildlife Program to review reports. Katie Easton of Spokane Tribe DNR was contacted on 4/23/2013 and said there are no records of T&E wildlife species on the Reservation.
16	Federal Regulatory Requirement	Wildlife	Migratory Bird Treaty Act (MBTA) (16 USC 703 - 712).	The MBTA makes it unlawful to pursue, capture, hunt, or take actions adversely affecting a broad range of migratory birds. The MBTA and its implementing regulations are applicable to remedial activities that could affect any protected migratory birds. The Selected Remedy will be carried out in a manner that avoids "taking" or killing of protected migratory bird species, including individual birds or their nests.	The RA will be carried out, in a manner that avoids the "taking" or killing of protected migratory bird species, including individual birds or their nests or eggs. Measures to protect these bird species include: • Clear land and vegetation outside of the bird nesting season (March to July). • Wildlife biologists will conduct preconstruction bird nesting surveys if clearing is required during the nesting season. • If active nests are identified within or adjacent to the active construction area, USFWS and WA DFW will be consulted to avoid "taking".	Compliance with the requirements of the MBTA will be accomplished by documenting timing of clearing activities and documenting survey results if necessary. The USFWS and WA DFW will be consulted, if active nests are discovered in or adjacent to the active construction area.	Contact WA DFW and USFWS as necessary.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Floodplains							
17	Federal Regulatory Requirement	Floodplain	Protection of Floodplains, Executive Order 11988 (40 CFR Part 6, Appendix A).	This executive order mandates that response actions taken by federal agencies must be designed to avoid adverse impacts to floodplains. Specifically, if remediation activities are located within a 100-year floodplain, the activities must be designed to avoid adversely impacting floodplains wherever possible. If remedial activities take place in a floodplain, such as within the Blue Creek floodplain, these requirements will be applicable.	The RA has been designed to minimize and avoid adverse impacts to the Blue Creek floodplain. Impacts to floodplains are negligible and will consist of placement of the WTP outfall pipeline and diffuser.	Compliance with the requirements of the E.O. 11988 will be accomplished by temporarily placing the pipeline on the lake bottom until extreme low water conditions allow for the burying of the pipe during dry conditions.	NA
Cultural Resources							
19	Federal Regulatory Requirement	Cultural Resources	Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. §3001 *et seq.* 43 CFR Part 10.	NAGPRA regulations protect Native American graves from desecration through the removal and trafficking of human remains and "cultural items" including funerary and sacred objects. To protect Native American burials and cultural items, the regulations require that if such items are inadvertently discovered during excavation, the excavation must cease and the affiliated tribes must be notified and consulted. This program is applicable to ground disturbing activities such as soil grading and removal.	The RA will protect Native American grave sites and funerary and sacred objects. A Ground Disturbance Permit application was submitted to the Spokane Tribe's Tribal Historic Preservation Officer (THPO). The Spokane Tribe Archaeology & Preservation Office (Preservation Office) will conduct cultural resource surveys to identify the potential for cultural resources prior to construction. A cultural resource monitor will also be present during construction in areas with the potential for cultural resources. If any grave sites or funerary objects are identified, construction work will stop immediately and the THPO will be consulted to determine recovery and preservation options.	Compliance with the requirements of the NAGPRA will be accomplished through pre-construction surveys and subsurface testing and the use of cultural resources monitors during construction activities to identify any potentially eligible grave sites. The THPO will be consulted if graves or funerary objects are identified. The Preservation Office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.	The THPO, Randy Abrahamson, was initially consulted through the submittal of the Ground Disturbance Permit Application on 9/12/2013. He recommended pre-construction field surveys and monitoring. James Harrison and Jackie Corley of the Preservation Office were contracted to conduct a literature search, interviews of previous mine employees, field surveys, monitoring, historical research, in 2014/2015. The report summarizing the survey results is expected to be completed in the fall of 2015.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
20	Federal Regulatory Requirement	Cultural Resources	American Indian Religious Freedom Act, 42 U.S.C. §1996 *et seq.*	This program is applicable to ground-disturbing activities such as soil grading and excavation at the Midnite Mine Site. It protects religious, ceremonial, and burial sites and the free practice of religions by Native American groups. If sacred sites are discovered in the course of soil disturbances, work will be stopped and the Spokane Tribe will be contacted.	The RA will protect religious, ceremonial, and burial sites and the free practice of religion by Native American Groups. Prior to site disturbances, the Preservation Office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary. If any religious, ceremonial, or burial sites are identified inside the project boundary, THPO will be consulted to explore alternatives and determine mitigation, if necessary.	Compliance with the requirements of the American Indian Religious Freedom Act will be accomplished through preconstruction interviews and field surveys and through cultural resources monitors during construction activities to ensure that the THPO is consulted if any eligible sites are found. The Preservation Office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.	The THPO, Randy Abrahamson, was initially consulted through the submittal of the Ground Disturbance Permit Application on 9/12/2013. Per the THPO's recommendation, James Harrison and Jackie Corley of the Preservation Office was contracted to conduct literature search, interviews of previous mine employees, cultural field surveys, historical research, monitoring, and consultation with the THPO if necessary. The field surveys were conducted in 2014 and 2015 and the final report summarizing the results of these tasks are expected in fall of 2015.
21	Federal Regulatory Requirement	Cultural Resources	National Historic Preservation Act (NHPA) Regulations, 36 CFR Parts 60, 63, and 800.	NHPA regulations require agencies to consider the possible effects on historic sites or structures by actions proposed for federal funding or approval and are applicable to remedial actions at Midnite Mine. Historic sites or structures are those included on or eligible for the National Register of Historic Places, generally older than 50 years. If an agency finds a potentially adverse effect on historic sites or structures, such agency must evaluate alternatives to "avoid, minimize, or mitigate" the impact, in consultation with the Tribal Historic Preservation Officer (THPO). The NHPA and implementing regulations are applicable to selected remedial activities such as building demolition or excavation activities which could disturb historical sites or structures.	The RA will protect or mitigate impacts to listed sites or sites eligible for listing on the National Register of Historic Places. The Preservation Office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, to determine if any listed or eligible sites are present within the RA area. If listed or eligible sites are found, the Preservation Office will comply with Section 106 of the NHPA and consultation with the THPO and other agencies will be initiated to evaluate alternatives, minimize impacts, and determine mitigation, if necessary.	Compliance with the requirements of the NHPA will be accomplished through identifying eligible sites, through field surveys and monitoring construction to ensure that the THPO is consulted if any eligible sites are found. The Preservation Office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.	The THPO, Randy Abrahamson, was initially consulted through the submittal of the Ground Disturbance Permit Application on 9/12/2013. Per the THPO's recommendation, James Harrison and Jackie Corley of the Preservation Office was contracted to conduct literature search, interviews of previous mine employees, cultural field surveys, historical research, monitoring, and consultation with the THPO if necessary. The field surveys were conducted in 2014 and 2015 and the final report summarizing the results of these tasks are expected in fall of 2015.

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Soil Cleanup							
22	Federal Regulatory Requirement	Surface Material and Sediment	Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (August 2, 1997).	This directive presents clarifying guidance for establishing cleanup levels protective of human health for radioactive contamination at CERCLA sites. The cleanup levels are expressed as a risk, exposure, or dose level and not as a soil concentration level. The directive clarifies that the appropriate risk range for radionuclides, which are all carcinogens, is 10-4 to 10-6 (some NRC regulations do not achieve this range and are therefore not sufficiently protective). The directive further states that cancer risk at a site from both radiological and non-radiological contaminants should be summed, and CERCLA decision documents should provide an estimate of the combined risk to individuals presented by all carcinogenic contaminants. Attachment A to this directive lists potential federal radiation ARARs and indicates whether the ARARs are likely to be applicable or to be relevant and appropriate. Attachment B indicates that EPA has consistently concluded that levels of less than or equal to 15 mrem/yr effective dose equivalent above background (corresponding to an excess lifetime cancer risk of approximately 3 x 10-4) are protective and achievable. The MM ROD established cleanup levels for surface material and sediments (see BODR Table 4-1 and 4-2). These values are based on background concentrations.	The RA will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the cleanup standards in the WCAs. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR. These values are based on background levels.	Compliance with the cleanup levels will be accomplished via verification sampling of the remediated areas and OM&M of the WCA cover systems. The Verification Plan is included in BODR Appendix S and the OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q.	NA
23	Federal Regulatory Requirement	Surface Material and Sediment	Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-25, Use of Soil Cleanup Criteria in 40 CFR Part 192 as Remediation Goals for CERCLA Sites (February 2, 1998).	This directive addresses the use of soil cleanup criteria in 40 CFR Part 192 when setting remediation goals for subsurface soil. The guidance clarifies the extent to which 40 CFR Part 192, Subpart A standards are potentially relevant and appropriate. The MM ROD established cleanup levels for surface material and sediments (see BODR Table 4-1 and 4-2), which are based on background concentrations. Setting these clean up criteria is consistent with this Directive.	The RA will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the cleanup standards in the WCAs. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR. These values are based on background levels.	Compliance with the cleanup levels will be accomplished via verification sampling of the remediated areas and OM&M of the WCA cover systems. The Verification Plan is included in BODR Appendix S and the OM&M Plan is included in BODR Appendix P, and the Site-Wide Monitoring Plan is included in BODR Appendix Q	NA

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No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
Other Requirements							
24	Federal Regulatory Requirement	Water Resources	Spill Prevention, Counter-Measures, and Control Rules, 40 CFR, Part 112.	EPA requires certain facilities to prepare and implement Spill Prevention, Counter- measures, and Control (SPCC) Plans to prevent oil discharges into navigable waters and adjoining shorelines. The SPCC rule is part of the Oil Pollution Prevention regulations at 33 CFR part 112, listed under Section 311 of the Federal Water Pollution Control Act, or Clean Water Act (CWA).	The existing site SPCC Plan will be reviewed and updated in accordance with good engineering practices and be certified by a Professional engineer. The updated SPCC Plan will include: • Facility diagram and facility description • Oil discharge prediction • Secondary containment and diversion structures • Facility drainage • Bulk storage requirements - inspection, overfill and integrity • Transfer procedures and equipment • Qualified oil-filled operational equipment • Brittle fracture evaluation for above ground field containers • Personnel training and prevention briefings • Recordkeeping • Five year Plan review • Management approval • Plan certification Spill kits will be easily accessible to contain and minimize spills.	Compliance with the requirements of the SPCC will be accomplished through implementation of the SPCC and documented as described in the OM&M Plan in Appendix P.	NA

Table M-4. Summary of Regulatory Requirements

No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
25	Federal Regulatory Requirement	Air Resources	Clean Air Act, 42 USC §7401 *et seq.*	The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Under the CAA, the EPA has established air quality standards to protect public health and public welfare as well as protecting against decreased visibility and regulating emissions of hazardous air pollutants. Implementation of the CAA standards within the exterior boundaries of the Spokane Reservation are covered under the Federal Air Rules for Reservations (FARR) (40 CFR Parts 9 and 49). The applicability of the Prevention of Significant Deterioration (PSD) Program's New Source Review (NSR) permitting requirements is based on whether a facility is a major emitting facility that exceeds the NSR Major Source Threshold. NSR Major Sources in Attainment Areas are stationary sources that have a Potential to Emit (PTE), either 100 tons per year (TPY) of "any air pollutant" from one of 28 listed source categories or 250 TPY for other source categories. The Remedial Action does not fall in any of the 28 listed source categories. A facility that is a NSR Major Stationary Source must also analyze whether the source's emissions may affect visibility in a Class I area. See 40 CFR § 52.21(p). EPA policy interprets "may affect" to include all major sources within 100 km of a Class I area. The visibility analysis must be assessed by the appropriate Federal Land Manager to determine whether the source would have an adverse impact on visibility. A facility that is a Minor Source PSD - a source that does not meet the definition of a NSR Major Stationary Source - is not required to analyze its effect on visibility in a Class I area, unless the Minor Source undergoes a modification that would increase emissions above a "Major Source" threshold.	Within 90 days after beginning operations, the facility will register with the EPA under FARR requirements, and annually thereafter by February 15 of each year (40 CFR Part 49, Section 138). However, EPA considers this an administrative requirement and registering with FARR would be strictly voluntary (EPA May 30, 2014 comment on 2013 plan). Facility shall maintain adequate records to demonstrate that actual emission remain below 50 percent of the PTE thresholds for Major Source status for purposes of Title V. If necessary, prevent emissions from stationary sources from exceeding 100 TPY of NO_x by limiting run-time for certain equipment, installing non-resettable runtime meters on the engines and calculating emissions on a rolling 12-month basis. Implement BMPs to control fugitive PM as described in the Surface Water and Sediment Controls Plan in Appendix F and the OM&M in Appendix P. Monitor visible emissions in accordance with EPA Method 9 and fugitive PM emissions with EPA Method 22 within 30 days of start of the operation and on an annual basis thereafter, during typical operating and weather conditions (40 CFR Part 49.124 and 49.126).The date, time, and results of the survey will be documented. If visible emissions from stationary sources exceed 20 percent opacity requirement, an action plan will be prepared to identified sources and actions to prevent exceedance. If fugitive PM emission is identified, measures will be taken to minimize fugitive emission. Comply with the applicable requirements as follows: • 40 CFR §60.4200 *et seq.* for stationary compression ignition internal combustion engines, • 40 CFR §63.6580 *et seq.* for stationary reciprocating internal combustion engines,	Compliance with CAA will be accomplished through tracking stationary engine runtime and monitoring of visible emission and fugitive PM to ensure established thresholds are not exceeded.	The Air Quality Management Plan was submitted to EPA for review on 12/2/2014. The AQMP includes the submittal of the PTE calculations which EPA determined to be a minor source.

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No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
25, Cont.	Federal Regulatory Requirement	Air Resources	Clean Air Act, 42 USC §7401 *et seq.*	Title V Major Source Thresholds are 100 TPY for any pollutant in Attainment Areas; 10 TPY or more of any individual Hazardous Air Pollutant (HAPs) (section 112(b) of the CAA) or 25 TPY or more for all HAPs emitted; or Greenhouse Gases (GHG) of at least 100,000 TPY CO2 equivalent (CO_2e) and greater than the applicable major source threshold (i.e., 100 or 250 TPY, depending on the source category) on a mass basis for GHGs. FARR also requires that fugitive PM be controlled and monitored. 40 CFR § 49.124 establishes that visible emissions from air pollution sources may not exceed 20 percent opacity, averaged over six consecutive minutes, as measured by EPA Method 9. EPA has adopted National Emission Standards for Hazardous Air Pollutants (NESHAPS) for certain HAPs and source categories, which may be applicable. • Subpart T - National Emission Standards for Radon Emissions from the Disposal of Uranium Tailings (40 CFR § 61.220 *et seq*.) • Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR § 63.6580 *et seq*.) Section 111 of the CAA authorized EPA to develop technology based standards which apply to specific categories of stationary sources. These standards are referred to as the New Source Performance Standards (NSPS) and are found in 40 CFR Part 60. • Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants (40 CFR § 60.670 *et seq*.). These standards apply to certain sources at fixed or portable nonmetallic mineral processing facilities including crushers, screening operations and belt conveyors. • Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR § 60.4200 *et seq*.). These standards would apply to diesel engines manufactured after a certain date that are used to operate certain equipment including emergency generators.	• 40 CFR §61.220 *et seq.* for radon emissions from the disposal of uranium mill tailings after closure. • 40 CFR §60.670 *et seq.* for sources at nonmetallic mineral processing facilities. • 40 CFR §49.130 et seq. for rules for reducing sulfur in fuels. • 40 CFR §63.6580 et seq. for National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.		

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No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
26	Federal Regulatory Requirement	Radiological Material	Nuclear Energy and Radiation Control Act, RCW 70.98 and WAC 246-220 and 255.	The Washington Department of Health, under Nuclear Regulatory Commission delegated authority, regulates sources of ionizing radiation for the protection of occupational and public health and safety. The State terminated its radioactive materials license (WN-I0390-1) on December 31, 2008. However, the license requirements are and will continue to be followed for the water treatment plant sludge as part of the RA implementation through operations and maintenance of the project.	The conditions of the terminated State radioactive materials license (WN-I0390-1) will be continued to be complied with in the operation and management of the WTP and WTP sludge.	Substantial compliance will be accomplished by implementing the terminated license requirements as described in OM&M Plan, Appendix P.	NA
27	Federal Regulatory Requirement	Health and Safety	Occupational Safety and Health Act of 1970 (OSHA) (Public Law 91-596 84 Stat. 1590.	Occupational Safety and Health Administration (OSHA) provides requirements for safe and healthful workplaces by setting and enforcing standards and by providing safety and health training requirements associated with working with hazardous waste or materials. Spokane's Tribal Occupational Safety and Health Administration (TOSHA) provides administration of OSHA rules and regulations on lands within the Reservation.	OSHA and TOSHA requirements have been incorporated into the Health and Safety Plan.	Compliance with the requirements of OSHA and TOSHA will be accomplished through the implementation of the Health and Safety Plan included in the OM&M Plan, Appendix P.	NA
28	Federal Regulatory Requirement	Hazardous Materials	Hazardous Materials Transportation Guidelines, 49 CFR 173.	The transportation of hazardous materials, such as WTP sludge which is classified as a Low Specific Activity Group I (LSA-I) is regulated by US Department of Transportation. LSA-I material will be transported, packaged, and labeled in accordance with these guidelines (Title 49, Transportation, Parts 100-199).	Any Reportable Quantities (RQ) of radioactive material having a specific activity greater than 0.002 µCi/g will be transported, packaged, and labeled in accordance with the Hazardous Material Transportation Guidelines.	Compliance with the requirements of the Hazardous Materials Transportation Guidelines will be accomplished by implementing DOT guidelines for hazardous material if RQ are identified.	NA
29	Federal Regulatory Requirement	Wildlife Resources	Bald and Golden Eagle Protection Act (BGEPA), 16 USC §668-668c.	The BGEPA prohibits "taking" of bald and golden eagles, including their parts, nests, and eggs without a permit. The term "taking" also includes disturbing or agitating to the degree of injury, decreased productivity, or interfering with normal feeding, breeding or nesting behavior.	Prior to construction, surveys for eagle nests will be conducted to identify active eagle nests. Restricted access within ¼ mile of active nests could be required from November 15 until the nest becomes unoccupied.	Compliance with the requirements of the BGEPA will be accomplished by restricting access within ¼ mile of active nests or roosts during sensitive periods. The USFWS will be consulted for avoidance measures, if an eagle nest becomes active within ¼ mile of the project area to avoid "taking".	Katie Eaton of Spokane Tribe DNR was consulted on 5/1/2013 and Lori Guggenmos of Washington Department of Fish and Wildlife was consulted on 4/23/2013. They indicated that there were no known eagle nests in the project vicinity.
30	Federal Regulatory Requirement	Paleontological Resources	Indian Affairs Manual, Environmental and Cultural Resources Management, Paleontological Resources Directive #10-32).	The Bureau of Indian Affairs (BIA) Directive (#10-32) requires a permit be issued by BIA prior to the excavation or removal of imbedded fossils from Indian land. No known paleontological resources in the area. No permits are required for on-site activities.	Consult BIA if paleontological resources are discovered; however, the excavation of fossils is unlikely.	Compliance with BIA Directive #10-32 will be accomplished through monitoring. The Cultural Resources Monitors will identify any paleontological resources during their monitoring of construction activities.	NA

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31	Federal Regulatory Requirement	Cultural Resources	Archaeological Resources Protection Act (ARPA) of 1979, 93 Stat. 721; 16 USC §470 AA *et seq.*, PL 96-95.	The ARPA protects archaeological resources, including material remains of archaeological interest and cultural items on public lands and Indian lands of the United States.	Upon the discovery of archaeological resources including material remains and cultural items, construction activities will immediately stop at that location and the THPO will be consulted and their instructions will be followed.	Compliance with the requirements of the Archaeological Protection Act will be accomplished by consultation with the THPO if archaeological resources or sites are discovered.	The THPO, Randy Abrahamson was initially consulted through the submittal of the Ground Disturbance Permit Application on 9/12/2013. James Harrison and Jackie Corley of the Preservation Office were contracted to conduct cultural resources field surveys in 2014 and 2015.
32	Federal Regulatory Requirement	Invasive Species	Invasive Species Executive Order (EO) 13112	EO 13112 mandates that federal agencies, with project approval authority, prevent the introduction and spread of invasive species and rapidly control invasive populations once identified.	Invasive species will be controlled when identified. Seed, mulch, and BMP materials will be certified as invasive free for revegetation and erosion control.	Compliance with the requirements of EO 13112 will be accomplished by implementing the Noxious Weed Management Plan (WME 2013).	The Spokane Tribe DNR was consulted in the development of the Noxious Weed Management Plan.
33	Federal Regulatory Requirement	Land use and resource planning	Integrated Resource Management Plan for the Spokane Indian Reservation	The IRMP provides Reservation-wide guidance for land use and resource management planning for land within the Spokane Reservation.	The Plan of Operations for the Rhoads Borrow Area was developed to follow the requirements of the IRMP and has incorporated additional resource concerns provided by the Tribe's Inter-Disciplinary Team (IDT) and Tribal Council. Once the Blue Creek Pipeline design is further refined following finalization for the NPDES Permit the pipeline route will be submitted to the IDT for a formal review of the limited conditional entry into the riparian and lake buffer zones is consistent with the IRMP's Individual Program Goals.	Compliance with the IRMP will be accomplished by implementing the requirements described in the Spokane Tribal Resolution 2014-135 as part of the design and monitoring described in the OM&M Plan in Appendix P on the Rhoads Borrow Area.	Spokane Tribal Council approved the development of the Rhoads Borrow Area on 2/21/14.
34	County Requirement	Land use and resource planning	Stevens County Land Use Code 3.03.090	The Stevens County Land Use Code requires land use approval on fee land within the Spokane Reservation boundary to ensure compliance with the Stevens County Comprehensive Plan and Development Regulations.	A Stevens County Administrative Conditional Use Permit (ACUP) was granted on 7/30/14.	Compliance with Stevens County Land Use Code will be accomplished by implementing the conditions of the permit.	Consulted with Jenni Anderson and Katie Hoverter of Stevens County Planning Department on 12/5/2013 and 2/20/2014 regarding the permitting of the Rhoads Borrow Area. An ACUP was issued on 7/30/2014.

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No.	Authority	Medium, Resource or Remedial Component	Environmental Requirement Reference	Synopsis of Requirement	Actions to be Taken to Attain the Requirement	Tracking and Documentation	Agency Contact and Discussion Results/Status
35	State Regulatory Requirement	Land use and resource planning	State Environmental Policy Act (SEPA), RCW 43.21	The SEPA requires state and local government decision makers to consider potential environmental impacts of proposed actions. As part of the Stevens County Conditional Administrative Use Permit, Stevens County requires a SEPA checklist as part of their application for the development of the Rhoads Borrow Area.	As part of the Stevens County ACUP for the development of the Rhoads Borrow Area Stevens County issued a Determination of Nonsignificance (DNS) on 7/30/2014.	Compliance with SEPA will be accomplished through implementing the Rhoads Property Plan of Operations and Reclamation, Revision 2.	Consulted with Jenni Anderson and Katie Hoverter of Stevens County Planning Department on 12/5/2013 and 2/20/2014 regarding the permitting of the Rhoads Borrow Area. The SEPA DNS was issued on 7/30/2014.
36	State Regulatory Requirement	Forest Resources	Forest Practices Act, RCW 76.09, RCW 6.13 RCW, AND WAC 222-16-010	A Forest Practices Act (FPA) Permit is required for timber harvests on Tribal fee land, specifically applicable to Rhoads Borrow Area. A Class III – General Forest Practices Permit will be obtained for the Rhoads Borrow Area which allows trees to be logged prior to the excavation of borrow material.	A Forest Practices Permit application will be submitted to WA DNR as part of the development of the Rhoads Borrow Area.	Compliance with the FPA permit requirements will be accomplished through implementing the conditions of the permit and periodic monitoring as described in the OM&M Plan, Appendix P.	Bernie Jones of WA DNR, was consulted with on 12/5/2013 regarding the permitting of the Rhoads Borrow Area.
37	State Regulatory Requirement	Mineral Resources	Surface Mining Act, WAC 332-18 AND 78.44	A Surface Mining Reclamation Permit is required for surface mines greater than three acres of disturbed ground or has high-walls greater than 30 ft and steeper slopes than 45 degrees.	A Surface Mining Reclamation Permit application will be submitted to WA DNR, for the development of the Rhoads Borrow Area.	Compliance with the Surface Mining Permit requirements will be accomplished through implementing the conditions of the permit and periodic monitoring as described in the OM&M Plan, Appendix P.	Brian Garcia of WA DNR, Surface Mining Reclamation Permits provided comments to Stevens County on 12/5/2013 regarding the permitting of the Rhoads Borrow Area.
38	County and Spokane Tribe Requirement	Water	Sanitation Standard for General Industry (29 CFR 1910.141(a)(2)	Standards for potable water and septic systems have been developed and are implemented locally by both the Tribe's Utility Services Department and Northeast Tri-County Health District	Design potable water system and septic system in accordance with Tribe's Utility Services Department and Northeast Tri-County Health District requirements.	Compliance with the requirements of Sanitation Standard for General Industry will be accomplished through meeting the design standards and documenting performance through and routine testing and maintenance of septic system as described in the OM&M Plan, Appendix P.	Bryan Hunt of NE Tri-County Health District and Brian Crossley of Spokane Tribe were consulted with on 12/5/2013 regarding water and septic requirements.

M3.1 Clean Water Act (33 USC 1251 et seq.)

The Clean Water Act restores and maintains the chemical, physical, and biological integrity of the Nation's waters.

M3.1.1 Section 304 – Water Quality Standards

Section 304 of the Clean Water Act requires the EPA to develop, publish, and revise criteria for water quality accurately reflecting the latest scientific knowledge on all identifiable effects on health and welfare. These requirements are implemented by the promulgated regulations which include 40 CFR 131 and the Spokane Tribe's water quality standards. The water quality criteria have been determined to be relevant and appropriate for those contaminants in surface water where there are no other appropriate standards, such as the Tribal Water Quality and where background criteria are not higher than the criteria. The water quality standards are an identified Applicable or Relevant and Appropriate Requirement (ARAR) and are specifically applicable to the effluent discharge water quality criteria where EPA determines no other appropriate standards exist. The clean-up standards are provided in Table 8-1 in the ROD for surface water and Table 8-2 in the ROD for groundwater (EPA, 2006), and in Table 4-3 of the BODR for surface water and in Table 4-4 of the BODR for groundwater. Regulatory compliance with this ARAR are as follows:

On-Site Substantive Requirements

- During the RA, mine impacted surface water will be captured and treated at the WTP as described in:
    - BODR Appendix E Water Management Ponds; and
    - BODR Appendix F Surface Water and Sediment Controls.
- As the Remedial Action progresses, surface water from remediated areas will be allowed to drain to the natural drainages down gradient of the MA.
- Compliance will be documented through the routine Operation Monitoring and Maintenance (OM&M) inspections of the water management systems, leak detection monitoring of the storage ponds, and by site-wide monitoring of surface water down gradient of the MA during and following RA construction. The OM&M Plan is included in the BODR Appendix P and the Site-Wide Monitoring Plan is included in BODR Appendix Q.

M3.1.2 Section 402 – National Pollution Discharge Elimination System (33 USC § 1342)

The CWA National Pollution Discharge Elimination System (NPDES) Program is listed under 40 CFR 122 and regulates the discharge of pollutants into waters of the U.S. The NPDES program provides separate requirements for non-point source stormwater and point source discharges as discussed below.

Point Source Wastewater Discharge. The EPA regulates water quality and permits for point source industrial discharges under 40 CFR §122.29 *et seq*. to ensure the discharge does not cause an exceedance of applicable water quality standards in the receiving water body outside an approved surface waters mixing zone on lands within Reservations. The ROD (EPA, 2006) identified NPDES permit requirements as an ARAR for on-site discharges. The interim limits for water treatment plant discharge in Section 12 of the ROD are no less stringent than the existing

permit limits. The ROD authorizes an interim action waiver of discharge limits which may be additional to or more stringent than the interim limits in Table 12-2 of the ROD. The EPA has determined that the Blue Creek Pipeline, the WTP discharge, and mixing zone are all on-site and that EPA will be issuing an NPDES permit for this discharge (EPA 2015). An application to modify the NPDES permit was submitted to the EPA on March 21, 2013 and processing has been ongoing. There have been a number of discussions with EPA to understand additional polishing requirements. Work Plans were recently submitted to EPA and approved to conduct additional studies for aluminum and arsenic that is planned for summer of 2015.

On-Site Permitting Requirements

- Apply for a modified NPDES permit for the Blue Creek Pipeline discharge into Lake Roosevelt.
- A Section 401 Water Quality Certification (as described below) will be applied for from the Spokane Tribe once the NPDES permit is further in development.
- The compliance with the existing NPDES Permit No. WA-002572-1, effective October 30, 1995 will be maintained until the new NPDES permit takes effect.
- Monitoring and testing of effluent constituents will be consistent with the newly reissued NPDES permit.

Stormwater Discharge. The EPA regulates water quality and permits construction related stormwater discharges on lands within the Reservation as required by 40 CFR 122.26 and are described in the EPA Construction Stormwater Permit. A Stormwater Management Plan (SWMP) included in Appendix O of the BODR has been prepared in accordance with Stormwater Management Manual for Eastern Washington (SMMEW; Washington Department of Ecology [WDOE], 2004) to protect water quality through the implementation of BMPs in accordance with the Tribe's water quality standard for land within the Reservation (Mined Area, Blue Creek Pipeline, Drainage and Haul Road Clean-up, and Rhoads Borrow Area). Implementation of the SWMP will include monitoring that demonstrates that the discharge does not result in a violation of water quality standards. For land off of the Reservation, Washington State Department of Ecology (WA DOE) regulates stormwater discharge.

On-Site Substantive Requirements

- Best Management Practices (BMPs) will be installed as described in the SWMP that reduce or prevent discharge of pollutants into receiving waters.
- BMPs will be inspection in accordance with the OM&M Plan in BODR Appendix P and Site-Wide Monitoring Plan in BODR Appendix Q.

Off-Site Permitting Requirements

- A Stormwater NPDES permit will be applied for on EPA's Electronic Construction General Permit (CGP) Notice of Intent (eNOI) online for the Rhoads Borrow Area.
- A Sand and Gravel NPDES permit will be applied for from WA DOE for the Ford Borrow Area if it is developed as an alternative site.
- The permit will be applied for at least 14 days prior to commencing earth moving activities at the Rhoads Borrow Area or Ford Borrow Area.

- General conditions of the CGP or Sand and Gravel Permit will be complied with including preparing and implementing stormwater pollution prevention plans (SWPPPs) or stormwater management programs both using best management practices (BMPs) that effectively reduce or prevent the discharge of pollutants into receiving waters.
- Approximately one year prior to earth moving activities at the Rhoads Borrow Area (if selected), a Section 401 Water Quality Certification (as described below) will be applied for from the Spokane Tribe to certify that the stormwater NPDES permit for the Rhoads Borrow Area.

BMPs will be monitored and documented as required by the conditions in the permit.

M3.1.3 Section 404 – Discharge of Dredge or Fill into Waters of the U.S. (33 USC § 1344)

The U.S. Army Corps of Engineers regulates the discharge of dredged or fill material into waters of the U.S. Waters of the U.S. under 33 CFR 320.3, and includes traditional navigable waters, interstate waters, permanent or seasonal non-navigable tributaries, adjacent wetlands, and other waters. Section 404 requirements are identified as an Applicable or Relevant and Appropriate Requirement (ARAR) if regulated streams and wetlands are identified and impacted. Nationwide Permit (NWP) 38 is applicable for impacts to wetlands and waters of the U.S. associated with the cleanup of hazardous and toxic waste. Although on-site impacts would be exempt from permitting under CERCLA, the conditions of NWP 38 would be applicable.

A wetland delineation was performed to identify jurisdictional wetlands and other non-wetland waters of the U.S. in accordance with the 1987 Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (USACE, 2010). The Wetland Delineation (WME 2015a) was submitted to EPA on December 16, 2013. Since that time there have been a number of revisions submitted based on requests for additional information and changes in presentation. The latest version was submitted as a redline draft to EPA on May 8, 2015. In addition, the Conceptual Wetland and Stream Mitigation Approach (WME 2015b) was submitted to EPA on March 15, 2015. These documents have not been included in this Appendix. However, a placeholder for these attachments is provided in Attachments M-1 and these documents will be included once they are approved by EPA and the documents are finalized.

Jurisdictional wetlands occur in the Western, Central, Eastern, and Northern Drainages (tributaries to Blue Creek) and throughout the length of Blue Creek. The wetlands are “palustrine” under Cowardin’s Classification and “riverine” under a hydrogeomorphic (HGM) wetland classification, originating from springs or seeps that appear to flow most of the year. However, the wetlands in the Eastern Drainage and downstream confluences of the Central Drainage are artificially supplemented by the seasonal discharge of up to 500 gallons per minute of effluent from the water treatment plant (WTP). The discharge is located just upstream of the East Haul Road in the NPDES pond. There are not wetlands in the Whitetail Drainage and Southwest Drainage.

There are approximately 8,769 linear ft of tributary streams in the Western, Central, and Eastern Drainages. During the April 2015 field trip, the EPA determined that the Whitetail Drainage and the Southwest Drainage do not have a significant nexus and are not jurisdictional. The wetlands adjacent to the tributaries in the Western, Central, and Eastern Drainages range from 10 to 150 feet in width and are primarily scrub/shrub vegetation dominated by mountain alder, red alder, redosier

dogwood, Douglas hawthorne, redtop, and Rocky Mountain maple. A total of 6.8 acres of wetlands occur within the study area, including 0.58 acre in the Western Drainage, 1.79 acres in the Central Drainage, 4.28 acres in the Eastern Drainage, 0.12 acre in the Northern Drainage, and 0.07 acre at the Blue Creek inlet. Wetlands are also found throughout Blue Creek with some wetlands encroaching onto the Blue Creek Road bench; however, these wetlands would be avoided during construction. In addition to the wetlands, riparian communities occur throughout the length of these drainages. Riparian corridors provide important habitat (i.e., food, cover, and water) for wildlife in the area and serve as migratory corridors. Although these drainages provide habitat for aquatic life and are a water resource for wildlife, these wetlands contain contaminated sediment and soil that will be cleaned up as part of the Remedial Action. Non-wetland waters of the U.S. occur in Lake Roosevelt below the high water mark, at an elevation 1,290 feet above mean sea level (amsl). No jurisdictional wetlands or non-wetland waters of the U.S. occur on the Rhoads property.

Consistent with the 404(b)(1) Guideline priority sequencing, adverse impacts to aquatic resources will be avoided, minimized, and mitigated. The Washington Interagency Mitigation Guidance (EPA et al., 2006) defines permanent impacts as those impacts that result in the permanent loss of wetlands or other non-wetland waters of the U.S., such as by the placement of fill associated with the flood attenuation berms. Long-term temporary impacts are those impacts that affect functions in such a way that they can be restored but would take longer than a year, such as the impacts associated with the mine drainage clean-up. Short term temporary impacts are those impacts that last a limited time and functions return to pre-impact performance in about one year, such as the impacts associated with the installation of the pipeline in the dry lakebed. The Mitigation Guidance provides that compensatory mitigation is required for permanent and long-term temporary impacts, but not for short-term temporary impacts. Impacts associated with each of these project components are described below.

Drainage Clean-up: The contaminated sediment in the Western, Central, and Eastern Drainages will be excavated from the stream and wetlands. Preliminary investigations indicate that significant portions of the areas currently identified as wetlands are contaminated. The contaminated sediments will be removed as part of the remediation. There will likely also be wetland areas where sediments do not exceed cleanup limits. These areas will be avoided to the extent practical. The amount of cleanup and the stream and wetland areas that will be impacted by cleanup activities will not be known until after cleanup has been completed.

Excavation of contaminated sediments will be done in a manner that minimizes impacts to wetlands and streams. In areas of flowing water, the streams will be temporarily diverted around the removal areas using pipelines. Low-ground pressure, rubber-tracked excavation and haulage equipment will be used to remove the contaminated sediment from the drainage channels. This equipment will move the collected sediment materials to general staging areas within the drainages where the materials can then be stockpiled in upland areas for loading and transport by rubber-tired, articulating haulage trucks to the Waste Disposal Area (Pits 3) at Midnite Mine. Temporary access roads will be designed and constructed to access the drainage cleanup areas from existing adjacent forest roads. It is expected the equipment footprint will be limited to the sediment cleanup area as much as possible using the stream channel to access, remove, and transport sediments to the general upland staging areas. Impacts to jurisdictional areas will be avoided or minimized where ever possible. Prior to any cleanup activities, the drainage sediments will be properly characterized and flagged in the field as identified in the Remedial Design Work Plan to avoid any unnecessary impact(s). By using these construction techniques, impacts to wetlands will be minimized and direct impacts due to drainage clean-up in the mine drainages will be temporary in nature.

Following the removal of the contaminated sediment, the stream channel will be restored to a natural

stable state by regrading the remaining uncontaminated soils. Typical Rosgen type “A” channels will be constructed with appropriate sinuosity and meander lengths (Figure 14). The design will include steps, riffles, pools to control grade, provide habitat, and minimize erosion. The bankfull channel will be sized for design flows based on expected attenuated peak flows conditions after mine reclamation. The overbanks will be revegetated using wetland and riparian species. The sediment clean-up impacts to jurisdictional features associated with the drainage clean-up are expected to be temporary.

Eastern Haul Road Clean-up: The Eastern Haul Road crosses the Eastern and Northern Drainages. The fill material associated with the Eastern Haul Road will be removed from these drainages. The existing culvert in the Northern Drainage will be removed. The stream channel will be restored to the design flows and wetland and riparian species will be planted along the overflow bank. The size of the depressional wetland and the amount of water that may pond in Reaches E1 and N1 will be dependent upon the extent of the contaminated road fill material removed. The contaminated material will be placed in the Mine Waste Disposal Area. The direct effects associated with the haul road removal are expected to be temporary in nature. The road fill disturbed area which contains no existing delineated wetlands will be used for placement of an attenuation berm. The drainage areas up-gradient and down-gradient of the attenuation berm will be restored with wetland species following remediation.

Flood Attenuation Berms: Four flood attenuation berms will be installed within the mine drainages. One attenuation berm in the upper Central Drainage and another in the upper Western Drainage have been designed in non-wetland areas to minimize the wetland impacts associated with the attenuation berm in the Central Drainage downstream of Western Drainage confluence.

The third attenuation berm is located in the approximate vicinity of the lower Central Drainage beaver pond complex at the confluence of the Western and Central Drainages and has been sited in part based on comments from the Spokane Tribe to minimize visual impacts from the highway. While placement of the lower Central Drainage attenuation berm will be sited to minimize impacts to existing wetlands, some permanent impacts will occur.

The fourth attenuation berm is located where the Eastern Haul Road crosses the Eastern Drainage. This attenuation berm will be constructed within the disturbed footprint of the Eastern Haul Road such it avoids direct wetland impacts where ever possible, however, this structure will permanently impact wetlands.

The flood attenuation berms will consist of compacted alluvium soils with a 24-inch corrugated metal pipe (CMP) culvert with a perforated standpipe at the upstream side. The berms are designed to attenuate flows for the 100-yr, 24-hr storm expected with pre-mining surface water flows. Storms greater than the 100-yr, 24-hr storm will flow over the spillway. The unavoidable, direct impacts associated with the flood attenuation berms are expected to be permanent in nature.

Blue Creek Pipeline: The Blue Creek Pipeline will be constructed approximately 3,600 feet into the Lake Roosevelt National Recreation Area (LARO NRA) from elevation 1,310 ft to the historic Spokane River channel in Lake Roosevelt. The pipeline will be constructed of an eight-inch High Density Polyethylene (HDPE) fuse welded pipe with a six inch single port diffuser and elastomeric duckbill valve place at the end. The wetlands at the mouth of Blue Creek at Lake Roosevelt (Reaches BC and LR) will be avoided during construction. During one of the annual lake drawdown events, the pipeline would be constructed in an approximate 40-foot wide work area and buried two to four feet below the lake floor. The lakebed will be re-contoured to pre-construction natural contours. In inundated areas, the pipeline would be assembled on shore, floated into the lake, and

submerged with concrete anchors until an extreme low water conditions would allow the remainder of the pipeline to be buried. The schedule for construction within the LARO NRA is not certain but the final burying of the pipeline would occur during a scheduled extreme lake drawdown that would be associated with dam works maintenance or repairs. The effect of the pipeline within the lakebed would be temporary in nature. The lakebed where the pipeline is buried is inundated annually.

It is estimated that approximately 8,769 linear feet of tributary streams (8,529 lin ft temporarily and 236 lin ft permanently) and 5.93 acres (5.71 acres temporarily and 0.22 acres permanently) of wetlands will be affected by the RA. Unavoidable impacts will be mitigated using the ratios described in Table 1b of EPA's interagency Wetland Mitigation Guidance in Washington State (EPA et al. 2006), and replaced. Temporary effects are expected to be long-term temporary, lasting for more than one or two growing seasons.

At this time it is not known the extent of the wetlands that are artificially supported by the NPDES discharge. Some of these wetlands in the Eastern Drainage and downstream reaches of the Central Drainage may revert to dry land once the discharge ceases. In addition, groundwater the Western, Central and Eastern Drainages may be significantly impacted by the collection of contaminated alluvial groundwater upstream of the stream reaches. The full extent of wetlands disturbed and the natural hydrology (following the removal of the WTP discharge and construction of the alluvial interceptor trenches) will limit the extent of uncontaminated wetlands that can be supported.

A Conceptual Wetland and Stream Mitigation Approach (WME 2015b) submitted to EPA on March 16, 2015 outlines the conceptual restoration methods. A more comprehensive Wetland Restoration Plan that describes the methods and performance criteria will be developed once there is agreement on the impacts and mitigation framework. Many of the wetland and riparian species will recover naturally from surrounding seed sources and root suckering. Native wetland and riparian species will be seeded and installed as cuttings and container plants to help reduce erosion, speed the recovery time, and reduce the risk of invasion by invasive weed species. The Restoration Plan will include: objectives; site selection criteria; site protection instruments (e.g., Institutional Controls); baseline information (for impact and compensation sites); credit determination methodology; a work plan; a maintenance plan; ecological performance standards; monitoring requirements; a long-term management plan; and an adaptive management plan. Wetland impacts in the plan will be estimated and final impacts will be assessed once construction is completed.

On-Site Substantive Requirements

- Identify jurisdictional wetlands and non-wetland waters of the U.S.
- Avoid and minimize impacts to wetlands and streams and mitigate for unavoidable impacts.
- The applicable conditions associated with NWP 38 will be followed including:
    - May have minimal individual and cumulative adverse effects on the aquatic environment; and
    - Must comply with Sections 401 and 404 of CWA, National Historic Preservation Act, Endangered Species Act, Bald and Golden Eagle Protection Act; and Migratory Bird Treaty Act, and other federal requirements such as Executive Orders for wetlands, and floodplains.
- Mitigate impacts to jurisdictional wetlands using EPA's interagency Wetland Mitigation Guidance in Washington State. Discussions regarding stream mitigation requirements is ongoing with EPA.

- Prepare and implement a Wetland Restoration Plan consistent with Section 404(b)(1) requirements:
    - Replace disturbed material with clean, suitable material;
    - Install BMPs;
    - Revegetate impacted areas with native wetland, riparian and upland species; and
    - Maintain and monitor restoration until performance standards are achieved.
- A Wetland Delineation (WME 2015a) and Conceptual Wetland and Stream Mitigation Approach (WME 2015b) have been submitted to EPA for review and will be provided in Attachment M-1 once finalized.
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- If wetland restoration on-site is not successful, alternative off-site locations within the Spokane Indian Reservation will be identified and pursued, or the purchase into the Meadowcroft Wetland Mitigation Bank.

M3.2 Protection of Wetlands – Executive Order 11990

Executive Order 11990 mandates that federal agencies minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands for projects that they have approval or permitting authority over. As described previously, wetland delineation was conducted in accordance with the 1987 Army Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (USACE, 2010), and is provided in Attachment M-1. Wetlands occur in the Western, Central, and Eastern Drainages as well as along Blue Creek. No other wetlands occur within the project area. Those wetlands identified in the Western, Central, and Eastern Drainages will be impacted as part of the required drainage clean-up that would remove contaminated sediments. Those wetlands identified in Blue Creek will be avoided since the pipeline will be installed entirely within the existing dirt road. Impacts to wetlands will be minimized to the extent practical in the design process. Impacts to wetlands will be assessed once the design is further refined and summarized in the Design submittal. Wetlands protection associated with Executive Order 11990 has been identified as an ARAR and will be incorporated into the project design.

On-Site Substantive Requirements

- Avoid and minimize impacts to wetlands. Mitigate for any unavoidable impacts to wetlands.

M3.3 Rivers and Harbors Act (33 USC § 403)

M3.3.1 Section 10 – Navigable Waters

Section 10 of the River and Harbors Act (R&HA), under 33 CFR Parts 320 to 332, prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. unless permitted by the U.S. Army Corps of Engineers. An obstruction or alteration includes the construction of any structure in or over navigable waters, the excavation of dredge or deposition of fill, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters. Section 10 permits are a condition of the 404 permitting program. One of the primary considerations in the issuance of the permit is that the project is not contrary to the public interest and is consistent with the conditions described in 33 CFR part 325, including effects on historic

properties and endangered species. Lake Roosevelt is a navigable water of the U.S., below elevation 1,290 ft. amsl. The installation of the Blue Creek Pipeline and diffuser are considered an alteration to navigable waters. Compliance with Section 10 of the R&HA is a condition of compliance with Section 404 of the CWA under the Nationwide Permit (NWP) program. Since a Section 10 permit is not required for on-site activities under CERCLA, the project design will be coordinated with the U.S. Army Corps of Engineers to comply with this requirement.

On-Site Substantive Requirements

- Coordinate design and construction of the Blue Creek Pipeline in Lake Roosevelt with the Bureau of Reclamation and U.S. Army Corps of Engineers once the pipeline design is resumed following the pending resolution of the NPDES permitting requirements.

M3.4 Section 401 – Water Quality Certification (33 USC § 1341)

Section 401 of the water quality certification program requires states (or authorized tribes) to certify federally permitted discharge into waters of the U.S. to protect state water quality standards as required by 40 CFR 121. In 2002, the EPA granted the Spokane Tribe certification authority to be treated in the same manner as a state (TAS). The 401 Certification process ensures that Tribal Water Quality Standards are being met for federal Clean Water Act permitted projects on lands within the Reservation. On December 19, 2013, the EPA disapproved the Tribe's 2010 proposed Water Quality Standards, specifically the proposed mercury and thallium standards. It is unclear what the final standards for these constituents will be. A 401 Water Quality Certification will be obtained for activities that require a CWA permit. These include effluent discharged from the Blue Creek Pipeline into Lake Roosevelt and the Rhoads Borrow Area that require a stormwater NPDES permits and concurrent 401 Certification from the Tribe.

On-Site Permitting and Substantive Requirements

- Submit a 401 Certification Application to the Spokane Tribe Department of Natural (DNR) Resources to certify that the point source NPDES permit for the Lake Roosevelt discharge requirements are consistent with the Spokane Tribe's water quality standards. The 401 certification request will be submitted pending resolution of NPDES permitting requirements.
- The clean-up standards for surface water were established in Table 8-1 of the ROD.
- Water quality will be inspected in accordance with the OM&M Plan in BODR Appendix P and Site-Wide Monitoring Plan in BODR Appendix Q.

Off-Site Permitting Requirements

- Submit a 401 Certification Application to the Spokane Tribe DNR to certify the stormwater NPDES permit associated with EPA's CGP is consistent with the Tribes water quality standards at least 14 days prior to construction.

M3.5 Spokane Tribe of Indians Surface Water Quality Standards Resolution 2010-173, February 25, 2010

The Spokane Tribe of Indians Surface Water Quality Standards Resolution 2010-173 was considered in developing the water quality criteria being used for the clean-up standard on lands within the Reservation. In some cases the ambient background was higher than the standard and

was considered in developing the standard. On December 19, 2013, the EPA disapproved the Tribe's 2010 proposed Water Quality Standards, specifically the proposed mercury and thallium standards. It is unclear what the final standards for these constituents will be. The resulting standards will be used for both the NPDES permit for discharge into tribal waters as well as for the concurrent 401 certification administered by the Tribe. The Spokane Tribe has treatment as a State (TAS) status for regulating surface water quality on lands within the Reservation. The Tribes TAS status has been identified as an ARAR. The ROD authorizes an interim waiver of Tribal water quality standards for the water treatment plant discharge that are additional to or more stringent than the interim limit set in Table 12-2 of the ROD. The Tribe's Surface Water Quality Standard has been identified as being appropriate standards to be considered in establishing clean-up levels. Surface water clean-up levels have been identified in Table 8-1 of the ROD (EPA, 2006) and will be achieved through collection and treatment of contaminated waters and natural attenuation following source control.

On-Site Substantive Requirements

- As the RA progresses, surface water in the remediated areas will be allowed to drain from cover soils to the natural drainages down gradient of the MA.
- The process for containing the mine-impacted water is described in BODR Appendix E – Water Management Ponds and BODR Appendix F – Surface Water and Sediment Controls.
- Shedding clean water from the remediated areas is presented in the Technical Memorandum titled: Midnite Mine – Management of Stormwater Runoff from Remediated Areas – Revision 1 (WME, 2013a), which is included as Attachment O-1 to the SWMP.

M3.6 Safe Drinking Water Act (42 USC § 300F ET SEQ.)

National Primary Drinking Water Regulations (40 CFR Part 141) is listed under the Safe Drinking Water Act (SDWA). The Safe Drinking Water Act regulations protect drinking water sources. The Tribe's Department of Natural Resources and Utility Services Department jointly manage and regulate surface and groundwater on lands within the Reservation. The Utility Services Department monitors drinking water quality on lands within the Reservation according to the Safe Drinking Water Act and EPA requirements. It also regulates activities near sources of drinking water under the Tribe's Well Head Protection Program. Groundwater is the sole source for all drinking water on lands within the Reservation and groundwater is regulated by the Tribe's Hazardous Substances Control Act (HSCA). Table A-1 in the HSCA provides groundwater clean-up levels to protect human health. Clean-up levels for groundwater are provided in Table 8-2 of the ROD (EPA, 2006).

The Tribe has treatment as a state (TAS) status under the Clean Water Act in 2002 and the EPA approved the Tribe's water quality standards in 2003. The maximum contaminant levels (MCLs) are ARARs for human health Contaminants of Concern (COCs) in ground water outside of the waste management areas and surface water at the site. Groundwater outside of the waste management area and surface water on the site will be monitored to ensure the water quality standards are being achieved. No drinking water wells would be allowed in the area until EPA's drinking water standards can be safely achieved.

A Public Water System would be developed at the Mined Area since it would serve more than 25 persons and fall under EPA's Group A, Non-Community, Non-Transient Water System requirements. Water for employees would comply with SDWA and be used for potable non-human consumption activities such as hand washing, showers, laundry, etc. Drinking water would be purchased from local vendors.

On-Site Substantive Requirements

- Consolidate contaminated material in the WCA and hydraulically isolate from surface and ground water which will be pumped and treated at the WTP as described in BODR Appendix D – Mine Waste Excavation and Containment.
- Groundwater down gradient from the WCA will be monitored to demonstrate compliance with groundwater cleanup standards as described in BODR Appendix Q – Site Wide Monitoring Plan.
- Compliance will be documented as part of the Site-Wide Monitoring.
- A potable water system will be developed on site for workers consistent with Washington State Department of Health requirements for Group A, Non-Community, Non-Transient water system.

M3.7 Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR Part 192,

M3.7.1 Subpart A – Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites, Table 1: Maximum Concentrations of Constituents for Groundwater Protection

The Uranium Mill Tailings Radiation Control Act (UMTRCA) standards have been identified as an ARAR for groundwater at the Site. UMTRCA, under 40 CFR 192 subpart A, allows the use of background levels that exceed the listed standards as is the case for U-234 and U-238. Background for U-234 and U-238 has been determined to be 37 pCi/L and 35 pCi/L, respectively (EPA, 2006). The Midnite Mine Groundwater Monitoring Program will monitor the natural attenuation of groundwater following the natural flushing following source control.

On-Site Substantive Requirements

- The RA will include consolidating the mine wastes into a WCA. Water that accumulates in the WCA will be pumped to the operating WTP and treated. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment.
- As the RA progresses, surface water in the remediated areas will be allowed to drain from cover soils to the natural drainages down gradient of the MA.
- The Institutional Control Implementation and Assurance Plan (ICIAP) (MWH, 2014) will provide directions for institutional controls that will preclude access to groundwater that does not meet the standards.

M3.7.2 Subpart B – Clean-up of Land and Buildings Contaminated with Residual Radioactive Materials

The UMTRCA standards have been identified as an ARAR for the clean-up standards for soil. UMTRCA, listed under 40 CFR 192 subpart B, allows for soil limits to be set at values greater than background (i.e. 5 pCi/g radium above background). Since the limits for the RA are at background, they are more restrictive than would be required under UMTRCA. Soil will be monitored as part of the remediation to ensure that the clean-up levels identified in Table 8-3 of the ROD (EPA, 2006) are achieved as determined using procedures in BODR Appendix S – Analytical Support and Verification Plan for Remediation of Surface Materials and Sediments.

On-Site Substantive Requirements

- The Remedial Action will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the clean-up standards in the WCAs.
- These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR.
- The soil cleanup limits for the site are set at background concentrations
- All existing buildings on-site will be demolished and disposed of with the mine waste in the WCA. Buildings that are used during the RA will either be decontaminated to UMTRCA limits and taken off-site or disposed of on-site.

M3.8 Spokane Tribe of Indians Hazardous Substances Control Act (HSCA, Resolution 2004-085)

The Spokane Tribe of Indians Hazardous Substances Control Act (HSCA), Resolution 2004-085 is the standard for groundwater, surface water, and soil/sediment clean-up on lands within the Spokane Indian Reservation. The EPA recognizes and treats the Spokane Tribe in the same manner as a state for the Tribe's clean-up standards under NCP (55 Federal Register 8741, March 8, 1990). The HSCA uses a calculated clean-up standard using the table in the HSCA as well as recognizes that background levels are above HSCA standards for most Contaminants of Concern (COCs) and the cleanup standards in such cases are equal to background. The HSCA has been identified as an appropriate requirement to be considered in establishing clean-up levels for soil, sediment, groundwater, and surface water at the Midnite Mine Remediation Project. Clean up standards for surface water, groundwater, soil, and sediment have been identified in Tables 8-1, 8-2, 8-3, and 8-4 of the ROD (EPA, 2006).

In addition, the HSCA provides guidance for the siting of hazardous waste disposal facilities. No hazardous waste (i.e., water treatment residuals) will be disposed of on-site. Water treatment residuals will be temporarily staged on-site and disposed of off-site in accordance with applicable laws.

On-Site Substantive Requirements

- The RA will include consolidating, hydraulically isolating, and covering the mine wastes. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are provided in Tables 4-1 and 4-2 of the BODR and are based on background conditions.
- No hazardous waste (i.e., WTP residuals, construction/maintenance materials) will be disposed of on-site. Water treatment residuals will continued to be disposed of off-site at a licensed facility in accordance with the Residuals Management Plan for the Midnite Mine Water Treatment Plant (the RMP) submitted to EPA on November 1, 2013 (WME, 2013b).

M3.9 National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Uranium Mill Tailings Disposal Sites (40 CFR Part 61, Subpart T)

The National Emissions Standards for Hazardous Air Pollutants (NESHAPs), under 40 CFR 61, Subpart T, requires that 20 pCi/m^2/sec. for radon-222 be used as the standard to limit flux emissions

to ambient air at Midnite Mine. The standard is an average applied over the entire surface of the disposal site and over at least a one year period of time and applies only to emissions from residual radioactive materials to the atmosphere. The NESHAP standard for radon-222 has been identified as an ARAR for the WCA. The cover is designed to meet the standard and radon-222 will be monitored for this criteria to ensure compliance.

On-Site Substantive Requirements

- The RA will consolidate the mine waste into the WCAs and radon flux will be contained by the cover system, presented in the Mine Waste Excavation and Containment included in BODR Appendix D.
- The cover system will consist of a synthetic Polyvinyl Chloride (PVC) geomembrane overlain by a soil cover. The soil cover was designed using UMTRCA protocols to limit radon flux to the standard of 20 pCi/m^2/sec assuming the geomembrane layer was not present.
- Radon flux will be measured from the completed cover system using UMTRCA procedures to ensure radon flux levels are achieved.

M3.10 Resource Conservation and Recovery Act, Subtitle D (40 CFR PARTS 257, Subpart A)

The Resource Conservation Act (RCRA), subtitle D (40 CFR Parts 257, Subpart A) provides siting requirements that limit the disposal of solid waste in certain locations and are identified as an ARAR in the ROD (EPA, 2006). These regulations apply to the short-term management and disposal of the water treatment residuals and require facilities in floodplains to not restrict the flow of the base flood, not reduce the temporary water storage capacity of the floodplain, result in the washout of solid waste; or cause or contribute to the taking of any endangered or threatened species; or cause a discharge of pollutant into waters of the U.S. that violates the NPDES program and must not contaminate an underground drinking water source beyond the solid waste boundary. No WTP residuals will be disposed of on-site or be temporarily stored in a floodplain or contribute to the "taking" of endangered species, violate the NPDES program or contaminated underground drinking water outside the waste boundary. A licensed company will be contracted to transport solid waste to legally dispose the waste at a licensed facility. All necessary DOT requirements will be followed. A number of Dawn Mining Company staff has training for DOT requirements in the handling and transport of LSA I material, if required.

On-Site Substantive Requirements

- All WTP residuals will be legally disposed of at a licensed off-site facility.
- As described in the RMP, the temporary staging of WTP residuals to facilitate off-site transport will not be located in a floodplain.
- As described in the Biological Assessment (WME 2014b), the temporary staging of WTP residuals not would result in the taking of threatened or endangered species.

M3.11 Licensing Requirements for Land Disposal of Radioactive Waste (40 CFR Part 61)

The performance objectives and technical requirements for the Nuclear Regulatory Commission (NRC) licensing of land disposal for radioactive waste will be used as the short-term on-site

management of water treatment residuals and rock containing uranium at levels that qualify the rock as source material. There will not be any on-site disposal of water treatment sludge and all waste rock and contaminated soil will be disposed of in compliance with the ROD and CD which is consistent with the following criteria. These release limits have been identified as ARARs and are as follows.

On-Site Substantive Requirements

- Protection of releases to the general environment in ground water, surface water, air, soil, plants, or animals, would not result in an annual dose of radioactivity exceeding 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of members of the public;
- Protection of individuals from inadvertent intrusion;
- Protection of individuals during operation; and
- Stability of the disposal site after closure.

M3.12 Endangered Species Act (7 USC § 136, 16 USC § 1531 ET SEQ.)

M3.12.1 Section 7 – Consultation

The Endangered Species Act, under 50 CFR 17, provides for the regulatory protection and recovery mechanism for imperiled species and their habitat and makes it unlawful to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a federally listed species. Section 7, under 50 CFR 402, Subpart B, requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action authorized does not jeopardize a listed species or destroy or adversely modify designated critical habitat. A Biological Assessment (BA) has been prepared to analyze the effects of the project on federally listed species at the On-Reservation areas and included as Attachment M-2. There are four endangered species analyzed in the BA as provided by the USFWS for Stevens County Washington: bull trout, Canada lynx, grizzly bear, and Ute's ladies tresses orchid. Only the bull trout has the potential for being within the project area; however, there are no known spawning populations of bull trout in Lake Roosevelt and are thought by USFWS to be wash-over from Lake Coeur d'Alene. The other listed species analyzed do not occur on or in the vicinity of the Spokane Indian Reservation. The effects determination in the BA is that the Action "may affect, but not likely to adversely affect bull trout". If the USFWS concurs with this determination, informal consultation would end and the USFWS will not be required to issue a Biological Opinion. The protection of endangered species has been identified as an ARAR. There is no endangered species habitat at the Rhoads Borrow Area or Ford Borrow Area that would require the need for the preparation of a BA.

On-Site Substantive Requirements

- A Biological Assessment (BA) has been prepared that analyze the effects of the RA on federally listed threatened and endangered species. Bull trout is the only listed species with the potential to occur within the RA area; however, no spawning habitat occurs in Lake Roosevelt. BMPs will be implemented to control turbidity from stormwater runoff as described in the SWMP, located in BODR Appendix O. The BA is attached to BODR Appendix M and was submitted by EPA to USFWS on 9/29/2014.

M3.13 Fish and Wildlife Coordination Act (16 USC § 661 et seq.)

The Fish and Wildlife Coordination Act, requires federal agencies to coordinate and consult with federal and state wildlife agencies as appropriate. As part of the preparation of the BA, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service (NMFS), Spokane Tribe's Natural Resources Department, Washington Department of Fish and Wildlife's Priority Habitats and Species Department, and Washington State's Natural Heritage Program were contacted to see if there were any records of listed species in the vicinity of the project. These agencies did not have any records of listed species within the project area. However, the USFWS does get a number of reports of bull trout in Lake Roosevelt each year. The USFWS has determined that there are no spawning populations of bull trout in Lake Roosevelt and that any bull trout in Lake Roosevelt are likely a result of wash-over from Lake Coeur d'Alene. The coordination with federal, tribal, and state wildlife agencies has been determined to be an ARAR. Coordination with these agencies occurred in April 2013.

On-Site Substantive Requirements

- Consultation with federal, state, and Tribal wildlife agencies occurred as follows:
    - Michelle Ames and Julie Campbell of U.S. Fish and Wildlife Service were contacted on 7/15/2013 and confirmed that the project is outside the currently known grizzly bear and Canada lynx range, and the presence of Utes ladies' tresses orchid. Isolated occurrences of bull trout have been recorded in Lake Roosevelt; however, no known spawning habitat occurs at the lake and that individual bull trout recorded in the lake are likely wash-over from Lake Coeur d'Alene.
    - Justin Yeager of U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NMFS) was contacted on 7/15/2013 and NMFS does not have jurisdiction above Chief Joseph Dam.
    - Lori Guggenmos of Washington Department of Fish and Wildlife, Washington Natural Heritage Program was contacted on 4/23/2013 and GIS data show Blue Creek being bull trout habitat. A follow up correspondence with Lori, and regional biologist Bill Baker determined this record was likely established at a mapping event and is not likely an actual record that needs to be considered. No other records of T&E species are in the area.
    - Jasa Holt of WA Natural Heritage Program was contacted on 5/6/2013 and no T&E plants are in the project area.
    - Brian Crossley of the Spokane Tribe DNR was contacted on 4/23/2013 and Casey Flanagan of the Spokane Tribe DNR responded that there are no records of endangered fish in and around the project area. He provided all the studies published to date.
    - Brent Nichols of Spokane Tribe Department of Natural Resources was contacted on 1/21/2013 and said he does not have any records of bull trout in the area and provided a web links to the Columbia Basin Fish and Wildlife Program to review reports.
    - Katie Easton of Spokane Tribe DNR was contacted on 4/23/2013 and said there are no records of T&E wildlife species on the Reservation.
    - The EPA submitted the BA to USFWS for informal consultation on September 29, 2014.

M3.14 Migratory Bird Treaty Act (16 USC §§ 703–712)

The Migratory Bird Treaty Act (MBTA), under 50 CFR 10.13, prohibits the "taking" of migratory birds, nests, and feathers. If vegetation clearing occurs during the nesting season, pre-construction surveys will be performed to ensure that no active nests are in the area. If actively nesting birds are found, USFWS, WA Department of Fish and Wildlife and the Tribe will be consulted to ensure that nesting birds are not disturbed and the removal of their nest, eggs or young will be avoided until the nest is abandoned or the young have fledged to comply with the MBTA. The protection of migratory birds covered under MBTA has been identified as an ARAR.

On-Site and Off-Site Substantive Requirements

- Clear land and vegetation outside of the bird nesting season (March to July); however, actual season may vary.
- Wildlife biologists will conduct preconstruction bird nesting surveys if clearing is required during the nesting season.
- If active nests are identified within or adjacent to the active construction area, USFWS, Tribe, and WA DFW will be consulted to avoid "take".

M3.15 Protection of Floodplains – Executive Order 11988

Executive Order 11988 mandates federal agencies to protect floodplains by analyzing project effects and minimizing impacts to floodplains for projects that they have approval or permitting authority over. There are no floodplains mapped within the Spokane Indian Reservation; however, the high water for Lake Roosevelt is elevation 1,290 ft AMSL. Other potential floodplains occur along the margins of Blue Creek, and in the Western, Central, and Eastern Drainages. The Blue Creek Pipeline would be primarily constructed in the existing Blue Creek Road outside of the floodplain and then in the floodplain as it enters Lake Roosevelt. The pipeline will be buried and would not impede or restrict the floodplain. The only above ground structure would be the diffuser in the historic Spokane River channel. Following the installation, the surface contours will be returned to pre-construction grades.

In addition, the drainage clean-up in the Western, Central, Eastern, and Northern Drainages will be within stream channels and associated floodplains that consist of wetlands. These impacts are unavoidable and are required to implement the ROD. The work performed within the floodplain has been minimized to the maximum extent practical and would not be considered an adverse impact to the floodplain. The protection of floodplains associated with Executive Order 11988 has been identified as an ARAR and will be incorporated into the project design.

On-Site Substantive Requirements

- Impacts to the floodplain will be minimized through the design, such as minimizing any intrusions or obstructions into the floodplain that would impede floodplain volume or flow velocity.
- Return soil grades to pre-construction condition following construction.

M3.16 Native American Graves Protection and Repatriation Act (25 USC § 3001 et seq.)

The Native American Graves Protection and Repatriation Act, under 43 CFR Part 10, provide for the protection of Native American graves including Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony. No permits are necessary for on-site activities, but pre-construction field surveys were conducted by the Preservation Office as part of Section 106 of the NHPA to identify potential sites. Tribal cultural monitors will monitor ground disturbing activities in areas recommended by THPO. In addition, further protection of graves and cultural items will be protected by implementing applicable measures recommended by THPO. If any Native American graves or cultural items are identified during construction, all activity will be ceased until THPO and the Office of Preservation is consulted to ensure features are protected. THPO recommendations will be followed to ensure compliance with this Act.

On-Site Substantive Requirements

- A Ground Disturbance Permit application was submitted to the Spokane Tribe's Tribal Historic Preservation Officer (THPO).
- The Spokane Tribe Archaeology & Preservation Office (Preservation Office) will conduct cultural resource surveys to identify the potential for cultural resources prior to construction. A cultural resource monitor will also be present during construction in areas with the potential for cultural resources. If any grave sites or funerary objects are identified, construction work will stop immediately and the THPO will be consulted to determine recovery and preservation options.
- The preservation office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.

M3.17 American Indian Religious Freedom Act (42 USC § 1996) (PL 95-341)

The American Indian Religious Freedom Act directs federal agencies to evaluate their policies and procedures to protect and preserve Native American religious cultural rights and practices. Compliance with this Act will not require any permits for on-site activities; however, any relevant cultural right or practices that need to be preserved will be identified as part of the Section 106 of NHPA review being conducted by the Office of Preservation under the purview of THPO. The preservation of Native American cultural rights and practices has been identified as an ARAR.

On-Site Substantive Requirements

- Prior to site disturbances, the Preservation Office will conduct a literature review, interviews with former mine employees, historical research, and field surveys to identify any religious, ceremonial, and burial sites. If any sites are identified inside the project boundary, THPO will be consulted to explore alternatives and determine mitigation, if necessary.
- The preservation office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.
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M3.18 National Historic Preservation Act (16 USC § 470 et seq.) (PL 89-668) Section 106 Consultation (16 USC § 470f)

Section 106 of the National Historic Preservation Act (NHPA), under 36 CFR Part 800, requires federal agencies to consider effects of projects that they have approval or permitting authority over to protect historic properties and cultural resources. Section 106 of HNPA requires the consultation with State or Tribal Historic Preservation Officers (Spokane Tribal Historic Preservation Officer) and stakeholders to avoid, minimize, or mitigate adverse effects to cultural and historic resources.

On September 23, 2013 DMC met with Randy Abrahamson who serves as Spokane Tribe's THPO and James Harrison, Jackie Corley, and Chris Casserino of the Spokane Tribe Archaeology & Preservation Office (Preservation Office) to review in-the-field the entire Midnite Mine Remediation Project footprint. During the meeting, we requested that the entire footprint be reviewed for cultural issues in accordance with NHPA requirements. The THPO recommended a professional archaeological survey and sub-surface testing of the area and that ground disturbing activity be monitored. The Preservation Office conducted a literature search, interviews with former mine employee, and cultural field surveys in 2014 and 2015 to determine if there are any cultural features that are eligible for listing on the National Register of Historic Places, under the criteria at 36 CFR Part 60. The Preservation Office documented the mancamp structures with photographs, mapped (via GPS) and notes to include in the final report. The Preservation Office confirmed in an email to EPA (dated 3/17/2015) that the structures are not culturally significant.

The protection of cultural and historic resources under the National Historic Preservation Act is an identified ARAR. Prior to the overall cultural surveys of the entire footprint, exploratory work has been required that consisted of ground disturbing activities on lands within the Reservation. During those activities, the THPO indicated a cultural monitor from the Preservation Office monitoring the activity would be sufficient to ensure compliance with NHPA. Exploratory ground disturbing activities consisted of backhoe test pits along the Blue Creek Pipeline, drinking water well installation, and wetland delineation.

On-Site Substantive Requirements

- Protect or mitigate impacts to listed sites or sites eligible for listing on the National Register of Historic Places.
- The Preservation Office conducted a literature review, interviews with former mine employees, historical research, and field surveys to determine if any listed or eligible sites are present within the RA area in 2014 and 2015. No listed or eligible sites were identified. If eligible sites are found during cultural monitoring of construction, the Preservation Office will comply with Section 106 of the NHPA and consultation with the THPO and other agencies will be initiated to evaluate alternatives, minimize impacts, and determine mitigation, if necessary.
- The preservation office will prepare a report summarizing the results of their literature search, interviews of previous mine employees, field survey, monitoring, historical research, and THPO consultation if necessary.

M3.19 Office of Solid Waste and Emergency Response (OSWER)

M3.19.1 OSWER Directive No. 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination (August 2, 1997)

This directive clarifies guidance for establishing clean-up levels for radioactive contamination at CERCLA sites for human health protection. The directive describes the appropriate risk exposure or dose level range for radionuclides as a cancer risk range between 10^{-4} and 10^{-6}, cited in 40 CFR 300.430 (e)(2)(i)(A)(2), which are more protective than NRC's regulations. Attachment A to Directive 9200.4-18 lists potential ARARs for radiation on CERCLA projects. Attachment B indicates that EPA concludes that levels equal to or less than 15 millirems/yr is an effective dose equivalent that is protective and achievable, corresponding to an excess lifetime cancer risk of approximately 3 x 10-4. However, EPA guidance does not recommend cleanup levels be established at levels below background. Clean up levels using regulatory standards or risk based standards were used to develop cleanup standards unless background levels were higher than those standards. The ROD (EPA, 2006) establishes the clean-up standards for this project, which will be complied with as part of the project remediation.

On-Site Substantive Requirements

- The RA will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the cleanup standards in the WCAs.
- These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are based on background levels are provided in Tables 4-1 and 4-2 of the BODR.

M3.19.2 OSWER Directive No. 9200.4-25, Use of Soil Clean-up Criteria 40 CFR Part 192 as Remediation Goals for CERCLA Sites (February 2, 1998)

This directive clarifies the extent to which the soil clean-up criteria in 40 CFR Part 192 Subpart A were used when setting remediation goals for subsurface soils. Subpart A standards states that the control of residual radioactive materials and their listed constituents shall be designed so that there will not be more than two release rates exceeding an average of 20 pCi/m^2/sec. for radon 222. These limits will be complied with as part of the project remediation.

On-Site Substantive Requirements

- The RA will include consolidating, isolating, and covering the mine wastes including all soils and sediments in excess of the cleanup standards in the WCAs. These activities are described in BODR Appendix D – Mine Waste Excavation and Containment. The cleanup standards for surface material and sediments are based on background levels and are provided in Tables 4-1 and 4-2 of the BODR.

Other Regulatory Requirements To Be Considered

M3.20 Spill Prevention, Countermeasures and Control Rule (40 CFR Part 112.6)

The EPA requires certain facilities to prepare and implement Spill Prevention, Countermeasures, and Control (SPCC) Plans to prevent oil discharges into navigable waters and adjoining shorelines.

The SPCC rule is part of the Oil Pollution Prevention regulations in 33 CFR Part 112 under Section 311 of the Federal Water Pollution Control Act, or CWA. If a SPCC is needed for the Ford Borrow Area, Dawn Millsite's SPCC plan would be modified to include the new borrow area. No fuel will be stored at the borrow areas and spill kits will be readily available where work is being performed.

On-Site Substantive Requirements

- A SPCC for the WTP is provided in the OM&M Plan in Appendix O.
- A site-wide SPCC will be prepared in accordance with good engineering practices and be certified by a Professional engineer and contain the following elements:
    - Facility diagram and facility description;
    - Oil discharge prediction;
    - Secondary containment and diversion structures;
    - Facility drainage;
    - Bulk storage requirements- inspection, overfill and integrity;
    - Transfer procedures and equipment;
    - Qualified oil-filled operational equipment;
    - Brittle fracture evaluation for above ground field containers;
    - Personnel training and prevention briefings;
    - Recordkeeping;
    - Five year Plan review;
    - Management approval; and
    - Plan certification.

Inspection in accordance with the OM&M Plan in BODR Appendix P and Site-Wide Monitoring Plan in BODR Appendix Q.

Off-Site Permitting Requirements

- A SPCC will be prepared for the Rhoads Borrow Area or Ford Borrow Area and include the components specified above.

M3.21 Clean Air Act (42 USC §7401 ET SEQ.)

M3.21.1 Introduction

The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Under the CAA, the Environmental Protection Agency (EPA) has established air quality standards to protect public health and public welfare as well as protecting against decreased visibility and regulating emissions of hazardous air pollutants. Implementation of the CAA standards within the exterior boundaries of the Spokane Reservation are covered under the Federal Air Rules for Reservations (FARR) (40 CFR Parts 9 and 49). The Midnite Mine Remedial Action (RA) occurs within the Spokane Indian Reservation.

M3.21.2 Overview of the CAA and EPA's implementing regulations

M 3.21.2.1 NAAQS

The National Ambient Air Quality Standards (NAAQS) were developed by the EPA to identify levels of certain pollutants which have detrimental effects on human health (primary criteria) and public welfare (secondary criteria). Primary standards provide public health protection, including

protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Standards have been developed for sulfur dioxide (SO2), carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter (PM) less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), and lead (Pb), which are known as the criteria pollutants (Table M-6).

Table M-5.National Ambient Air Quality Standards

Pollutant	Primary/Secondary	Averaging Time	Level
CO	Primary	8 hr	9 ppm
		1 hr	35 ppm
Pb	Primary/Secondary	Rolling 3 month avg.	0.15 µg/m^3
NO_2	Primary	1 hr	100 ppb
	Primary/Secondary	Annual	53 ppb
O_3	Primary/Secondary	8 hr	0.075 ppm
$PM_{2.5}$	Primary	Annual	12 µg/m^3
	Secondary	Annual	15 µg/m^3
	Primary/Secondary	24 hr	35 µg/m^3
PM_{10}	Primary/Secondary	24 hr	150 µg/m^3
SO_2	Primary	1 hr	75 ppb
	Secondary	3 hr	0.5 ppm

The Spokane Indian Reservation has been designated an Attainment Area that complies with these NAAQS. The nearest area that has fallen below the NAAQS is the Spokane metro area for ozone and particulate matter; however, it has since raised air quality above the NAAQS and is now designated a Maintenance Area. The Spokane Indian Reservation is also designated as a Class I airshed, which is a designation reserved for the most pristine airsheds such as National Parks and designated wilderness areas. Class I airsheds are protected for visibility and other Air Quality Related Values (AQRVs).

M 3.21.2.2 PSD/NSR Requirements

The applicability of the Tribal Prevention of Significant Deterioration (PSD) Program's New Source Review (NSR) permitting requirements is based on whether a facility is a major emitting facility that exceeds the Tribal NSR Major Source Threshold. NSR Major Sources in Attainment Areas are stationary sources that have a Potential to Emit (PTE), either 100 tons per year (TPY) of "any air pollutant" from one of 28 listed source categories or 250 TPY from other source categories. PTE is the maximum capacity of a stationary source to emit a pollutant under its physical and operational design, generally at 8,760 hours per year. The Remedial Action does not fall in any of the 28 listed source categories. Applicable NSR Major and Minor Source Thresholds established for the Tribal New Source Review Rule in Attainment Areas are provided in Table M-7.

Table M-6.Tribal NSR Rule Thresholds for Attainment Areas.

Pollutants	NSR Minor Source Threshold (TPY)	NSR Major Source Threshold (TPY)
Carbon Monoxide (CO)	10	250
Nitrogen Oxides (NO_x)	10	250
Sulfuric Dioxide (SO_2)	10	250
Volatile Organic Compounds (VOC)	5	250
Particulate Matter (PM)	10	
PM_{10}	5	250
$PM_{2.5}$	3	250
Lead (Pb)	0.1	250
Fluorides	1	250
Sulfuric acid mist	2	250
Hydrogen sulfides (H_2S)	2	250
Total reduced sulfur (including H_2S)	2	250
Reduced sulfur compounds (including H_2S)	2	250
Municipal waste combustor emissions	2	250
Municipal solid waste landfills emissions	10	250

TPY – tons per year

A facility that is a NSR Major Stationary Source must also analyze whether the source's emissions may affect visibility in a Class I area (see 40 CFR § 52.21(p)). EPA policy interprets "may affect" to include all major sources within 100 km of a Class I area. The visibility analysis must be assessed by the appropriate Federal Land Manager to determine whether the source would have an adverse impact on visibility. A facility that is a minor source - a source that does not meet the definition of a NSR Major Stationary Source - is not required to analyze its effect on visibility in a Class I area, unless the minor source undergoes a modification that would increase emissions above a NSR "Major Source" threshold.

M 3.21.2.3 Title V

The CAA's Title V program requires major sources and certain other sources to obtain a permit that incorporates all of the CAA requirements for the facility into one document. Title V operating permits are legally enforceable documents issued to air pollution sources after the source has begun to operate. Title V Major Source Thresholds are separate requirements than those of NSR Major Source Thresholds.

Title V Major Source Thresholds are 100 TPY for any pollutant in Attainment Areas; or 10 TPY or more of any individual Hazardous Air Pollutant (HAPs) (section 112(b) of the CAA) or 25 TPY or more for all HAPs emitted.

M 3.21.2.4 FARR

In June 2005, under authority of Section 301(1) and 301(d)(4) of the CAA, the EPA promulgated implementation plan provisions to protect air quality within Indian Reservations. These provisions are specifically identified in 40 CFR Part 49, Subpart M, Implementation Plans for Tribes Region 10. This Federal Implementation Plan referred to as the FARR includes all persons and businesses

located within the federally recognized exterior boundaries of 39 Reservations in Idaho, Oregon, and Washington. The Spokane Indian Reservation is included under these rules.

FARR exempts a number of activities and emission sources for purposes of determining Major Source Thresholds under PSD/NSR and Title V. Exempted activities and sources include:

- Air pollution sources that do not have the potential to emit more than 2 tons per year of any regulated air pollutant;
- Mobile sources (cars, trucks, boats, trains, etc.);
- Single-family residences and residential buildings with four or fewer apartments or living units;
- Air conditioning units used for human comfort and that do not release manufacturing or industrial process pollutants into the air;
- Furnaces and boilers used only for space heating with a rated heat input capacity of less than 400,000 British thermal units per hour (Btu/h);
- Cooking of food, except for wholesale businesses that cook and sell cooked food;
- Consumer use of office equipment and products;
- Janitorial services and consumer use of janitorial products;
- Maintenance and repair activities, except for air pollution sources that maintain and repair equipment as a business;
- Agricultural, forestry, and silvicultural activities (including burning); and
- Open burning.

FARR also requires that visible and fugitive PM emissions be controlled and monitored for activities within the Indian Reservation. 40 CFR § 49.124 establishes that visible emissions from air stationary sources may not exceed 20 percent opacity, averaged over six consecutive minutes, as measured by EPA Method 9. 40 CFR § 49.126 establishes rules for limiting fugitive PM emissions from pollution sources and requires annual monitoring. EPA Method 22 is used to determine the presence of fugitive emissions.

M 3.21.2.5 NESHAPs

The CAA also regulates Hazardous Air Pollutants (HAPs). HAPs are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects or adverse environmental effects. Section 112 of the CAA identifies 187 hazardous air pollutants regulated by source category. EPA has adopted National Emission Standards for Hazardous Air Pollutants (NESHAPS) for certain HAPs and source categories.

NESHAPs are found in 40 CFR Part 61 and 40 CFR Part 63. Part 61 NESHAPs regulate only seven hazardous air pollutants: Asbestos, Beryllium, Mercury, Vinyl chloride, Benzene, Arsenic, and Radon/radionuclides. The NESHAPs promulgated after the 1990 Clean Air Act Amendments are found in 40 CFR Part 63. These standards require application of technology based emissions standards referred to as Maximum Achievable Control Technology (MACT) for specific sources. The post-1990 NESHAPs are also referred to as MACT standards.

Potentially applicable NESHAPS

Subpart M – National Emission Standards for Asbestos (40 CFR § 61.140 et seq.)

Subpart T - National Emission Standards for Radon Emissions from the Disposal of Uranium Tailings (40 CFR § 61.220 et seq.).
Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR § 63.6580 et seq.).

M 3.21.2.6 NSPS

Section 111 of the CAA authorized EPA to develop technology based standards which apply to specific categories of stationary sources. These standards are referred to as the New Source Performance Standards (NSPS) and are found in 40 CFR Part 60. The NSPS apply to new, modified and reconstructed affected facilities in specific source categories. In general, sources subject to NSPS are required to perform an initial performance test and periodic performance tests to demonstrate compliance.

Potentially applicable NSPS standards

- Subpart OOO - Standards of Performance for Nonmetallic Mineral Processing Plants (40 CFR § 60.670 et seq.). These standards apply to certain sources at fixed or portable nonmetallic mineral processing facilities including crushers, screening operations and belt conveyors.
- Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR § 60.4200 et seq.). These standards would apply to diesel engines manufactured after a certain date that are used to operate certain equipment including emergency generators.
    - All stationary engines will be certified to meet EPA required emission standards for the year manufactured.
    - All stationary engines will be maintained and operated consistent with the manufacturer's recommendations. Records of conducted maintenance will be kept, consistent with a maintenance plan to demonstrate compliance and to maintain and operate the engine consistent with good air pollution control practice for minimizing emissions.
    - Emergency stationary engines, will be operated for the purpose of maintenance checks and readiness tests, consistent with the manufacturer's recommendation, and will not exceed 100 hours per year.
    - For engines over 500 hp an emissions performance test will be conducted every 8,760 hours of engine operation or three years whichever comes first to demonstrate compliance with applicable emissions standards.

M 3.21.2.7 Washington Air Operating Permits

Washington Administrative Code (WAC) 173-401 provides for Washington's Operating Permit Regulation are applicable to the Ford Borrow Area. This code requires facilities to have an Operating Permit if it has the potential to emit any of the following:

- More than 100 tons per year of any pollutant, such as NO_x, VOCs, CO, SO_2, and PM. Lower thresholds may apply in nonattainment areas;
- More than 10 tons per year of any HAP, as listed in subsection 112(b) of the federal Clean Air Act; or

- More than 25 tons per year of a combination of any HAPs.

An Operating Permit may also be required if it is subject to certain federal air quality requirements, including:

- Title IV Acid Rain Program;
- New Source Performance Standards (NSPS); or
- National Emission Standard for Hazardous Air Pollutants (NESHAP).

WAC 173-400-110(4)(x) provides exemptions for construction activities that do not result in new or modified stationary sources or portable stationary sources, such as those activities at the Ford Borrow Area. WAC 173-400-040(4)(a) requires that fugitive dust sources must take reasonable precautions to prevent fugitive dust from becoming airborne and must maintain and operate the source to minimize emissions. Visual emissions will not exceed 20 percent opacity for more than three minutes in any hour at the emission point or within a reasonable distance of the emission point.

M3.21.3 AIR EMISSIONS INVENTORY

An air emissions inventory was conducted to identify emission sources at the site and those anticipated during construction of the RA. This inventory was then used to determine if the Site's PTE emissions would exceed the PSD/NSR Major Source Thresholds and/or Title V Major Source Thresholds. Emission factors used to determine emission rates were taken from AP-42, Compilation of Air Pollutant Emission Factors, fifth Edition, 1995, Volume I, Stationary Point and Area Sources (EPA, 1995) or other emission factors sources where available. Reasonably available information and assumptions that are consistent with the current design were used since equipment has not yet been specified. Once the contractor and the specific equipment are selected any significant difference in the emissions inventory will be updated. Conservative assumptions were used in identifying emission source equipment such as material handling capacity, engine power (hp) and generation needs, tank sizes, active construction footprint, etc. Identified emission sources are provided in Table M-8. Activities and sources that are exempt under FARR or CAA were excluded from the inventory. No air emissions from stationary sources at the Rhoads Borrow Areas are anticipated.

Table M-7.Midnite Mine Stationary Emission Sources (existing and anticipated).

Stationary Emission Sources	
Downhill Conveyor Units (250 hp diesel)	BPA Pump Generator (1.5 hp diesel)
Radial Conveyor Units (50 hp diesel, each up to five)	South Pond Pump Generator (30 hp diesel)
Primary Jaw Crusher (225 tph, 300 hp diesel)	East Seep Pump Station (12 hp diesel)
Secondary Cone Crusher (225 tph, 225 hp diesel)	Blood Pool Pump Station (24 hp diesel)
Primary Screening (Grizzly) (50 hp diesel)	PCP Pump Station (135 hp diesel)
Secondary Screening Performed with Crusher	Western Drainage Alluvial GW Wells (47 hp diesel)
Tertiary Screening	WTP

(50 hp diesel)	(604 hp diesel, emergency generator)
Pit 4 Pump Generator (150 hp yr 1 / 50 hp yr 2, 3, 4 diesel)	Diesel Tanks (916,448 gpy)
Pit 3 Pump Generator (50 hp diesel)	Gasoline Tanks (219,960 gpy)
Lime Silo (360 tpy)	

Abbreviations: horsepower (hp), tons-per-hour (tph), year (yr), Backfill Pump Area (BPA), Pollution Control Pond (PCP), ground water (GW), Water Treatment Plant (WTP), gallons-per-year (gpy), and tons-per-year (tpy).

A summary of the PTE and Estimated Actual Emissions by year based on the assumed construction schedule are provided in Tables M-9 and M-10, and HAPs emissions in Table M-11. Details of the spreadsheet calculations are provided in Attachment M-3 of Appendix M of the Basis of Design Report (BODR)(WME, 2014) and are organized into four parts: PTE calculations (Attachment M-3a), Estimated Actual Emission (Attachment M-3b), HAPs (Attachment M – 3c), and Tanks (Attachment M – 3d). Each section includes basic assumptions, a summary of emissions, and emissions broken out by the various activities and equipment. After Year 10, the construction aspect of the Remedial Action is assumed to be complete and long-term operations and maintenance emissions are expected to be consistent with year 10 emissions.

The PTE for the material handling equipment was based on a maximum run-time of 8,760 hours per year. The PTE for the emergency generators was based on maximum hourly emission rates for the various pollutants and a maximum run-time of 500 hours per year. All other generators and pumps were calculated with a maximum run-time of 8,760 hours per year. Detailed PTE calculations are provided in Attachment M-3a of Appendix M of the BODR (WME 2014) and include: Table 1 Estimated Potential to Emit of Criteria Pollutants, Table 2 Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task), Table 3 Estimated Potential to Emit of Green House Gases (GHGs) by Year and by Task, and Task Specific Worksheets.

The estimated Actual Emissions are based on estimated actual hours of operations for each piece of equipment over the 10 year period. For material handling and associated power requirements, it is based on the amount of drain rock required for each phase and estimated duration of processing time. Emissions from emergency generators are based on minimal use and annual testing to ensure proper functionality. Calculations for estimated Actual Emissions in Attachment M-3b includes: Table 1 Estimated Potential to Emit of Criteria Pollutants, Table 2 Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task), Table 3 Estimated Potential to Emit of Green House Gases (GHGs) by Year and by Task, and Task Specific Worksheets.

HAPs were calculated based on estimated actual hours and used AP-42 emission factors from stationary sources and fugitive construction dust based on composition of mine waste and soil (WME, 2012). Mine waste and soil composition was derived from analytical results presented in the RI/FS (URS, 2005). HAPs calculations in Attachment M-3c include: Table 1 Summary of Total Estimated Actual Emissions of Hazardous Air Pollutants (HAPs) by Year, Table 2 Calculation of Hazardous Air Pollutant (HAP) Concentrations in Dust by Material Type, Table 3 Calculation of Waste Rock Earthwork Hazardous Air Pollutants (HAP) Emissions by Year, Table 4 Calculation of Ore/Protore Earthwork Hazardous Air Pollutant (HAP) Emissions by Year, Table 5 Calculation of Rhoads Cover Soil Hazardous Air Pollutant (HAP) Emissions by Year, Table 6 Calculation of Silo and Engine Hazardous Air Pollutants (HAP) Emissions by Year, Table 7 Calculation of Hazardous Air Pollutant (HAP) Emissions from Unpaved Roads and Material Processing by Year, Table 8 Calculation of Hazardous Air Pollutant (HAP) Emissions from Generators by Year, and Table 9 Calculation of Fuel Transfer and WTP Hazardous Air Pollutant (HAP) Emissions by Year.

The parameters of the liquid and dry material storage and their use were input into EPA's TANKS 4.0.9d Software. Tank emissions calculation outputs include: Tank Identification and Physical Characteristics, Liquid Contents of Storage Tank, Detail Calculations (AP-42), and Individual Tank Emission Totals for each tank.

No emissions from stationary sources are anticipated at the Rhoads Borrow Area or at any other Off-Site area.

Table M-8.Potential to Emit Emissions (TPY)

Pollutant	Year									
	1	2	3	4	5	6	7	8	9	10
NO_x Uncontrolled	217.41	217.41	217.41	217.41	217.41	217.41	217.41	217.41	217.41	217.41
CO	46.90	46.90	46.90	46.90	46.90	46.90	46.90	46.90	46.90	46.90
SO_x	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75
PM_{10}	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19
$PM_{2.5}$	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19	54.19
VOC	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60
GHG CO_2e	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742
GHG mass	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742	5,742

See Attachment M-3 for Potential To Emit (PTE) spreadsheet calculations.

Table M-9.Estimated Actual Emissions (TPY).

Pollutant	Year									
	1	2	3	4	5	6	7	8	9	10
NO_x Uncontrolled	16	2	21	31	8	8	8	8	8	3
CO	3	0	5	7	2	2	2	2	2	1
SO_x	1	0	1	2	0	0	0	0	0	0
PM_{10}	6	0	9	14	0	0	0	0	0	0
$PM_{2.5}$	1	0	1	1	0	0	0	0	0	0
VOC	1	0	2	3	0	0	0	0	0	0
GHG CO_2e	590	83	781	1,142	159	159	159	159	159	113
GHG mass	590	83	781	1,142	159	159	159	159	159	113

See Attachment M-3 for Estimated Actual Emissions spreadsheet calculations.

Table M-10. Estimated Actual HAPs emissions (TPY), including fugitive sources

Description	Year									
	1	2	3	4	5	6	7	8	9	10
Chloride	4.56E-04	5.33E-04	1.76E-03	2.73E-03	1.79E-03	3.34E-03	3.14E-03	1.48E-03	8.70E-04	7.76E-04
Phosphorus	0.46	0.54	1.78	2.76	1.81	3.38	3.18	1.50	0.88	0.79
Sulfate	0.16	0.19	0.62	0.96	0.63	1.17	1.10	0.52	0.31	0.27
Antimony	0	0	0	0	0	0	0	0	0	0
Arsenic	0.04	0.04	0.14	0.21	0.14	0.26	0.25	0.12	0.07	0.06
Beryllium	1.36E-03	1.59E-03	5.25E-03	8.11E-03	5.33E-03	9.95E-03	9.34E-03	4.41E-03	2.59E-03	2.31E-03
Cadmium	2.17E-04	2.54E-04	8.40E-04	1.30E-03	8.53E-04	1.59E-03	1.49E-03	7.06E-04	4.14E-04	3.70E-04
Chromium	0.02	0.02	0.07	0.10	0.07	0.13	0.12	0.06	0.03	0.03
Cobalt	0.01	0.01	0.05	0.08	0.05	0.09	0.09	0.04	0.02	0.02
Lead	0.02	0.02	0.08	0.12	0.08	0.15	0.15	0.07	0.04	0.04
Manganese	0.93	1.09	3.60	5.56	3.66	6.82	6.41	3.03	1.78	1.58
Mercury	4.34E-05	5.08E-05	1.68E-04	2.60E-04	1.71E-04	3.18E-04	2.99E-04	1.41E-04	8.29E-05	7.39E-05
Nickel	0.02	0.02	0.07	0.10	0.07	0.13	0.12	0.06	0.03	0.03
Selenium	2.93E-04	3.43E-04	1.13E-03	1.75E-03	1.15E-03	2.15E-03	2.02E-03	9.53E-04	5.59E-04	4.99E-04
Radionuclides	0.08	0.10	0.33	0.51	0.33	0.62	0.58	0.28	0.16	0.14
Benzene	0.04	0.02	0.04	0.05	0.03	0.03	0.03	0.03	0.03	0.02
Toluene	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	9.26E-03
Xylenes	0.01	7.62E-03	0.01	0.01	7.89E-03	7.89E-03	7.89E-03	7.89E-03	7.89E-03	6.45E-03
Propylene	0.10	0.07	0.11	0.13	0.07	0.07	0.07	0.07	0.07	0.06
1,	1.58E-03	1.05E-03	1.62E-03	1.92E-03	1.08E-03	1.08E-03	1.08E-03	1.08E-03	1.08E-03	6.45E-03
Formaldehyde	0.05	0.03	0.05	0.06	0.03	0.03	0.03	0.03	0.03	0.03
Acetaldehyde	0.03	0.02	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.02
Acrolein	3.73E-03	2.47E-03	3.84E-03	4.54E-03	2.56E-03	2.54E-03	2.56E-03	2.56E-03	2.56E-03	2.09E-03
PAH	6.77E-03	4.49E-03	6.97E-03	8.25E-03	4.65E-03	4.65E-03	4.65E-03	4.65E-03	4.65E-03	3.80E-03
HCl	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	2.66	2.84	7.67	11.39	7.68	13.61	12.84	6.51	4.16	3.77

See Attachment M-3 for Estimated Actual Emissions of Hazardous Air Pollutant (HAPs) spreadsheet calculations.

M3.21.4 ANALYSIS

Based on the PTE, the activities proposed at the Site are not considered to be a Major Source for purposes of the PSD/NSR program. The EPA Air Administrator confirmed in an email dated September 3, 2014 that the PTE is well below the PSD applicable thresholds for a Major Source and would constitute as a minor source under the Tribal NSR. There are no substantive requirements under the PSD/NSR Program applicable to minor sources. The EPA Air Administrator also confirmed that modeling is not necessary since the actual emissions will be distributed across the project site and the PTE emissions are conservative, both with emission values and in sequential operation.

Based on the PTE, the source exceeds the Title V Major Source Thresholds for NOx. However, actual emissions of NOx will be less than 50 percent of the Major Source Threshold for Title V Permitting (100 TPY). The source is not a major HAPs source (HAPs emissions are below 10 TPY, individually, and 25 TPY, cumulatively). Consistent with EPA's guidance regarding PTE for Part 71 Implementation in Indian Country, the source should be considered a minor source for purposes of the Federal Operating Permits Program under 40 CFR Part 71.

Consistent with EPA's guidance, for every consecutive 12-month period (commencing after start-up of the stationary sources), the source will maintain adequate records to demonstrate that actual emissions are kept below 50 percent of the Major Source Threshold for NOx. If calculations indicate actual emissions at or greater than 50 percent of the Major Source Threshold for NOx, the source will limit run-time of the various equipment to prevent NOx emissions from exceeding 100 TPY.

With the exception of the WTP, the Midnite Mine does not contain radioactive material subject to NRC or Washington State regulatory requirements. Washington State is an "Agreement State". That is Washington has entered into an agreement with the Nuclear Regulatory Commission (NRC) to regulate the use of radioactive materials within the state. The Washington Department of Health (WDOH) issued a Radioactive Materials License (RML) to Dawn Mining for the WTP. The license was terminated on December 31, 2008. The WTP residuals are managed, stored and disposed of in accordance with the license conditions in the terminated WDOH license. The WTP residuals do not include air emissions and the WDOH RML did not include conditions for monitoring emissions from the WTP residuals except as required for occupational radiation protection. Further, the NRC promulgated standards for the protection of public health from the adverse effects of radioactive emissions from licensed materials under 10 CFR Part 20, Subpart D §20.1301 (Dose limits for individual members of the public) and 20.1302 (Compliance with dose limits for individual members of the public). WDOH adopted the 10 CFR 20 standards (WAC 246-221). The effective dose limit to individual members of the public is 0.1 rem (1 mSv) above background in a year (WAC 246-221-060). In addition, 20 CFR §20.1101 and WAC 246 221-005 mandate an annual constraint limit of 0.01 rem (0.1 mSv) per year on radioactive air emissions, excluding radon and background. Based on the mine waste composition, the control of fugitive dust as described in the Air Emission Control Technology, and the required regulatory monitoring, radiological doses are not expected to be exceeded. If these voluntary thresholds are exceeded, a determination will be made if the exposure from the source can be reduced or if the continued implementation of the RA is required to reduce the exposure level.

The implementation of the RA will include compliance with the following substantive requirements in accordance with the CAA and FARR.

On-Site Substantive Requirements

- A site specific fugitive dust control plan will be prepared prior to commencing construction or demolition (40 CFR §49.126).
- Implement work practices in accordance with Asbestos NESHAP (40 CFR §160.145) during demolition and disposal of any asbestos materials if they are found.
- Within 90 days after beginning operations, the facility will be registered with EPA under FARR requirements, and annually thereafter by February 15 of each year (40 CFR Part 49, Section 138). – EPA considers this an administrative requirement that is voluntary and not required under the CERCLA permit exemption.
- Maintain adequate records to demonstrate that actual emission remain below 50 percent of the PTE thresholds for Major Source status for purposes of Title V.
- If necessary, prevent emissions from stationary sources from exceeding 100 TPY of NOx by limiting run-time for certain equipment, installing non-resettable runtime meters on the engines and calculating emissions on a rolling 12 month basis.
- Implement Best Management Practices (BMPs) to control fugitive PM as described in the Surface Water and Sediment Controls Plan in BODR Appendix F and the Operations, Maintenance, and Monitoring (OM&M) Plan in BODR Appendix P.
- Monitor visible emissions in accordance with EPA Method 9 and fugitive PM emissions with EPA Method 22 within 30 days of start of the operation and on an annual basis thereafter, during typical operating and weather conditions (40 CFR Part 49.124 and 49.126). The date, time, and results of the survey will be documented.
    - If visible emissions from stationary sources exceed 20 percent opacity requirement, an action plan will be prepared to identified sources and actions to prevent exceedance.
    - If fugitive PM emission is identified, measures will be taken to minimize fugitive emission.
- Comply with the applicable requirements of 40 CFR § 60.4200 et seq. for stationary compression ignition internal combustion engines.
    - All stationary engines will be certified to meet EPA required emission standards for the year manufactured.
    - All stationary engines will be maintained and operated consistent with the manufacturer's recommendations. Records of conducted maintenance will be kept, consistent with a maintenance plan to demonstrate compliance and to maintain and operate the engine consistent with good air pollution control practice for minimizing emissions.
    - Emergency stationary engines, will be operated for the purpose of maintenance checks and readiness tests, consistent with the manufacturer's recommendation, and will not exceed 100 hours per year.
- Comply with the applicable requirements of 40 CFR § 63.6580 et seq. for stationary reciprocating internal combustion engines.
    - Stationary combustion engines will comply with EPA Tier III or Tier IV emission standards, excluding the rock crusher equipment.

- Comply with the applicable requirements of 40 CFR § 60.670 et seq. for sources at nonmetallic mineral processing facilities.
    - If a bag house is used to control fugitive emissions on the rock crusher, quarterly monitoring using EPA Method 22 for will be conducted for 30 minutes to determine if fugitive PM emissions are being emitted from the baghouse (40 CFR §60.674). If fugitive PM emissions are identified, corrective actions will be initiated within 24 hours. Quarterly monitoring will be documented as required by 40 CFR §60.674.
- Comply with the applicable requirements of 40 CFR §49.130 et seq. for rules for reducing sulfur in fuels.
    - Ultra-low sulfur diesel fuel will be used for diesel engines re-fueled on-site.
- Comply with the applicable requirements of 40 CFR §63.6580 *et seq*. for National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR).
    - If the stationary engine for the rock crushers was manufactured prior to June 12, 2006, the non-emergency, non-black start CI stationary RICE ≤ 300 hp would:
        - Change oil and filter every 1,000 hours of operation or annually, whichever comes first;
        - Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary;
        - Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.
    - If the stationary engine for the rock crushers was greater than 300hp and manufactured prior to June 12, 2006, additional requirements would apply (Table 2d to Subpart ZZZZ of Part 63).

Off-Site Permitting Requirements – Rhoads Borrow Area

- Monitor and document fugitive PM at the Rhoads Borrow Area as described above.

M3.21.5 AIR EMISSIONS CONTROL TECHNOLOGY

Consistent with the rules for limiting fugitive particulate matter under 40 CFR §49.126, air emissions control technology will be implemented at the Site to minimize fugitive PM. The control technologies described in Basis of Design Report (BODR) are listed below summarized.

Stationary Internal Combustion Engines

- With the exception of the rock crusher and it's supporting equipment (conveyors and screens), any stationary internal combustion engines used for the project will comply with at least the Tier III or IV EPA emissions standards (40 CFR § 60.4200 et seq.).
- All stationary compression ignition internal combustion engines will be operated and maintained in accordance with the manufacturer's instructions (40 CFR § 60.4200 *et seq*.).

Fuel

- All project specific diesel fueled equipment will use ultra-low sulfur diesel fuel.
- Equipment will be appropriately sized to minimize fuel consumption and emissions.

- Engine idling will be minimized to control exhaust emissions.

Rock Crusher

- The rock crusher units will be equipped with continuous wet suppression emitters or ventilated abatement equipment to control dust, specifically at all crushers, screens, drop points, and other possible release points.
- The drop distance for developing storage/stock piles will be minimized.
- If practicable and technically feasible, diesel particulate filters will be used on the rock crusher engines.

Dust Control on Roads

- The New Site Access Road from the Westend-Wellpinit Road to the Construction Support Facilities will be paved to control fugitive dust.

Dust Control on Roads (cont.)

- Water and/or biodegradable dust suppressants (e.g. lignin sulfonate) will be applied directly onto soils, work areas, and dirt roads as necessary to control dust.
- To minimize water use, organic dust suppressant additives such as lignin sulfonate will be used during demolition and construction activities. Use of dust suppressants will be coordinated and approved by the Tribe.

Speed Limits

- On-site and haul roads speed limit and no-idle zone signs shall be posted and designed to comply with WSDOT requirements, including but not limited to sign size, letter size, and posts. Size of lettering shall comply with the appropriate comprehension rate given the speed limit (refer to WSDOT Traffic Manual).
- On-Site vehicle speeds will be restricted to accommodate safe roadway conditions based on roadway grade, roadway soil conditions, roadway congestion, and the need to limit fugitive PM emissions from roadway surfaces. These fugitive PM emissions shall be controlled on-site through use of chemical dust suppressant and/or water applications to roadways.

Vehicle Loads

- Vehicle loads of soil, sand, or other loose material being hauled off site will be covered or at least two feet of freeboard vertical distance will be maintained to control dust.

Stockpiles

- Stockpiles will be watered or applied with a non-toxic soil binder as needed to control dust.
- Stockpiles remaining after the construction season will be stabilized with seed and hydromulch to control dust emissions.
- Soil-Sement® (polymer emulsion dust suppressant; see Appendix F in the Rhoads Property Plan of Operations and Reclamation for product information) and/or hydro-mulch/seed will be applied to inactive topsoil and cover soil stockpiles to control fugitive dust.

General Construction

- The cleared footprint will be limited to the area necessary for active construction.

- A non-toxic soil stabilizer will be applied to inactive areas or the areas will be watered as needed to control fugitive dust.
- Wheel washers will be used to control on-road dust if vehicle track-out onto public roads develops.
- Erodible areas will be stabilized with non-erodible permanent material such as crushed aggregate, riprap, gabbions, etc.

Demolition

- A water truck will be used to wet haul roads from the specific demolition site to the temporary storage or disposal location. The structures will be wetted to control fugitive dust during demolition, including the loading and dumping of debris.
- If asbestos is identified in the buildings to be demolished, the Asbestos NESHAP (40 CFR §160.145) work practices will be implemented. Prior to demolition, the existing structures will be evaluated by a certified asbestos building inspector or other qualified professional. If asbestos is found, it will be removed prior to demolitions. The Asbestos NESHAP requires notifications; material identification; control procedures for removal; adequate wetting; local exhaust ventilation; negative pressure enclosures; glove-bag procedures; High Efficiency Particulate Air (HEPA) filters; waste disposal work practices; reporting and recordkeeping; and, asbestos hazards and worker protection.

Revegetation

- Following soil stabilization, inactive areas will be seeded to establish at least 70 percent vegetative cover by perennial vegetation.

Wind

- Natural or artificial windbreaks will be installed as necessary to control fugitive dust for small dust sources.
- Work and activity on excessively windy days will be restricted to control dust emissions.

Tanks

- The lime slurry system at the water treatment plant will utilize a baghouse filter system on the lime bin to control dust related emissions.
- The liquid propane tanks will be pressurized and will not be allowed to breathe or vent to the atmosphere.

Plan/Monitoring

- A site-specific fugitive dust control plan will be prepared prior to the commencement of construction and demolition activities.
- Supervisory personnel will be trained and certified to use EPA Method 9 and Method 22 to monitor visible and fugitive dust emissions and stop or modify activity as necessary to control dust.
- Fugitive PM will be monitored within 30 day of the start of operations, during typical conditions, to ensure compliance with the 20 percent opacity limit averaged over any six consecutive minute period and annually thereafter (40 CFR Part 49, Section 126).

Blasting/Scaling

- Hydraulic scaling will reduce dust associated with the rockfall mitigation in the lower pit wall areas.
- The contractor will prepare a General Blasting Plan that includes the control of dust.

Fire

- All equipment will use spark arrestors and smoking will be limited to designated areas to help prevent fires and associated emissions.
- Methods for dealing with accidental fires and potential explosion risks are addressed in Remedial Action Health and Safety Plan.

M3.21.6 AIR MONITORING PROGRAM

The rules for limiting visible emissions (40 CFR §49.124) and rules for limiting fugitive PM emissions (40 CFR §49.126) require the monitoring for visible emissions from stationary sources and monitoring fugitive PM. EPA Method 9 will be used to monitoring visible emissions from stationary emission sources with exhaust stacks and EPA Method 22 will be used to monitor the presence of fugitive particulate emissions. The regulatory limit for visible emission from stationary sources is 20 percent opacity averaged over six consecutive minutes (40 CFR §49.124). The regulatory requirements for limiting fugitive PM emissions are to implement all reasonable precautions to prevent fugitive PM emissions and to maintain and operate identified sources with minimal fugitive PM emissions. Forestry activities and emissions from fuel combustion in mobile sources are exempt from these requirements.

The air monitoring methods and schedule are described in the Air Quality Monitoring Plan – Revision 1 (WME 2014a). Other voluntary air monitoring for radioparticulates are also described in the Air Quality Monitoring Report.

M3.22 NUCLEAR ENERGY AND RADIATION CONTROL ACT (RCW 70.98 AND WAC 246-220 AND 246-255)

The Washington Department of Health, under Nuclear Regulatory Commission delegated authority, regulates sources of ionizing radiation for the protection of the occupational and public health and safety. The State terminated DMC's radioactive materials license (WN-I0390-1) on December 31, 2008. However, the requirements of the license are being and will continue for the water treatment plant sludge as part of the implementation through operations and maintenance of the project.

On-Site Regulatory Requirements

- The conditions of the terminated State radioactive materials license (WN-I0390-1) will be continued to be complied with in the operation and management of the WTP and WTP sludge.

M3.23 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSHA) (PUBLIC LAW 91-596 84 STAT. 1590)

Occupational Safety and Health Administration (OSHA), under 29 CFR Part 1910, provides

requirements for safe and healthful workplaces by setting and enforcing standards, and by providing training, outreach, education, and assistance. Tribal Occupational Safety and Health Administration (TOSHA) are similar to OSHA on lands within the Reservation and provide worker health and safety requirements.

Implementation of all applicable OSHA and TOSHA requirements will be identified in the Health and Safety Plan, included in the BODR. All workers will have received OSHA 40 hour and site specific radiation safety training. Implementation of the Health and Safety Plan will be followed and updated as necessary from implementation to maintenance and operation for the life of the project.

On-Site Regulatory Requirements

- Implement OSHA and TOSHA requirements that have been incorporated into the Health and Safety Plan included in the BODR Appendix P - OM&M Plan.

M3.24 HAZARDOUS MATERIALS TRANSPORTATION ACT (49 CFR 105-180)

The U.S. Department of Transportation (DOT) regulates the transportation of hazardous material under the DOT hazardous materials requirements (49 CFR Subchapter C, Hazardous Materials Regulations) under the authority of the Hazardous Material Transportation Act. These regulations requires that any Reportable Quantity (RQ) of Hazardous Substances or Low Specific Activity Group I (LSA-I) be transported, packaged, and labeled in accordance with these procedures. The list of RQ for Hazardous Substances Other Than Radionuclides on Table 1 and Radionuclides on Table 2 by substance in Appendix A of §172.101 - List of Hazardous Substances and Reportable Quantities. DOT defines radioactive material as any material having a specific activity greater than 0.002 µCi/g.

Material that would be transported on public roads include WTP residuals to the off-site disposal facility and potentially sediment from the Blue Creek Delta, if determined to be contaminated which would cross Westend-Wellpinit Road for disposal in the WCA. No material at the site is expected to exceed the Reportable Quantities per container or truckload. However, if any material becomes a RQ, the material will be packages, labeled and transported in compliance with DOT requirements. Dawn Mining Company staff is trained in DOT requirements and will be included in the chain of custody of the material. If it is determined that the sediment at the Blue Creek Delta is required to be cleaned up, sediment characterization will determine the necessary thresholds that would trigger RQ. Based on the maximum concentration of constituents for surface sediment data collected from Blue Creek Delta (Church et al. 2007), the sediment is not expected to trigger a RQ. However, additional sediment characterizations may change that determination.

On-Site Substantive Requirements

- Any Reportable Quantities (RQ) of hazardous substances including LSA-I transported on public roads will be packaged, labeled, and transported in accordance with Hazardous Material Transportation Act requirements.

M3.25 Bald and Golden Eagle Protection Act (16 USC § 668-668c)

The Bald and Golden Eagle Protection Act (BGEPA), promulgated under 50 CFR 22, prohibits “take” of bald and golden eagles, including their parts, nests, and eggs without a permit. The term “take” also includes disturbing or agitating to the degree of injury, decreased productivity, or interfering with normal feeding, breeding or nesting behavior. The Spokane Tribe’s Natural Resources Department and other

state and federal wildlife agencies do not have any records of eagles within or adjacent to the project area. Prior to construction, a survey for eagle nests and winter roosts will be conducted in the project area to identify if there are any active eagle nests that would need to be seasonally avoided. Surveys would occur in the fall prior to the commencement of construction to ensure that any new nests are identified.

On-Site Substantive Requirements

- Prior to construction, surveys for eagle nests will be conducted to identify active eagle nests. Restricted access within ¼ mile of active nests could be required from November 15 until the nest becomes unoccupied.

M3.26 Paleontological Resources Protection Act (16 USC § 470aaa(4))

The Paleontological Resources Protection Act provides protection for paleontological resources on Federal land. However, Indian land which is held in trust by the United States, is explicitly exempt from protection under this Act. The federal land (Lake Roosevelt National Recreation Area) in the project area is also Indian land. In addition, the Geologic Resources Evaluation Workshop for Lake Roosevelt National Recreation Areas indicated that there are no known paleontological resources at Lake Roosevelt (NPS, 2002). Impacts to paleontological resources would be avoided. In the unlikely event that any fossils are identified during the course of the remediation work, the Tribe and BIA will be consulted. Fossils will not be removed from the site.

On-Site Substantive Requirements

- Consult with BIA if paleontological resources are discovered; however, the presence of fossils in the area is unlikely.

M3.27 Indian Affairs Manual, Environmental and Cultural Resources Management, Paleontological Resources

The Bureau of Indian Affairs (BIA) Directive (#10-32) requires a permit, under 25 CFR 162.100 *et seq*., be issued by BIA prior to the excavation or removal of imbedded fossils from Indian land. There are no known paleontological resources in the area. Impacts to paleontological resources would be avoided. In the unlikely event that fossils are identified during the course of the remediation work, the Tribe and BIA will be consulted and left in place. No permits are required for on-site activities.

On-Site Substantive Requirements

- Consult with BIA if paleontological resources are discovered; however, the presence of fossils in the area is unlikely.

M3.28 Archaeological Resources Protection Act of 1979 (93 STAT. 721; 16 USC § 470 AA et seq.) (PL 96-95)

The Archaeological Resource Protection Act of 1979 (93 Stat. 721; 16 USC § 470aa *et seq*.) (ARPA), implemented under 43 CFR Part 7, protects archaeological resources including material remains of archaeological interest and cultural items from unnecessary removal on public and Indian lands. Material remains include evidence of human activities at least 100 years of age such as human habitation, occupation, use, or activity and capable of providing scientific or human understanding of

past human behavior or cultural adaptation. Cultural items includes human remains, associated and unassociated funerary objects, sacred objects, and cultural patrimony as defined in the Native American Graves Protection and Repatriation Act. In off-site areas, Native American material remains must be permitted under Section 4 of the ARPA prior to being removed. In on-site areas, the Tribe must be consulted prior to removal of all Native American material remains. If material remains are discovered, DMC will consult with the THPO and the Preservation Office on proper procedures and approvals required.

On-Site Substantive Requirements

- Upon the discovery of archaeological resources or grave sites, construction activities will immediately stop at that location and the THPO will be consulted and their instructions will be followed.

M3.29 Invasive Species – Executive Order 13112

Executive Order 13112 mandates federal agencies to prevent the introduction and spread of invasive species and rapidly control populations for projects that they have approval or permitting authority over. Control of invasive species will be addressed in the Operations Maintenance and Monitoring Plan, included in the BODR. Invasive species control will be addressed in the implementation and as part of operations and maintenance of the project throughout the life of the project.

On-Site Substantive Requirements

- Invasive species will be controlled when identified as described in the Noxious Weed Management Plan (NWMP) found in Appendix E of the Rhoads Property Plan of Operation and Reclamation (POOR) and will be applicable to on-site areas as well . Seed, mulch, and BMP materials will be certified as invasive free for revegetation and erosion control as described in the POOR and will be applicable to on-site areas as well.

M3.30 Integrated Resource Management Plan for the Spokane Indian Reservation

The Integrated Resource Management Plan (IRMP) is a Reservation wide guide for land use and resource management on all lands within the Spokane Indian Reservation. Applicable requirements from the IRMP are as follows:

On-Site Substantive Requirements

Cultural Resource Protection

- NHPA and other cultural resource laws must be followed. Prior to excavation, a Ground Disturbance Permit form will be submitted to THPO for consultation on cultural activities and follow recommendations.
    - THPO has been consulted and a Ground Disturbance permit application has been submitted.
- Survey of lands prior to any undertaking with Federal involvement.
    - The Preservation Office conducted cultural field surveys in 2014 and 2015. No cultural resources were discovered that would affect the design and the final

report summarizing the findings are expected in the fall of 2015.

- Protect cultural aesthetic values within 1 mile of mountain peaks.
    - The remediation will occur within 0.5 miles of the Spokane Mountain; however, the final reclamation will improve the aesthetic values from its current condition following the final grade contours and establishment and maturity of native revegetation.

Water and Riparian Resource Protection

- Discharges to comply with the Tribal Water Quality Standards and the Hazardous Substance Control Act.
    - The Tribe's Water Quality Standard and Hazardous Substances Control Act are identified ARARs that have been considered in developing the clean-up standard.
- Obtain NPDES for point source discharges.
    - An NPDES permit application was submitted to the EPA in March 2013.
- Obtain 401 certification through Tribe for federal permits.
    - A 401 certification will be requested once the NPDES permit is further in development.
- Comply with federal laws such as Clean Water Act and Safe Drinking Water Act.
    - The project is being designed to comply with the Clean Water Act and Safe Drinking Water Act, including minimizing impacts to jurisdictional wetlands and other non-wetland waters of the U.S. and maintain wellhead protection areas.
- Implement BMPs for new construction.
    - BMPs will be incorporated into the design and SWMP.

Tribal Water Quality Standards and Hazardous Substances Code

- Follow water quality and hazardous substances standards.
    - The Tribe's Water Quality Standard and Hazardous Substances Control Act are identified ARARs that have been considered in developing the clean-up standard.

Riparian Zones and Corridors

- No new construction or excavation within:
    - 100 ft beyond riparian vegetated streams, lakes, and ponds;
        - The Blue Creek pipeline will be primarily constructed in the existing Blue Creek Road and the pipeline will be buried and will not affect existing riparian vegetation. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, **pending resolution of NPDES permitting requirements.**
        - The run-off associated with the drainage and haul road cleanup are contaminated and impacts to wetlands and riparian vegetation require cleanup of contaminated soil and sediment.

- Within ½ mile of rivers and 1,310 ft elevation;
  - The Blue Creek Pipeline and drainage clean-up are within ½ mile of Blue Creek and elevation 1,310 and within the designated Riparian Zone. The pipeline will be buried and will not be visible once installed and no riparian vegetation will be impacted as part of the installation of the Blue Creek Pipeline. The Blue Creek Pipeline will cross a short section of upland grasses and shrubs between Blue Creek Road and Lake Roosevelt. This upland vegetation will be revegetated with native species once the pipeline is installed. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, **pending resolution of NPDES permitting requirements.**
  - BMPs will be implemented to minimize the transport of sediment into riparian and wetland communities.
- No pesticide (e.g., herbicide, insecticide, fungicide, and rodenticide) and fertilizer use within 500 ft.
  - No pesticides will be used within the Riparian Zone corridor.

Shoreline Recreation Zones

Prohibits development or consumptive or destructive uses within ½ mile from elevation 1,310 ft on Lake Roosevelt.

- The Blue Creek Pipeline will be within the Shoreline Recreation Zone at the Blue Creek Road and into Lake Roosevelt. However, the pipeline will be buried and primarily be located within the existing dirt road (Blue Creek Road). It crosses a small section of upland vegetation adjacent to Lake Roosevelt with native species and then crosses through the lake bed. A formal IDT review of the limited conditional entry will be requested to confirm that the limited entry is consistent with the Tribe's IRMP Individual Program Goals (watersheds, riparian corridors, and surface water) once the specific engineering plans are refined, **pending resolution of NPDES permitting requirements.**

Surface Water Use for Dust Control

This section list water source priorities for dust control which are in the following order: 1) Spokane River/Columbia River; 2) Little Falls & Bull Pasture irrigation valves; 3) Western Nuclear; 4) SiJohn Field; 5) Harris Well; 6) Tank Below Post Plant; 7) Turtle Lake[1]; 8) Mathews Lake[1]; and 9) Benjamin Lake[1].

- Dust control water would be used from either the WTP water or the water well near the old "mancamp".
- If WTP water is used, it is consistent with the number one priority water withdrawal source site listed in the IRMP for dust abatement water, since the water would otherwise be discharged to the Spokane River /Columbia River.
- Any other surface water sources would require review and approval from the

[1] The lakes could be used on a case by case basis with limited withdrawal and close monitoring of lake levels.

Spokane Tribe's Water & Fish Program.

Wellhead Protection Areas

- No new construction or excavation within 500 ft. of community wells and Wellhead Protection Zone.
    - The remediation is not within 500 ft of a Wellhead Protection Zone.
- No pesticide (e.g., herbicide, insecticide, fungicide, and rodenticide) and fertilizer use within 500 ft.
    - The remediation is not within 500 ft of a Wellhead Protection Zone.

Wildlife Management Zone

- Prohibits development on wildlife mitigation lands, as established by covenant.
    - The remediation is not on wildlife mitigation lands.
- Tribe follows the federal Endangered Species Act.
    - A Biological Assessment has been prepared to determine if a formal Section Consultation with the U.S. Fish and Wildlife service would be necessary. Only the bull trout has the potential to occur within the project area. No other Threatened or Endangered species are expected to occur within the project site. The proposed remedial action "may affect, but would not likely adversely affect bull trout". EPA submitted the BA to USFWS on 9/29/2014.

Air Quality

- Meet the National Ambient Air Quality Standards (NAAQS) and FARR.
    - Based on the Potential to Emit (PTE), the RA at the Site are not considered to be a Major Source for purposes of the PSD/NSR program. The EPA Air Administrator confirmed in an email (EPA 9/3/2014) that the PTE is well below the PSD applicable thresholds for a Major Source and the PTE would constitute a minor source under the Tribal NSR.
    - The SWMP will address limiting fugitive dust emissions and be included in the BODR. A more detailed site specific fugitive dust control plan will be prepared prior to the commencement of construction or demolition activities.
    - Visible emissions and fugitive PM will be monitored.
    - Any Off-Site emission sources that meet the criteria will be registered under FARR. However, EPA considers registering under FARR administrative and exempt under CERCLA. No rock crusher would be used off-site.

The Selected Remedy being designed and implemented is compliant with the substantive requirements in the IRMP.

Off-Site Permitting Requirements

- The Plan of Operations and Reclamation for the Rhoads Borrow Area was developed to follow the requirements of the IRMP and was approved by the Tribal Council Tribal Resolution 2014-135.

M3.31 Stevens County

M3.31.1 Administrative Conditional Use Permit (3.03.090)

Stevens County regulates development activities on fee land within Stevens County. This includes all fee land within Stevens County regardless of whether that land is also located on lands within an Indian Reservation and is being regulated concurrently by an Indian tribe. Both the Rhoads Borrow Area and the Ford Borrow Area are fee lands within the County. The Rhoads Borrow Area is also within the Spokane Indian Reservation and considered subject to Tribal land use regulations. The County zoning designation for the Ford Borrow Area is Rural Area - 10. The County zoning designation for the Rhoads Borrow Area is Rural Area - 5. Although these lands have different County zoning designations, both designations are appropriate for resource extraction activities such as the development of a borrow area. The Administrative Conditional Use Permit application was submitted to Stevens County on May 5, 2014 and the permit (#ACU 2014-003) was issued on July 30, 2014. The permitting process included a stakeholder meeting that included Spokane Tribe DNR staff and a public notice. No appeals were received by Stevens County prior to the August 14, 2014 appeals window. The development of the Borrow Pit is scheduled for spring of year four and subsequent phases in years seven and ten.

Off-Site Permit Requirements - Rhoads Borrow Area

The Rhoads Borrow Area Plan of Operation and Reclamation has been approved by the Spokane Business Council, on condition that certain specified conditions in that approval are met under Tribal Resolution 2014-135. Stevens County and the Washington Department of Natural Resources both have concurrent jurisdiction since the property is fee land. An Administrative Conditional Use Permit was issued by Stevens County on July 30, 2014. As stated in the ACUP, additional permits are required as follows:

- Washington State Mine Reclamation Permit – (six to nine months to process)
- Washington State Forestry Practices Act Permit - (60 to 90 days to process)
- EPA Construction General Permit (CGP) (eNOI) (NPDES Stormwater Permit) - (14 day process)
- Tribe 401 Certification - (120 day approval process)

Off-Site Permit Requirements - Ford Borrow Area

A Stevens County Pre-Application form, Site Analysis, Project Description, and SEPA checklist were submitted to Stevens County in October 2013 for the Ford Borrow Area. A Pre-Application Meeting was held with Stevens County, and applicable agencies included:

- Washington State Department of Transportation (WSDOT);
- Washington Department of Natural Resources (DNR);
    - Surface Mining Reclamation Permitting
    - Forest Practices Permitting
- Tri-County Department of Health;

- Washington State Department of Health;
- Bureau of Indian Affairs;
- Spokane Tribe; and
- EPA.

The permitting effort for the Ford Borrow Area has been put on hold as the Rhoads Borrow Area is the preferred borrow area and the Ford Borrow Area would only be used if the development approvals for the Rhoads Borrow Area cannot be finalized. The design at the Ford Borrow Area will be updated to comply with agency suggestions as necessary to receive agency approval.

M3.32 State Environmental Policy Act (RCW 43.21)

Washington's State Environmental Policy Act (SEPA) requires decision makers to consider potential environmental impact of the proposed action. As part of the Stevens County Conditional Administrative Use Permit, Stevens County requires a SEPA checklist as part of their application. SEPA checklists will be prepared for the Rhoads Borrow Area or Ford Borrow Area, as applicable.

Off-Site Permit Requirements

- Environmental impacts for the Rhoads Borrow Area were documented in the SEPA checklist as part of the Stevens County Administrative Conditional Use Permit application. The SEPA checklist was submitted on May 5, 2014. Stevens County issued a SEPA Determination of Nonsignificance (DNS) on July 30, 2014.
- If it is determined that the Ford Borrow Area will be used, a separate SEPA checklist will be submitted to Stevens County.

M3.33 Forest Practices Permit (RCW 76.09, RCW 6.13 RCW, AND WAC 222-16-010)

The Forest Practices Permit is administered by the Washington Department of Natural Resources for timber harvests on fee land, specifically applicable to Rhoads Borrow Area and Ford Borrow Area. A Class III – General Forest Practices Permit will be obtained for the Rhoads Borrow Area or Ford Borrow Area which allows trees to be logged prior to the excavation of borrow material. The first phase of borrow area development would occur in year four and the Forest Practices Permit takes 30 days to process and is valid for three years. The Forest Practices Permit will be renewed to include the subsequent phases of borrow area development in years seven and ten.

Off-Site Permit Requirements

- The Forest Practices application will be submitted to WA DNR for permitting the harvest of timber from the Rhoads Borrow Area, or the Ford Borrow Area if the alternative borrow area is required. The Forest Practices permit is expected to take 60 to 90 days to process.

M3.34 Surface Mining Reclamation Permit (WAC 332-18 AND 78.44)

Surface Mining Reclamation Permits are administered by Washington Department of Natural Resources for surface mines greater than three acres of disturbed ground or has high-walls greater than 30 ft and

slopes steeper than 45 degrees. A Surface Mining Reclamation Permit will be obtained from DNR for the Rhoads Borrow Area or Ford Borrow Area once agencies input is incorporated into the design for submission as part of the Stevens County Administrative Conditional Use Permit. A reclamation plan that includes revegetation is included as part of the Rhoads Plan of Operation and Reclamation and will be submitted as part of the Surface Mining Reclamation Permit.

Off-Site Permit Requirements

- The Application for Reclamation Permit will be submitted to WA DNR prior to the 100 percent design submittal to permit the development of the borrow area at the Rhoads Borrow Area or the Ford Borrow Area, if the alternative borrow area is required. The Mine Reclamation permit is expected to take six to nine months to process.

M3.35 Sanitation Standards for General Industry (29 CFR 1910.141 (a)(2))

Standards for potable water and septic systems have been developed and are implemented locally by both the Tribe's Utility Services Department and the Northeast Tri-County Health District. A potable water system will be developed consistent with the Group A - Non-Transient Non-Community water system. Aseptic waste disposal system would be developed on the Mined Area to serve employee with sanitary requirements. The septic system would be developed to meet both the Tribe's Utility Services Department and Northeast Tri-County Health District requirements for on-site sewage (regulation 01-2007). However, no permits would be required for CERCLA on-Site activities.

On-Site Substantive Requirements

- A potable water system will be developed On-Site for workers consistent with Washington State Department of Health requirements for Group A, Non-Community, Non-Transient water system.
- Design and construct septic system consistent with the Northeast Tri-County Health District as described in the OM&M Plan located in BODR Appendix P.
- Periodically test water system to ensure that standards are being achieved as described in the OM&M Plan located in BODR Appendix P.

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Attachment M-1

Revised Wetland Delineation, Midnite Mine

This provides a placeholder for Attachment M-1 that will include the Wetland Delineation and Conceptual Wetland and Stream Mitigation Approach. These documents are currently under review by EPA and will be included once finalized.

Attachment M-2

Biological Assessment, Midnite Mine

Biological Assessment
Midnite Mine – Revision 2

Midnite Mine
Spokane Tribe of Indians Reservation
Stevens County, WA
Revision 2, September 2014

Prepared For:
U.S. Environmental Protection Agency

Prepared On Behalf of:
Newmont USA, Limited and
Dawn Mining Company

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Table of Contents

1.0 INTRODUCTION 1

1.1 Project Background 1

1.2 Biological Assessment Objectives 4

1.3 Threatened and Endangered Species Considered 4

1.4 Previous Related Consultations 6

2.0 Baseline Site Conditions 7

2.1 Site Characteristics 7

2.1.1 Site Topography 7

2.1.2 Existing Structures 7

2.1.3 Geologic Setting 7

2.1.4 Hydrogeological Setting 7

2.1.5 Climate/Seasons 8

2.1.6 Ecological Setting 8

3.0 Proposed Action Description 9

4.0 Environmental Baseline and Species Accounts 17

4.1 Action Area 17

5.0 SPECIES ACCOUNTS 18

5.1 Bull Trout (*Salvelinus confluentus*) 18

5.2 Canada Lynx (*Lynx canadensis*) 19

5.3 Grizzly bear (*Ursus arctos horribilis*) 24

5.4 Ute ladies'-tresses orchid (*Spiranthes diluvialis)* 26

6.0 EFFECTS 29

6.1 Direct Effects 29

6.2 Indirect Effects 30

7.0 CONCLUSION AND DETERMINATION 32

8.0 LITERATURE CITED 33

List of Tables

Table 1. Summary of Federally Listed Species for Stevens County 5
Table 2. Effluent Categories by Analyte 16

List of Figures

Figure 1. Project Vicinity 2
Figure 2. Project Location 3
Figure 3. Example Diagram of Temporary Stream Diversion 13
Figure 4. Pipeline Diffuser 14
Figure 5. GAP Habitat Map for Snowshoe Hare in Washington 21
Figure 6. GAP Habitat Map for Canadian Lynx in Washington 23
Figure 7. GAP Habitat Map for Grizzly Bear in Washington 25
Figure 8. Known Distribution of Ute's Ladies Tresses Orchid in Washington 27

List of Appendices

ATTACHMENT A Agency Communication Log
ATTACHMENT B NPDES Permit Application

1.0 INTRODUCTION

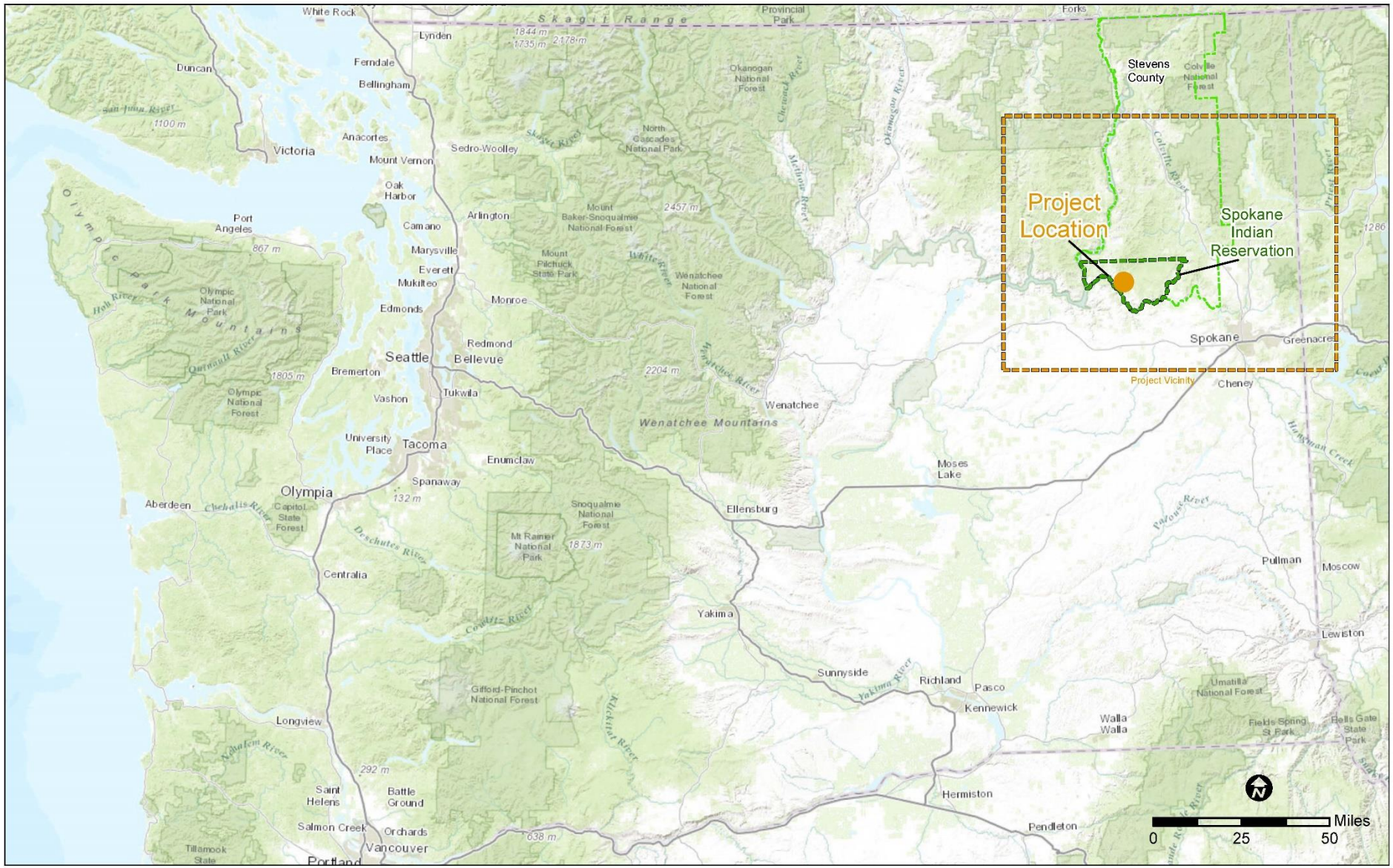
1.1 Project Background

This Biological Assessment (BA), Revision 2 evaluates the potential for the Midnite Mine Superfund Remedial Action Project to adversely affect listed species or designated or proposed critical habitat, in accordance with the 1973 Endangered Species Act (ESA). This revised submittal addresses the applicable 60 and 90 percent design comments from EPA.

The Midnite Mine Superfund Site (Site) is located on the Spokane Indian Reservation in Eastern Washington State (Figures 1 and 2). The Project Action Area is located in sections 1, 11, 12, 13, 14, 23, 24, 26, 27, 33, and 34, of Township 28 North and Range 37 East and sections 7 and 18 of Township 28 North and Range 38 East, Stevens County, Washington.

The former open pit uranium mine was in operation between 1955 and 1981. The current Site includes two large open pits, backfilled pits, a number of waste rock piles, ore/protore stockpiles, seep collection and pump back facilities, and water treatment plant (WTP). The Midnite Mine ceased operation in September of 1981 and from that time water has collected in the two open pits on the site. Contaminated water is seeping below the waste rock and ore piles and is currently being captured and treated at the WTP and discharged into Blue Creek. Blue Creek is a tributary to the Spokane River are of Lake Roosevelt, which is also a designated National Recreation Area. There is contaminated sediment deposited in the drainages below the mine and along the former mine haul roads. The key contaminants of concern (COC) for the protection of human health at the mine are radioactive isotopes of uranium (U-234, U-238) and their decay products, such as radium-226, radon gas (radon-222), lead 210, and others (EPA, 2006). Manganese is a COC for both human and ecological health and a number of other metals are COCs for ecological health. The Remedial Action (RA) involves the clean-up of contaminated mine waste and groundwater associated with this former mine (U.S. EPA Docket No. CERCLA-10-2009-0026).

Dawn Mining Company, LLC (DMC) and Newmont USA (Newmont) are taking this action as required by the January 7, 2012 Consent Decree in accordance with the Midnite Mine Superfund Site Record of Decision (ROD, [EPA, 2006]).



WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Figure 1
Midnite Mine Project Vicinity

Date:	July 2014
Project:	Midnite Mine
File:	Project Vicinity.MXD

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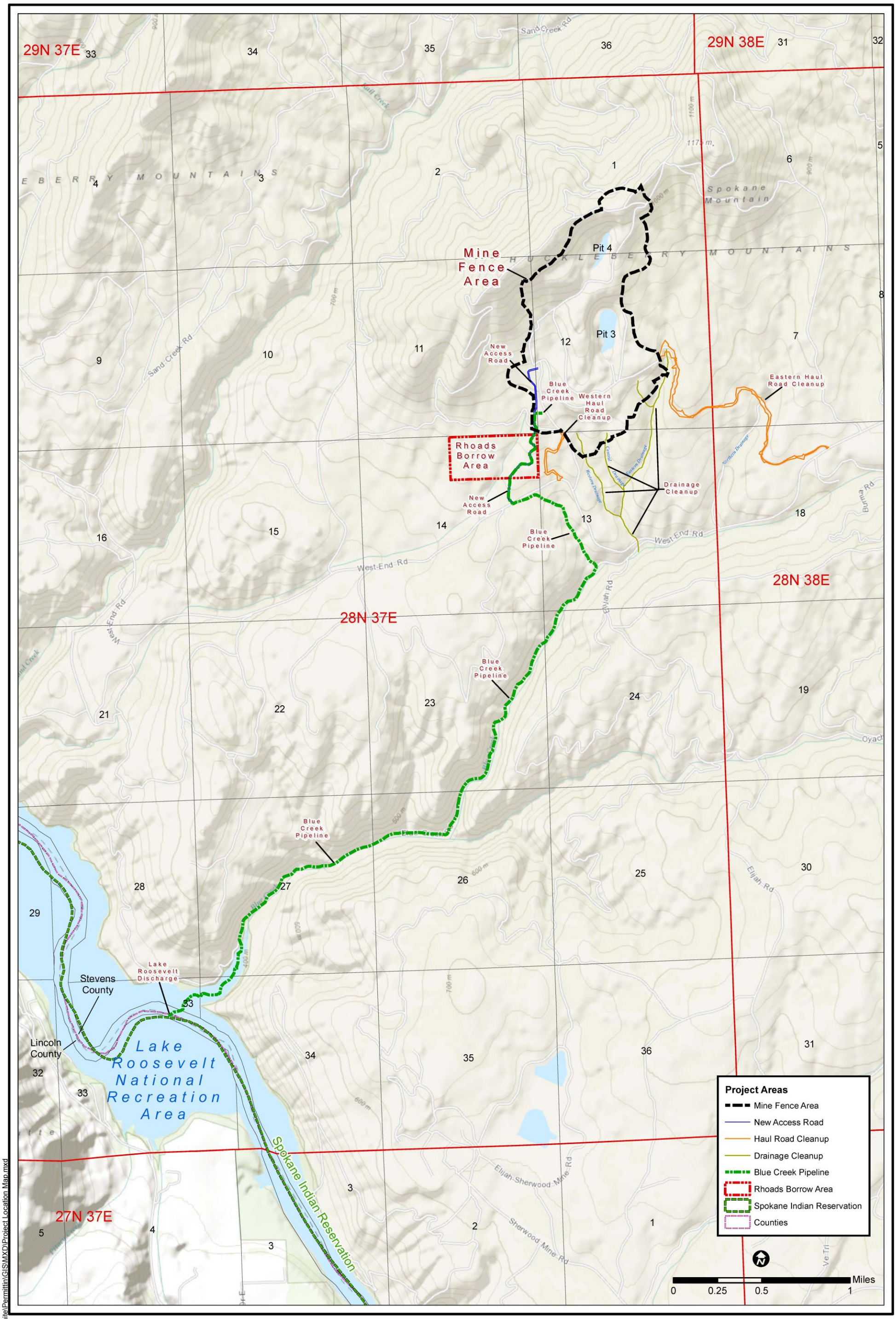

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WORTHINGTON MILLER ENVIRONMENTAL, LLC.

Figure 2
Midnite Mine Project Areas

Date:	September 2014
Project:	Midnite Mine
File:	MMComponents.MXD

1.2 Biological Assessment Objectives

This BA was prepared in accordance with the legal requirements of Section 7 of the ESA to support the EPA with Section 7 consultation with USFWS.

The objectives of this BA are to:

- Characterize baseline conditions of existing habitat;
- Identify federally listed threatened and endangered species that have a potential to occur within the Action Area or be affected by the RA;
- Identify and address potential project impacts to listed species;
- Describe best management practices (BMPs) that will be used to avoid, minimize, or mitigate adverse effects.

1.3 Threatened and Endangered Species Considered

The U.S. Fish and Wildlife Service provided a list of Threatened and Endangered species that may be present in Stevens County, Washington, which identified the following species.

- Bull trout (*Salvelinus confluentus*) — Threatened
- Canada lynx (*Lynx canadensis*) — Threatened
- Grizzly bear (*Ursus arctos horribilis*) — Threatened
- Ute ladies'-tresses (*Spiranthes diluvialis*) — Threatened

Those species are further evaluated in this Biological Assessment. A summary of the listed species and their probability to occur within the project action area are provided in Table 1.

Table 1. Summary of Federally Listed Species for Stevens County

Species	Federal Status	Habitat Requirements	Likelihood of Occurrence	Critical Habitat
Bull trout (*Salvelinus confluentus*)	Threatened	Streams, lakes, and ocean with coldest water, cleanest substrate, complex (e.g., riffles, deep pools, undercut banks and large logs, and connected habitats with connection to headwaters for spawning.	Low. No suitable spawning habitat occurs in Lake Roosevelt.	No
Canada lynx (*Lynx canadensis*)	Threatened	High elevation coniferous or mixed forest adjacent to tundra with abundant prey	No suitable habitat is present in the Project Action Area.	No
Grizzly bear (*Ursus arctos horribilis*)	Threatened	Large contiguous tract of undisturbed land across a wide variety of habitats with concentrated food sources such as salmon runs and calving grounds.	No suitable habitat is present in the Project Action Area.	No
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Broad low elevation inter-montane valley with sub-irrigated calcareous wetlands wet meadows	No suitable habitat is present in the Project Action Area.	No

Applicable resource agencies were contacted to determine if there were any records of Threatened or Endangered species occurring in the project action vicinity. Agencies contacted included:

- Spokane Tribe Natural Resources Department
- Washington Department of Fish and Wildlife, Priorities Habitats and Species
- Washington Natural Heritage Program
- US Fish and Wildlife Service
- National Oceanic and Atmospheric Association, National Marine Fisheries Service, Habitat Program

The U.S. Fish and Wildlife Service (USFWS) was the only agency that had any records of listed species in the project action vicinity. A small number of bull trout in Lake Roosevelt are recorded annually (Per. Comm. Ames, 2013; Campbell, 2014). The National Marine Fisheries Service regulates anadromous fish and indicated that no anadromous fish occur upstream of the Chief Joseph Dam (Per. Comm. Yeager, 2013). All other agencies indicated that they do not have any records of listed species in the vicinity of the project action area. A log of communications with agencies is provided in Appendix A. Of the four species listed by USFWS in Stevens County, Washington, only bull trout has the potential to occur within the Action Area. Brief discussions of each of the species are discussed in the Species Account Section.

1.4 Previous Related Consultations

There have not been any previous related consultations with between U.S. Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service (USFWS) on the Midnite Mine Remediation Project.

2.0 Baseline Site Conditions

2.1 Site Characteristics

2.1.1 Site Topography

Midnite Mine is located on approximately 350 acres in a mountainous area on the southeast side of the Spokane Mountain peak (elevation 3,870 ft above mean sea level (amsl)). The relatively steep site has approximately 2,500 feet of relief. The Site occurs within a sub-watershed within the Blue Creek Watershed. The sub-watershed ranges in elevation from 3,870 ft amsl at the ridge top to approximately 2,100 ft where the Central Drainage flows into Blue Creek. From the confluence with the Central Drainage, Blue Creek flows 3.5 miles, dropping over 600 ft in elevation, to Lake Roosevelt. Lake Roosevelt was formed by the construction of the Grand Coulee Dam on the Columbia River that has impounded this portion of the Spokane River.

2.1.2 Existing Structures

There are several structures within the Mine Fence Area which include the WTP and associated facility, several trailers, and decontamination building, and remnants of historical "mancamp" buildings. There are also a number of pipelines and culverts found throughout the site. All of these structures will be demolished as part of the RA.

2.1.3 Geologic Setting

Midnite Mine and the surrounding area are dominated by granitic quartz monzonite that intrudes the Togo Formation, a metamorphosed sedimentary rock. The Togo Formation contains the primary mineralized uranium at Midnite Mine. Most of the overlying sedimentary rock has been eroded away leaving a roof pendant of the Togo Formation comprised of phyllite schist and calc-silicate rocks, including marble, quartzite, and hornfels. Surface soils on top of the bedrock range in thickness between 0 and 20 feet consisting primarily of Hartill, Dragoon, and Raisio-rock outcrop soil complexes.

2.1.4 Hydrogeological Setting

The Mined Area drains into a number of small seasonal and intermittent streams (Western, Central, and Eastern Drainage) that flow into Blue Creek and ultimately into the Spokane Arm of Lake Roosevelt. There is a small area in the southwest side of the Mined Area that is within the Whitetail

Creek watershed, which also ultimately flows into Lake Roosevelt. Lake levels in Lake Roosevelt fluctuate based on Bureau of Reclamation management. Natural flows in the Western, Central, and Eastern Drainages are minimal throughout the year and supplemented by the discharge of treated effluent, up to 500 gallons per minute, from the WTP into the Eastern Drainage. The WTP operates April through November. Blue Creek flows perennially in most years, with low flow in late summer. Daily flows in Blue Creek upstream of the confluence with the Central Drainage ranged from 0.04 to 60 cubic feet per second (cfs) between 1984 and 2002 (USGS).

Lake Roosevelt is managed by the Bureau of Reclamation and is drawn down seasonally for hydroelectric power, flood control, irrigation, fish passage, and other downstream uses. In 2012, water levels in Lake Roosevelt fluctuated between 1,290 ft amsl and 1,227 ft amsl, with low water typically occurring in spring in preparation for spring runoff and then allowed to refill to normal operating levels by late June.

2.1.5 Climate/Seasons

The climate can be characterized by warm dry summer and wet and cold winters. The mean temperature in the area is approximately 47° F with monthly average temperatures ranging from 29.2° F in January to 71.0° F in August. Annual precipitation is approximately 18.5 inches and monthly average precipitation ranges from 0.3 inches in August to 2.5 inches in December. Average seasonal snowfall is 47 inches.

2.1.6 Ecological Setting

Most of the Mined Area is comprised of disturbed upland, mostly exposed ground and rock waste piles with little to no vegetation. The surrounding area is characterized as forested, grassland, open, and steep sub-habitats. The forested areas are comprised mainly of ponderosa pine (*Pinus ponderosa*) forest and mixed ponderosa pine/Douglas fir (*Pseudotsuga menziesii*) forest. The Western, Central, and Eastern Drainages and areas along Blue Creek contain scrub/shrub wetlands and riparian habitat comprised of a mix of alders (*Alnus* spp.), redosier dogwood (*Comus stolonifera*), Douglas hawthorne (*Crataegus douglasii*), redtop (*Agrostis gigantea*), and Rocky Mountain maple (*Acer glabrum*) and other species. Areas along the lake shoreline are relatively barren due to the fluctuating water levels.

3.0 Proposed Action Description

The Project Action Area footprint is approximately 603 acres and consists of the following areas:

- Mine Fence Areas (includes the Mined Area)
- Rhoads Borrow Area
- Blue Creek Pipeline and Access Road (Outside Fence and Borrow Area)
- Haul Road Clean up (outside fence)
- Drainage Clean up (outside fence)

The RA primarily involves the consolidation and disposal of contaminated material in the Waste Containment Area that will be hydraulically isolated from surface and ground water. The groundwater will be pumped and treated at the WTP and the treated effluent will be discharged into Lake Roosevelt. Work associated with this project action will include the following:

On-Site Areas

Mine Fence Areas (553 acres)

- Sediment and stormwater control installation
- Site preparation and clearing
- Decontamination area construction
- Construction support facilities area preparation development
- Drain material processing and Area 5 stockpiling
- Hillside waste rock pile processing for Pit 4 drain rock
- Mine waste excavation
- Pit 4 backfilling
- South Pond construction
- Water treatment plant and associated ponds construction
- Water treatment plant effluent pipeline and diffuser construction (Blue Creek pipeline)
- Alluvial groundwater controls installation
- Pit 3 backfilling
- Hillside waste rock processing for Pit 3 drain rock
- Area 5 re-grading
- Backfilled Pit Area remediation
- Existing WTP Building demolition
- West Pond construction
- Pollution Control Pond removal
- South Pond removal
- South Waste Rock Pile remediation
- Central Drainage sediment remediation

- West Pond removal
- Permanent influent pipelines, site maintenance roads, and fencing construction
- Waste surface contouring
- Waste Cap cover construction
- Cap and other mined area reclamation
- Pit water, seeps, and groundwater treatment
- Stormwater and sediment control installation/maintenance
- Site reclamation/revegetation
- Clean runoff diversion away from Waste Containment Area
- Long-term monitoring

Blue Creek Pipeline (4.6 acres)

- Sediment and stormwater control installation
- Impeding tree removal
- Wellpinit – Westend Road traffic control
- Effluent pipeline installation in existing Blue Creek Road
- Effluent pipeline installation in dry portion of Lake Roosevelt
- Outfall diffuser Installation
- Effluent pipeline submersion in inundated portion of Lake Roosevelt
- Site reclamation/revegetation
- Long-term monitoring

Mine Road Remediation (Eastern and Western Haul Road Clean-up) (17 acres)

- Sediment and stormwater control installation
- Road base and sediment excavation
- Site reclamation/revegetation

Drainage Clean-up (Western, Central, and Eastern Drainages) (>3 acres)

- Sediment and stormwater control installation
- Sediment excavation
- Groundwater collection trench installation
- Flood attenuation berm installation
- Sediment and stormwater control installation
- Site reclamation/revegetation

New Access Road (1 acre)

- New access road grading and paving

Off-Site Areas

Borrow Area

Rhoads Borrow Area (67 acres)

- Sediment and stormwater control installation
- Site access development
- Haul road construction
- Borrow area development

- Timber harvest
- Slash and stump removal
- Topsoil salvage
- Borrow material extraction
- Site re-contour
- Topsoil placement
- Site revegetation

Lake Roosevelt

- As applied to discharge of water treatment system effluent only

Other project components are included as part of remediation, but are inconsequential to this analysis.

With the exception of the WTP effluent discharge into Lake Roosevelt and the Rhoads Borrow Area, all other components of the project action are considered on-site and are exempt from permitting requirements under CERCLA (OSWER Directive 9355.7-03). The on-site areas that are exempt from permitting requirements, include the Mine Fence Area (includes Mined Area), New Access Road, Haul Road Cleanup (Eastern and Western Haul Roads), Drainage clean up, and Blue Creek Pipeline. The Rhoads borrow area and the WTP effluent discharge into Lake Roosevelt (waters of the U.S.) are off-site and applicable permit such as the National Pollution Discharge Elimination System Permit (NPDES). As such, permits are required for actions in these off-site areas. See discussion of the pending NPDES permit update for treated mine water.

Since bull trout is the only species of concern most of the discussion within this BA will primarily focus on the portion of the RA in and adjacent to Lake Roosevelt. Construction on the Blue Creek Pipeline is expected to commence in May of 2016. However, the design of the pipeline has been put on hold until the NPDES permitting requirements can be resolved.

3.1.1.1 Blue Creek Pipeline

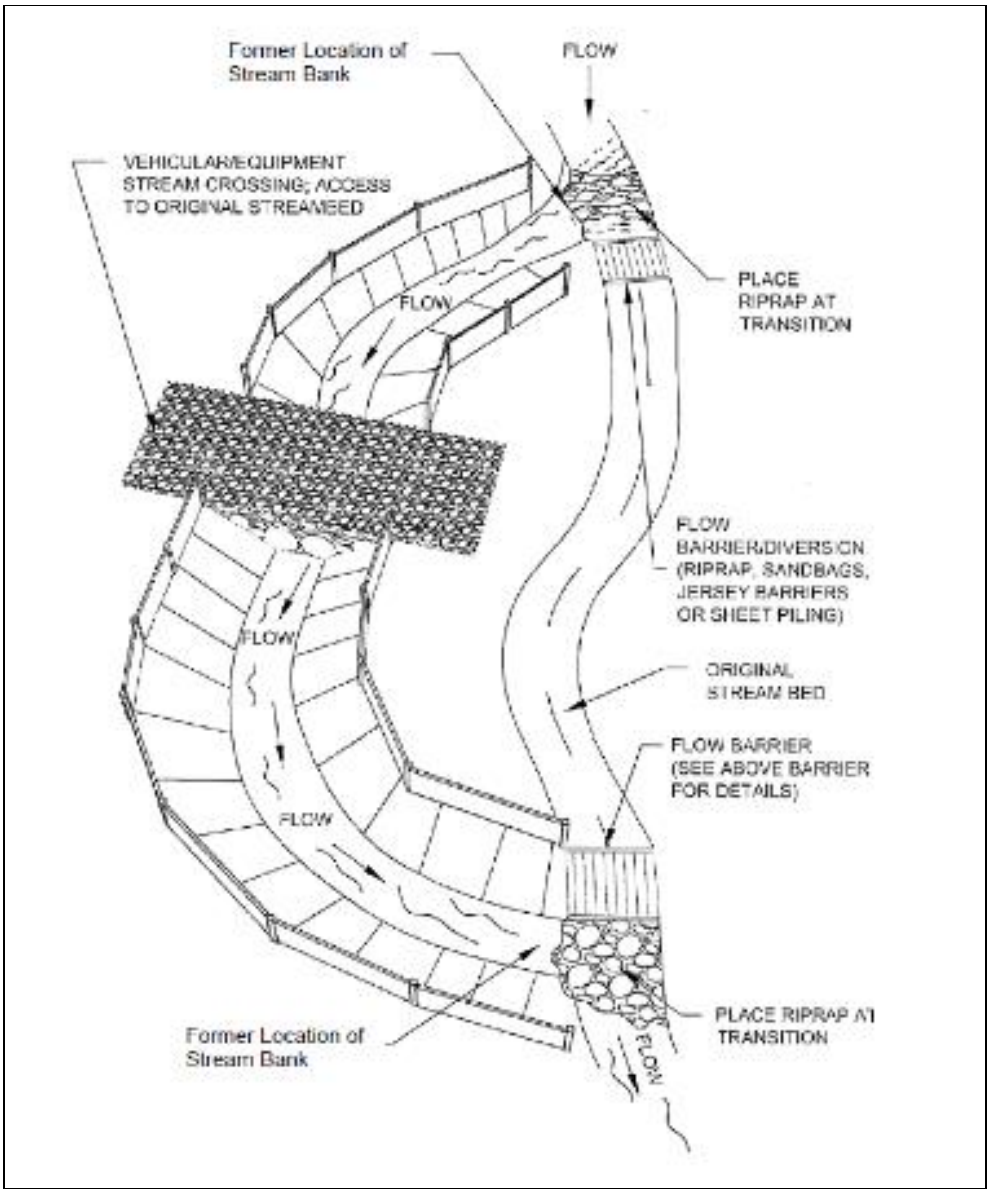
The Blue Creek Pipeline will be constructed below Lake Roosevelt's high water line (1,290 ft amsl) when the reservoir level is drawn down in the Spring of 2016. The pipeline will be routed from the end of Blue Creek Road through a short section of upland grassland and scrub and into the Lake Roosevelt lake bottom. The pipeline will be approximately 3,600 feet, in a 40 ft wide work area, within Lake Roosevelt National Recreation Area (LARO NRA), from elevation 1,310 ft to the historic Spokane River channel into Lake Roosevelt. In order to avoid a landslide area and other unstable

slopes on the south side of Blue Creek, the pipeline will cross to the north side of the creek. The pipeline will be constructed across Blue Creek during high spring runoff and will be constructed in a way that minimizes impacts to fish that may inhabit the stream.

Construction across the creek will use a temporary diversion method that minimizes impacts to the overall stream channel by temporarily diverting the flows to a channel or culvert while the pipeline is constructed across the stream. See Figure 3 for an illustration of the method (Urban Drainage and Flood Control District, 2012). By creating a temporary diversion, the amount of time of the actual construction across the creek can be minimized to days instead of weeks, thereby minimizing disruption to migrating and spawning fish. Once construction across the stream channel is completed, stream flows will be returned back to the original channel and the temporary channel will be removed.

The remainder of the pipeline will be constructed on the dry lakebed during low lake water levels using an eight-inch High Density Polyethylene (HDPE) fuse welded pipe with a six inch single port diffuser and elastomeric duckbill valve place at the end (Figure 4). The pipeline would be constructed in a 40-foot wide work area and buried two to four feet below the lake floor, down to elevation 1,260 ft. In inundated areas, the pipeline would be assembled on shore, floated onto the lake, and submerged with concrete anchors until an extreme low water conditions would allow the remainder of the pipeline to be buried. Only clean fill material would be used as trench backfill. Following each phase of construction, the lake bottom will be re-contoured back to pre-construction condition. No revegetation will be required below the high water line and only upland vegetation occurs where the pipeline enters the lake. BMPs such as silt fence and straw bales will be used to minimize any turbidity from stormwater runoff from reaching the stream. The soil/sediment at the Blue Creek delta is relatively coarse sand and turbidity is expected to be minimal.

Additional detail will be provided once the design is developed further in the 100 percent design. However, the pipeline design has been delayed until the NPDES permitting requirements are resolved.



**Urban Drainage and Flood Control District, Urban Storm Drainage Criteria Manual Volume 3, June 2012.*

Figure 3. Example Diagram of Temporary Stream Diversion

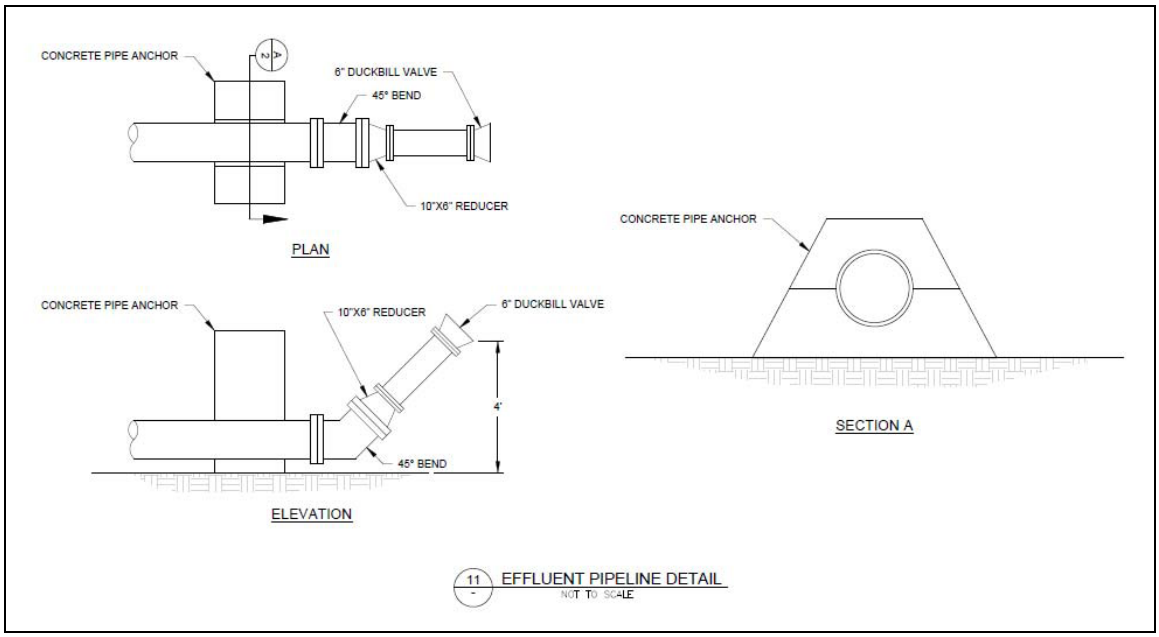


Figure 4. Pipeline Diffuser

3.1.1.2 Effluent Discharge.

The mine water is being treated at the existing Midnite Mine water treatment plant (WTP) and then discharged into Blue Creek (a tributary to Lake Roosevelt) under NPDES permit No. WA- 002572-1. An application to modify the NPDES permit was submitted to the EPA on March 21, 2013 and additional information was submitted on July 2, August 28, September 27, October 18, November 1, and December 9, 2013. A copy of the NPDES permit application is provided in Appendix B.

Based upon the results of the investigations, the WTP effluent falls into one of four categories for each analyte, as summarized on Table 2. The effluent either 1) achieves the STI standard, 2) has concentrations that are lower than common laboratory detection methods and the standard is also lower than concentrations that are detectable, 3) will achieve the STI standard with a mixing zone, or 4) the effluent and receiving water are both over the STI standard. The WTP effluent achieves the majority of the standards in the STI surface water quality standards for each of the corresponding analytes. Four of the analytes have standards that are below the MDC, and have not been measured in the effluent above the minimal detectible concentrations (MDC). Thirteen of the analytes will meet the STI water quality standards at the end of a mixing zone within Lake Roosevelt.

Total aluminum, total arsenic, and total mercury concentrations do not meet the adopted STI surface water standard in either the WTP effluent or Lake Roosevelt. Statistical analyses determined that the concentrations of aluminum are not significantly different between the WTP effluent and Lake Roosevelt, and the concentrations of arsenic are significantly less in the WTP effluent than in Lake Roosevelt. The concentrations of mercury are uncertain due to several estimated, biased high data, but statistically are significantly different for the WTP effluent and Lake Roosevelt. The WTP effluent and Lake Roosevelt water achieve the current EPA approved STI surface water quality standard for mercury.

While neither the effluent nor Lake Roosevelt meet the adopted standards for these three analytes, the concentrations in Lake Roosevelt may represent natural conditions specific to water quality standards. Effluent from the pipeline will be consistent with the existing Blue Creek discharge and comply with the new NPDES permit requirements. On December 19, 2013 EPA took action on the Spokane Tribe's 2010 revised water quality standards, approving the standards under the Clean Water Act, with certain exceptions (EPA 2013). Further design of the WTP and discharge pipe have been postponed until EPA issues a draft NPDES permit and factsheet. EPA will follow the normal permitting process with regards to ESA consultation. The Spokane Tribe is responsible for certification that the permit meets tribal standards under the Clean Water Act, Section 401.

Table 2. Effluent Categories by Analyte

Analyte	Units	2003 STI Water Quality Stds (EPA Certified)	2010 STI Water Quality Stds	Washington State Surface Water Quality Stds	Effluent Category			
					Effluent Meets Standard	Std. below detectable levels	Std achievable with mixing zone in LR	Effluent and LR greater than Std
Aluminum, tot (Al)	µg/L	50 [d]	50 [d]	-				X (Eff < LR)
Aluminum, diss (Al)	ug/L	87	87				X	
Antimony, tot (Sb)	µg/L	13	5.76	-	X			
Arsenic, diss (As)	µg/L	150 [g]	150 [g]	190	X			
Arsenic, tot (As)	µg/L	0.0069	0.000951					X (Eff < LR)
Barium, tot (Ba)	µg/L	1,000	1,000	-	X			
Beryllium, tot (Be)	µg/L	4 [d]	4 [d]		X			
Cadmium, diss (Cd)	µg/L	0.54 [a]	0.54 [a]	0.54 [a]	X			
Cadmium, tot (Cd)	µg/L	5 [d]	5 [d]		X			
Chloride (Cl)	mg/L	250 [d]	250 [d]	230	X			
Chromium, diss (Cr)	µg/L	36.5 [a,b]	36.5 [a,b]		X			
Chromium, tot (Cr)	µg/L	100 [d]	100 [d]	102.3 [a,b]	X			
Copper, tot (Cu)	µg/L	1,000 [d]	12.1		X			
Copper, diss (Cu)	µg/L	4.3 [a]	4.3 [a]	5.4 [a] -	X			
Fluoride (F)	mg/L	2 [d]	2 [d]	-	X			
Gross Alpha	pCi/L	15	15	-			X	
Gross Beta	pCi/L	50	50	-	X			
Iron, tot (Fe)	µg/L	300 [d]	300 [d]	-	X			
Lead 210 (Pb-210)	pCi/L	0.01	0.01	0.8 [f]		X		
Lead 212 (Pb-212)	pCi/L	2	2	160 [f]		X		
Lead, diss (Pb) (*)	µg/L	0.97 [a]	0.97 [a]	0.97 [a] -	X			
Manganese, tot (Mn)	µg/L	50 [d]	50 [d]	-			X	
Mercury, tot (Hg)	µg/L	0.01	0.0011	0.012 [c]				X
Nickel, tot (Ni)	µg/L	231	31.4		X			
Nickel, diss (Ni)	µg/L	25.1 [a]	25.1 [a]	75.7 [a]	X			
Nitrate/Nitrite-N (NO_2+NO_3)	mg/L as N	10 [d]	10 [d]	-	X			
Nitrate-N (NO_3)	mg/L as N	10 [d]	10 [d]	-	X			
Nitrite-N (NO_2)	mg/L as N	1 [d]	1 [d]	-	X			
pH	s. u.	6.5 – 8.5 [d]	6.5 – 8.5 [d]	6.5 – 8.5	X			
Polonium-210 (Po-210)**	pCi/L	0.04	0.04	3.2 [f]	X		X	
Protactinium-234 (Pa-234)**	pCi/L	30	30	2400 [f]	X			
Radium-226 (Ra-226)**	pCi/L	0.06	0.06	4.8 [f]			X	
Radium-228 (Ra-228)**	pCi/L	5 [e]	5 [e]	4.8 [f]	X			
Selenium, tot (Se)	µg/L	5 [c]	5 [c]	5 [c]	X			
Silver, diss (Ag)	µg/L	0.78 [a]	0.78 [a]	0.78 [a]	X			
Silver, tot (Ag)	µg/L	100 [d]	100 [d]	-	X			
Strontium 90 (Sr-90)	pCi/L	8 [d]	8 [d]	40 [f]	X			
Sulfate (SO_4)	mg/L	250 [d]	250 [d]	-			X	
TDS Total Dissolved Solids (TDS)	mg/L	500 [d]	500 [d]	-			X	
Thallium, tot (Tl)	µg/L	0.388	0.0445	-			X	
Thorium-232 (Th-232)**	pCi/L	0.03	0.03	2.4 [f]		X		
Thorium-234 (Th-234)**	pCi/L	5	5	400 [f]		X		
Tritium (H-3)	pCi/L	20,000 [d]	20,000 [d]	80,000 [f]	X			
Uranium 234 (U-234)**	pCi/L	0.3	0.3	24 [f]			X	
Uranium 235 (U-235)**	pCi/L	0.3	0.3	24 [f]			X	
Uranium 238 (U-238)**	pCi/L	0.3	0.3	24 [f]			X	
Uranium (nat)	pCi/L	0.3	0.3	-			X	
Zinc, diss (Zn)	µg/L	50.3 [a]	50.3 [a]	11 [a]	X			
Zinc, tot (Zn)	µg/L	5,000 [d]	5,000 [d]		X			

Table Footnotes:

a. Hardness dependent value based on a hardness of 42 mg/L as $CaCO_3$.

b. Value is for trivalent chromium.

c. Based on total recoverable fraction of the metal.

d. Value is for Primary Contact Ceremonial and Spiritual Uses.

e. Ra 226 and Ra228 combined must be less than 5 pCi/L

f. Washington State Surface Water Quality Standards for radionuclides are calculated as 1/12.5 of the values listed in WAC 246-221-290

g. Refers to the inorganic form only

Notes on Categorizing:

**lead in effluent qualified as baiased high (found in blank) in one sample, all others below detection with no qualifications due to data validation*

*** Radionuclide - value is in addition to receiving water which is assumed to be natural conditions*

4.0 Environmental Baseline and Species Accounts

4.1 Action Area

The Action area is "all areas that may be affected directly or indirectly by the proposed Federal action and not merely the immediate area involved in the action." The Action Area includes the Mine Fence Area (includes Mined Area), the Drainage Cleanup, the Eastern and Western Haul Routes, New Access Road, the Blue Creek Pipeline, and the WTP Effluent Discharge. In addition, the removal of the WTP discharge from the Eastern Drainage and the construction of the alluvial groundwater trenches will effectively dry up most of the wetlands in the Western, Central, and Eastern Drainages. The Drainage Cleanup and Eastern Haul Road Cleanup will consist of work in the wetlands and stream, between the Mined Area and Westend-Wellpinit Road. Attenuation berms will be constructed in the Drainage Cleanup area to help minimize flooding events during spring runoff and trap sediment. The Drainage Cleanup will occur in 2020 beginning in the Eastern Drainage and the Western and Central Drainages will be cleaned up in 2022. The construction of the Blue Creek Pipeline within the Lake Roosevelt will extend approximately 3,600 ft and will be constructed in a 40 ft wide work area on the dry lake bed. The construction of the pipeline will occur in 2016.

5.0 SPECIES ACCOUNTS

Habitat requirements and geographic range for each species and their likelihood for occurring within the action area are discussed below.

5.1 Bull Trout (*Salvelinus confluentus*)

Bull trout is a char of the salmonids family and were previously considered a Dolly Varden (*Salvelinus malma*) until reclassified in 1980. The U.S. Fish and Wildlife Service listed this species as Threatened in 1999.

Bull trout once ranged from northern California to the Yukon in Canada and east to the continental divide from Alberta down to northern Nevada (Haas and McPhail, 1991) including Washington, Oregon, Idaho, Montana, and Nevada (USFWS, 2010). This species once inhabited 60 percent of the Columbia River Basin, including the Spokane River, but reduced water quality and water impoundments have reduced their range to less than half of their historic range (USFWS, 2010).

This pre-glacial relic is found in relatively pristine cold clear water of high-mountain and coastal waters of the Pacific Northwest that provide clean gravel with deep pools and complex cover such as snags or cut banks. Bull trout inhabit cold water with temperatures below 55 °F, typically between 41 °F and -48 °F, and are rarely found in waters above 59 to 64 °F (USFWS, 2010). Bull trout also require oxygen levels of at least 6.5 mg/L (Chambers et al., 2000).

Most bull trout are largely migratory and primarily inhabit large rivers or lakes and return to small streams to spawn. However, some bull trout are residents; spending their entire life cycle in the same stream or water body. Bull trout are also anadromous and can migrate from one coastal stream to another via the ocean.

Juvenile bull trout (<3 years) are most often found in low velocity, shallow water with abundant cover and temperatures colder than most other juvenile salmonids will tolerate. Juveniles prefer relatively shallow water with most streams being less than 18 inches deep. Spawning is optimum at 12 to 24 inches in water depth.

Most juveniles remain in close proximity to the bottom under in-stream cover with slow velocities. Sexual maturity is reached in 4 to 7 years. Bull trout can grow to 20 pounds and live up to 12 years in lake conditions and up to 20 years in exceptional conditions.

Bull trout diet varies depending upon their age and life history strategy. Juvenile and migratory bull trout feed on terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish (USFWS, 2014). Adult and migratory bull trout primarily feed on trout (*Salmo* spp.) and salmon (*Onchorynchus* spp.), whitefish (*Prosopium* spp.), yellow perch (*Perca flavescens*), and sculpin (*Cottus* spp.) (USFWS, 2014).

Significant decline to bull trout populations are primarily due to the degradation and fragmentation of their habitat including the placement of dams throughout their migratory corridors and reduced water quality. Other threats to bull trout include the introduction of non-native species such as brown, lake and brook trout. Increased water temperatures associated with climate change has also shrunk their suitable habitat.

The Northeast Washington Recovery Unit includes the main stem of the Columbia River and all tributaries above Chief Joseph Dam up to the Canadian border, Spokane River and tributaries to Post Falls Dam (USFWS, 2002). There is no designated Critical Habitat for bull trout present in the vicinity of the project action area. The nearest bull trout designated Critical Habitats occur downstream on the Columbia River at the Chief Joseph Dam, upstream at Coeur d'Alene Lake, and Pend Oreille River.

A number of fish surveys were conducted in Blue Creek and the Blue Creek inlet from 1985 to present (Scholz et. al., 1988; Crossley, 2000; Per. Comm. Flanagan, 2013) and no bull trout have been documented during that time. Blue Creek does provide habitat for other fish species such as redband rainbow trout (*Oncorhynchus mykiss gairdneri*), brown trout (*Salmo trutta*), sculpin, and longnose sucker (*Catostomus catostomus*).

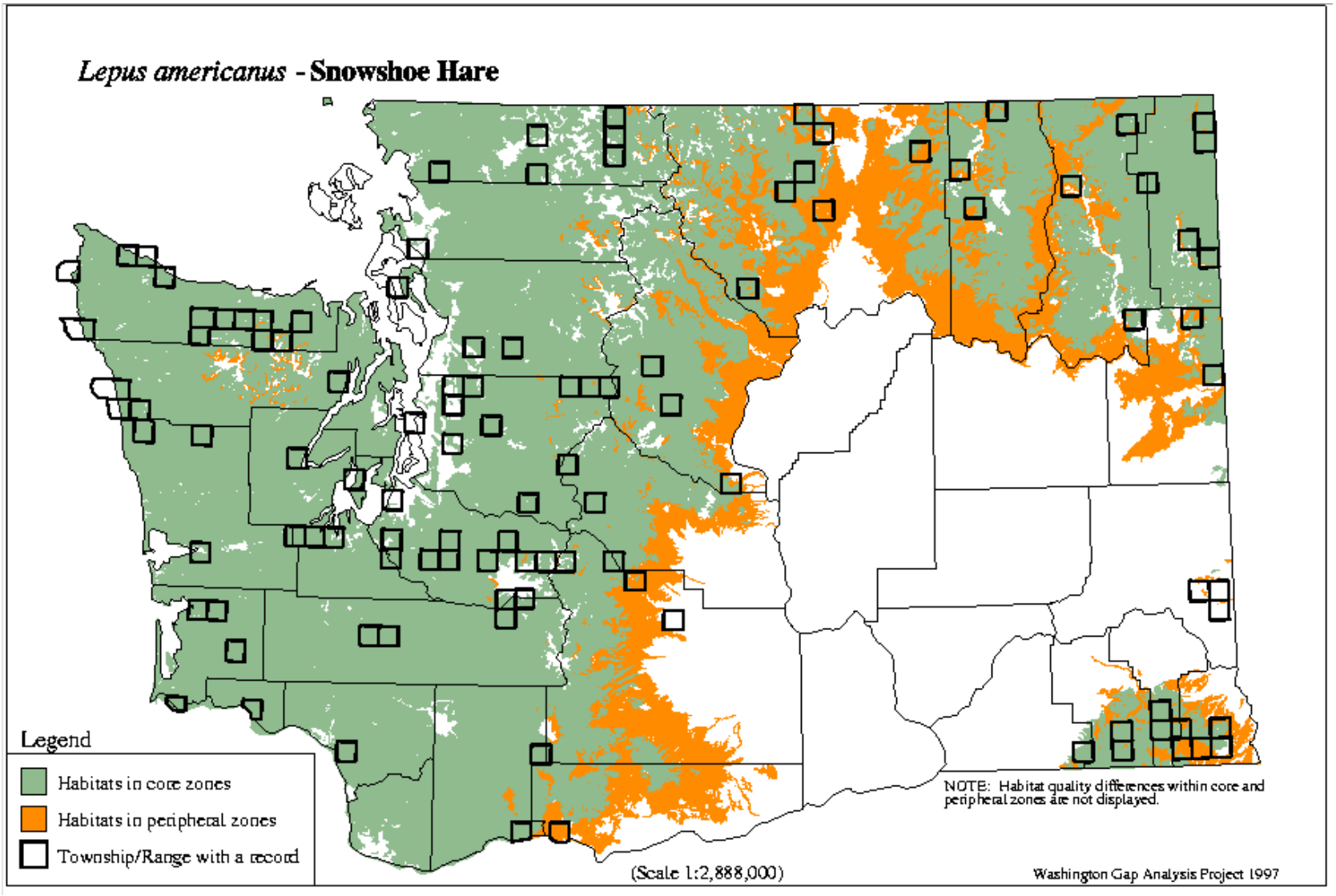
Lake Roosevelt, Blue Creek, and its tributaries do not contain the required habitat constituents of cold, clean, complex and connected habitat to support a spawning population of bull trout. There are no known spawning populations of bull trout in Lake Roosevelt. Isolated observations of bull trout in Lake Roosevelt are recorded annually. In 2012, about a dozen bull trout reported were likely washed down from Lake Coeur d'Alene, with most coming from the upper Columbia River (Per. Comm. Ames, 2013; Campbell, 2014).

5.2 Canada Lynx (*Lynx canadensis*)

Canada lynx are found throughout Alaska, Canada, the Rocky Mountains, northern Great Lakes region and northern New England. In Washington, Canada lynx are found in old growth, high

elevation, western boreal forests above 1,400 m (4,600 ft.) (Ruggeria et. al., 1999) concentrated in the Cascade and Selkirk Ranges (Nature Serve, 2013).

In the Selkirk Mountains, the boreal forest includes interior western cedar and hemlock. Lynx are highly dependent upon snowshoe hare, but they also prey upon red squirrels, small mammals, birds, and carrion. Snowshoe hares prefer areas with dense protective understories composed of edible shrubs and trees (Wolfe et. al., 1982). Preferred lynx hunting habitat consists of 20 to 30 year old pole-size stands of timber. Foraging habitat is considered a limiting factor for lynx (Fitzgerald, 1994). Denning sites require large downed woody debris such as hollow logs or root wads. The U.S. Geological Service maps land cover and models species habitat as part of the National GAP Analysis Program Maps. The GAP species model for snowshoe hare shows that the Action Area provides peripheral habitat (Figure 5); however, core habitat is higher up in elevation. There is a historical record of snowshoe hare occurring approximately 40 miles to the east of the Action Area. Although snowshoe hare habitat occurs in the Action Area, it is unlikely that Canada lynx occur on the site.

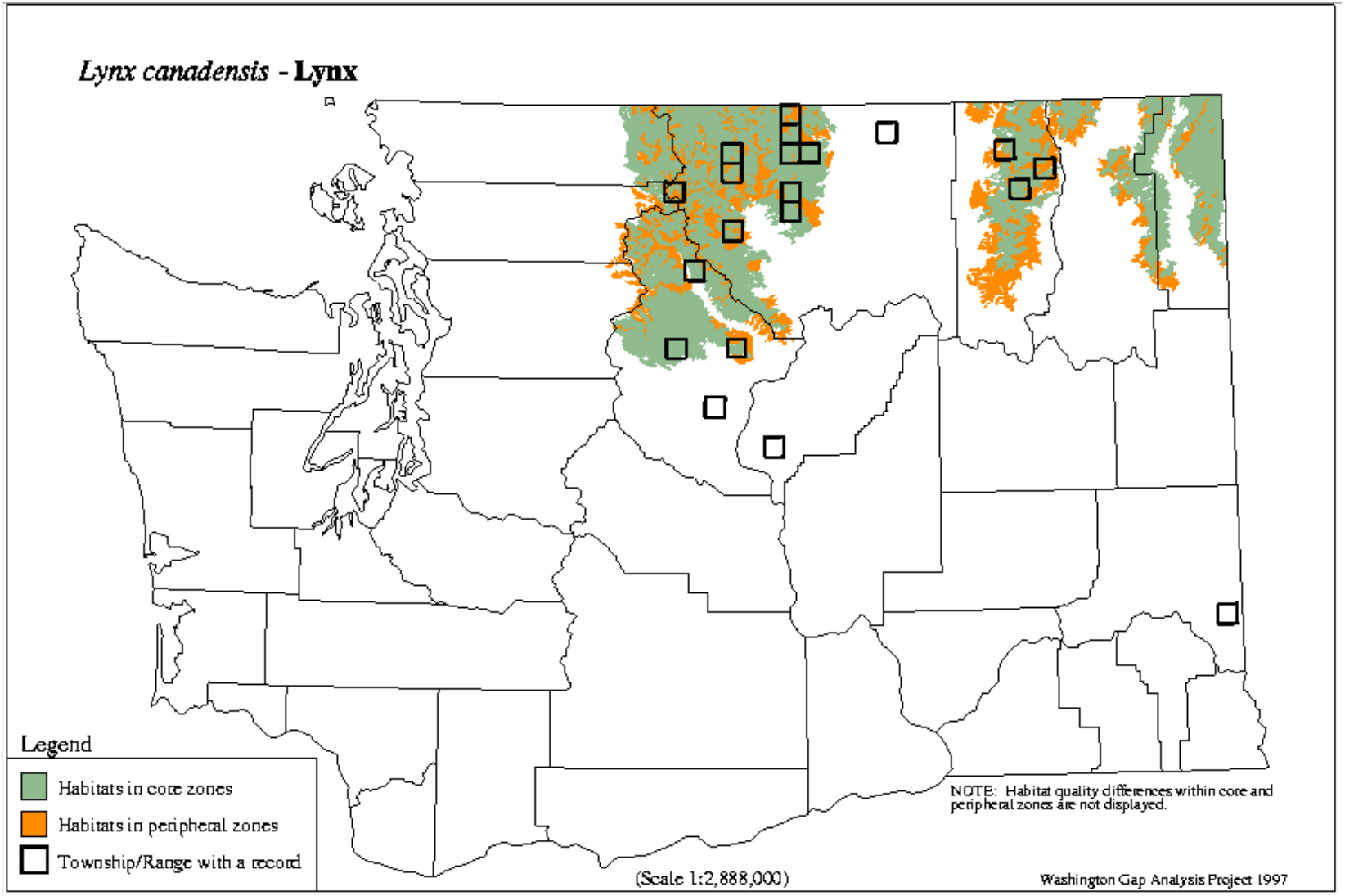


Source: Washington Department of Fish and Wildlife found at http://wdfw.wa.gov/conservation/gap/gapdata/mammals/gifs/leam.gif

Figure 5. GAP Habitat Map for Snowshoe Hare in Washington

The GAP model also shows that there is no Canada lynx habitat occurring within the Spokane Tribe of Indians Reservation (Figure 6). The nearest historical record from the 1997 Washington GAP Analysis map shows three to the north in Ferry County in the Oregon City Ridge and Gold Mountain Ridge (Figure 6). The 2001 State of Washington Lynx Recovery Plan (Stinson, 2001) shows that the nearest recently occupied territories occur in recovery areas of North Sherman (233) and Calispel (218) in the Kettle and Selkirk Mountain Ranges, respectively. These areas are approximately 40 miles to the north and northeast respectively.

Lynx populations have declined in the United States due to human alteration of forests, fire suppression, past exploitation, expansion of competitor range (particularly bobcats and coyotes), and increasing levels of human access to lynx habitat.



Source: Washington Department of Fish and Wildlife found at http://wdfw.wa.gov/conservation/gap/gapdata/mammals/gifs/lyca.gif

Figure 6. GAP Habitat Map for Canadian Lynx in Washington

There are no known occurrences of Canada lynx within the Spokane Indian Reservation. The site lacks the required habitat constituents to support a lynx population. Specifically, the site is not high enough in elevation and not contiguous with other suitable Canada lynx habitat.

5.3 Grizzly bear (*Ursus arctos horribilis*)

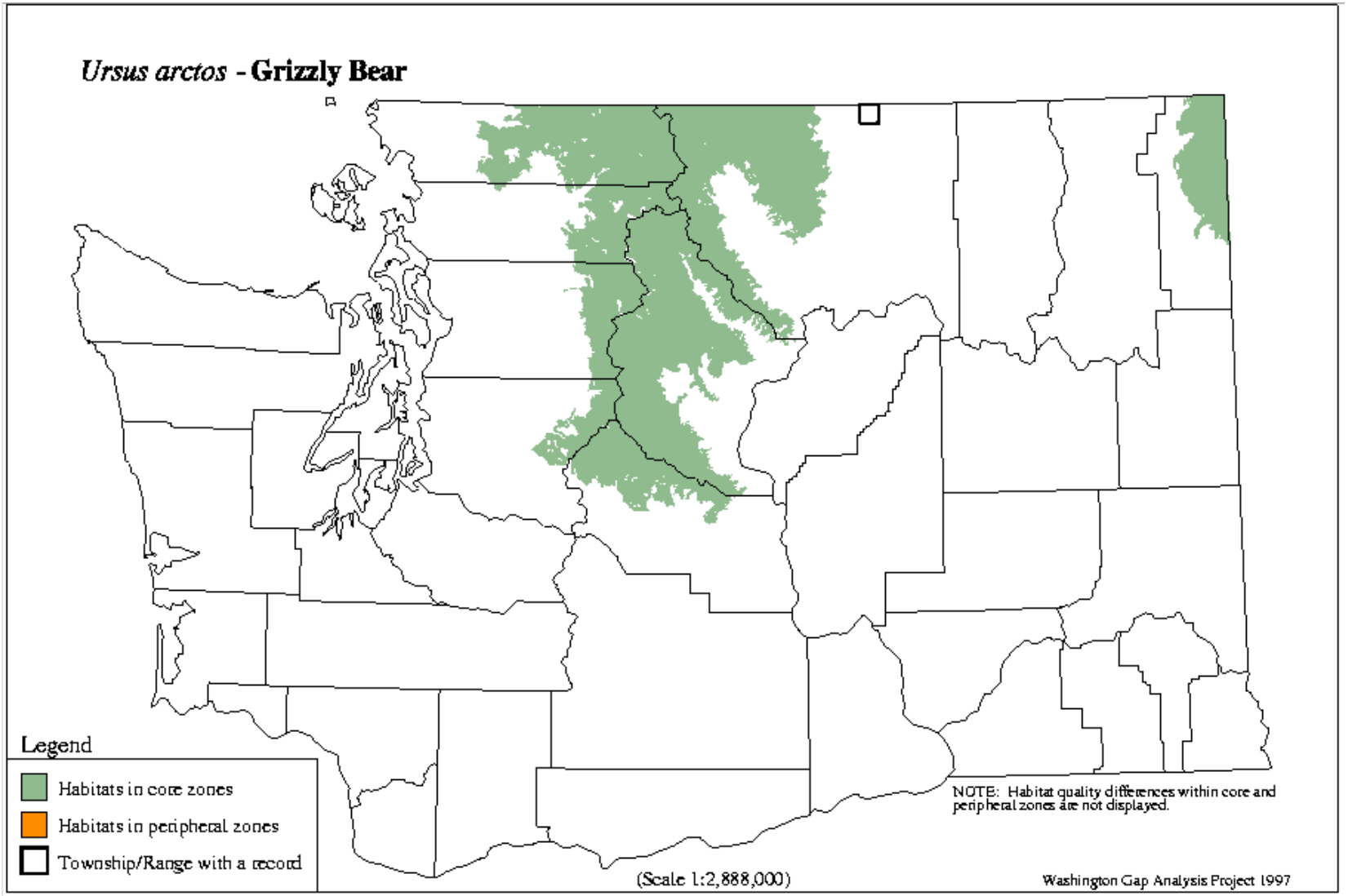
Grizzly bears once ranged throughout Western North America from Central Mexico to the Arctic Ocean (USFWS, 1993). Their range has been substantially reduced to less than 2 percent of their former range in the lower 48 states. Current range includes northeastern and northwestern Washington, northern and eastern Idaho, northwestern Wyoming, western Montana, British Columbia, Alberta, Northern Territories, and Yukon.

Most of the areas of their remaining populations include large contiguous tracts of relatively undisturbed land with high topographic relief and vegetation diversity (such as forest, shrublands, and grasslands), and low bear human conflict. These omnivores generally live in areas with concentrated food sources such as salmon or elk and caribou calving grounds. They are opportunistic feeders and will also feed on small mammals and garbage. In addition, grizzly bears supplement their diet with bulbs, tubers, berries, nuts, and fungi.

Grizzly bears are generally solitary animals with overlapping home ranges. They reach sexual maturity at around 5 years and have been known to live as long as 40 years. Grizzly bears' home ranges vary greatly depending upon food availability and habitat quality. Female bears average 150 square miles while male bears range from 110 to 540, with 309 square miles being average (USFWS, 2011). Grizzly bears in the Glacier National Park Area have been reported to have a population density of one bear per 8 square miles.

Threats to grizzly bears are primarily the loss of contiguous high quality habitat, genetic isolation and human bear interactions associated with livestock protection, threats to human safety, hunting, illegal kills, and nuisance behavior. Habitat fragmentation by highways and disturbance by motorized vehicles also limits their range.

There is no designated Critical Habitat for grizzly bear in Washington. The nearest population of grizzly bear is in the Selkirk Recovery Area which straddles the U.S. and Canadian border at the Washington and Idaho border. This area includes the southern-most portion of the Selkirk Mountains bounded by the Kootenai Lake and River on the north and east, the Salmon and Pend Oreille Rivers on the west and south and the Kootenai River Valley to the east (Figure 7).



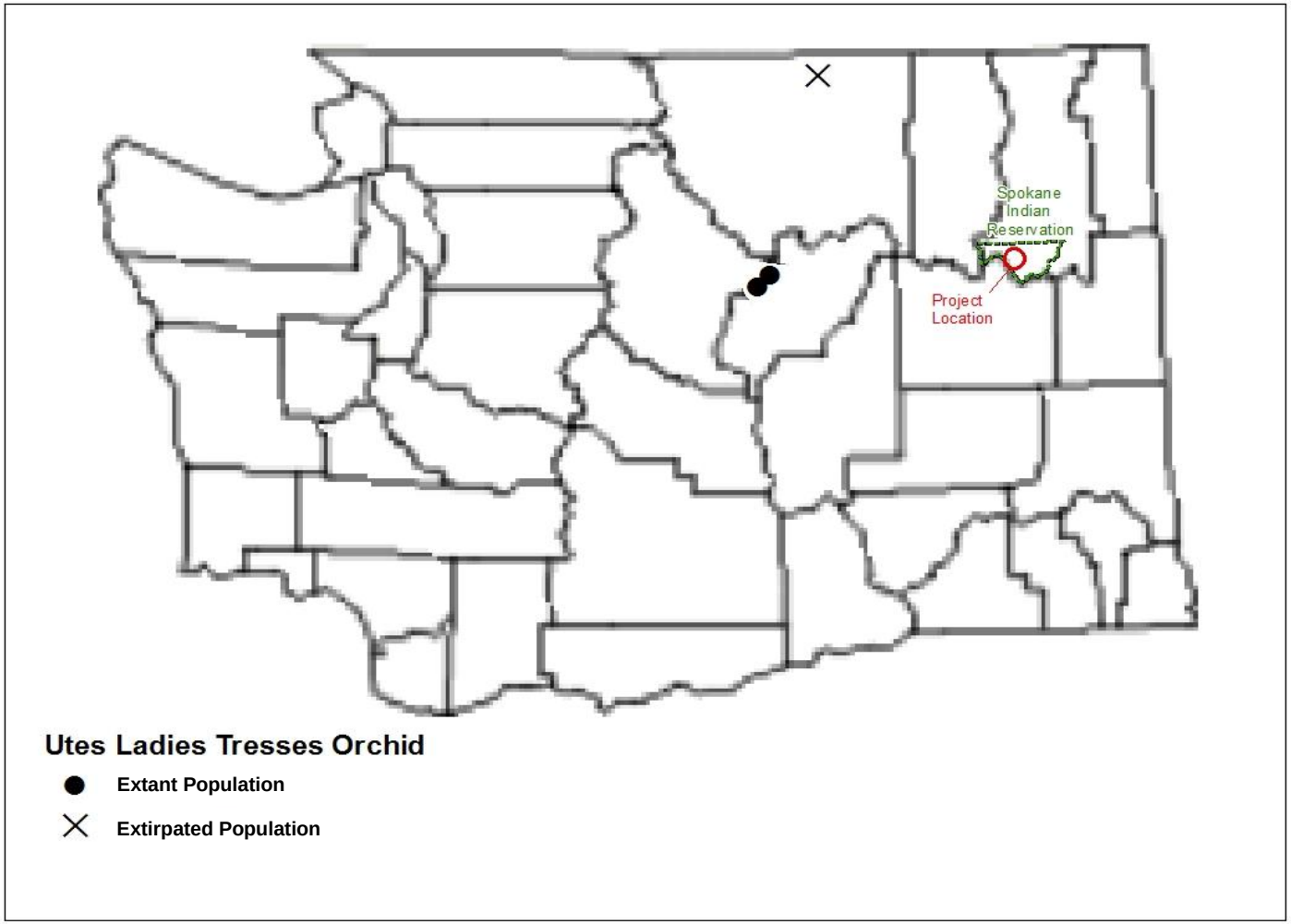
Source: Washington Department of Fish and Wildlife found at http://wdfw.wa.gov/conservation/gap/gapdata/mammals/gifs/urar.gif

Figure 7. GAP Habitat Map for Grizzly Bear in Washington

There are an estimated 50 to 70 grizzly bears in the Selkirk Recovery Area. The Selkirk Recovery Area is 50 miles to the northeast from the Action Area. In 2011, Western Wildlife Outreach GPS tracked a female grizzly outside of the recovery area, near Colville, WA, approximately 60 miles from its previous known range. Colville is approximately 40 miles north of the project action area. There are no recent records of grizzly bear on the Spokane Reservation and are unlikely to be present in the Action Area.

5.4 Ute ladies'-tresses orchid (*Spiranthes diluvialis)*

Utes ladies'-tresses orchid is found in eight states including central Washington, eastern Idaho, northern and central Utah, southern Nevada, northern Colorado, western Nebraska, southeastern Wyoming and southwestern Montana. In Washington, Ute's ladies tresses orchid is known to occur in Okanogan and Chelan counties (Camp and Gamon, 2011) (Figure 8).



Source: Washington Natural Heritage Program found at: http://www1.dnr.wa.gov/nhp/refdesk/fguide/pdf/spdi.pdf

Figure 8. Known Distribution of Ute's Ladies Tresses Orchid in Washington

This species occurs in broad low-elevation intermountain valley plains with deltaic meandered wetland complexes. It grows in temporarily inundated wet meadow zones and along stable channels with subsurface hydrology on calcareous substrate and relatively low vegetative cover. There are a few known sites that occur in periodically flooded alkaline flats adjacent to Ponderosa pine/Douglas fir woodlands and sagebrush steppe. In Washington State, Utes ladies' tresses orchid occur at elevations ranging from 720 to 1,500 ft. amsl, which falls within the elevational range of the Action Area (1,180 to 3,500 ft amsl).

Threats to Utes ladies' tresses include urban development, stream channelization, water diversion and other watershed alterations that change stream and flood stability. Pesticide use related to agricultural practices or landscape management may impact pollinators.

There are no sub-irrigated calcareous wetlands within the project action area. Surface hydrology along the banks of the Spokane Arm of Lake Roosevelt fluctuates greatly based on seasonal reservoir management and does not provide a suitable environment for this species. In addition, Blue Creek has a narrow bed and associated riparian corridor with no sub-irrigated calcareous soil. There is no designated Critical Habitat for Ute's ladies tresses orchid.

There are no known occurrences of Ute ladies'-tresses orchid in Stevens County and the project action area does not contain the necessary habitat constituents for this species.

6.0 EFFECTS

Of the four listed species analyzed, only bull trout has the potential to occur within the project action area. Canada lynx, Grizzly Bear and Ute ladies'-tresses are not likely to be present in the action area and therefore will not be affected by the project action. The potential effects of the project action on bull trout are further evaluated in Section 4.

The project action was analyzed for potential direct, indirect and cumulative effects on the bull trout. Direct effects are defined as those effects that would result in the direct loss of habitat associated with construction or the potential mortality or "take" of individuals. An example of direct effects would be the loss of habitat by heavy equipment within the project action footprint. Indirect effects would be alteration of conditions that may affect or disrupt the species behavior. Examples of indirect effects would be the loss of habitat associated with the importation of invasive weeds or sedimentation of waterways after the construction has been completed.

6.1 Direct Effects

Direct effects on bull trout associated with this project action could potentially result from disturbance of the lake bottom associated with the installation of the pipeline. The installation of the pipeline would occur in two phases with a portion of the pipeline being buried during seasonally low lake water and the remainder of the pipeline being buried during extreme low lake water associated with dam maintenance. Between these two periods, a portion of the pipeline and diffuser would be placed on the lake bottom. The length of the exposed pipeline is dependent upon the lake elevation during initial installation. The pipeline will be approximately eight inches in diameter and would be buried approximately two to four feet below the surface of the lake bottom. The temporary construction footprint for the pipeline would be approximately eight feet wide to include enough room for an excavator, the pipe material, and soil windrow. The pipeline and diffuser that would temporarily sit on the lake bottom would be assembled on shore and floated onto the lake and submerged with anchors. Once final construction is completed, only the pipeline below the extreme low water level and the diffuser will be present above the lake bottom. Bull trout are highly mobile and would likely swim to other areas of the lake during the placement of the pipeline and no direct mortality would occur.

6.2 Indirect Effects

Indirect effects to bull trout would be minor since bull trout do not inhabit Blue Creek and are only transient species in Lake Roosevelt and likely only present from accidental wash-over from upstream dams. Moving the water treatment plant discharge location from its current location in Blue Creek to Lake Roosevelt would improve water quality within Blue Creek, the Blue Creek Inlet, and Blue Creek Tributaries. No additional pollutants would be added to Lake Roosevelt as a result of moving the discharge location. The effect of the discharge in the historic Spokane River channel into Lake Roosevelt would be negligible since it is a larger body of water and currents would dilute the effluent much more quickly than at the Blue Creek Inlet. The water being discharged would comply with a newly issued NPDES permit that is pending from EPA and would comply with the Spokane Tribe of Indians Surface Water Quality Standards (STI, 2010) and would be unlikely to adversely affect bull trout. State of Washington Department of Ecology lists this section of Lake Roosevelt on the 1998 Section 303(d) list of impaired surface waters because they do not meet the state's water quality standards for total maximum daily loads (TMDLs) for dissolved oxygen, total phosphorus, and heavy metals i.e., zinc, cadmium, lead (SWDE, 2013). Zinc and cadmium are known to be harmful to salmonids and other aquatic life at relatively low concentrations resulting in bioaccumulation in fish tissue and bind to fish gills and cause suffocation (SWDE, 2013). The existing water quality in this section of Lake Roosevelt does not provide conditions preferred by bull trout. The discharge of the WTP effluent is not expected to adversely affect the few bull trout that inhabit Lake Roosevelt.

Lake temperatures near the discharge location range from 36 °F and 69 °F with a mean temperature of 52 °F. The current effluent temperature ranges from 56 °F to 71 °F with a mean temperature of 63 °F, between May and October. However, the temperature of the future WTP discharge during and following construction is not known. It is assumed that the temperature of the pit water will change once the pits are filled with mine waste and the Waste Containment Areas are covered. Any temperature differences in the effluent to the receiving water would likely disperse quickly in the mixing zone. The size of the temperature mixing zone is not yet known; however, the WTP effluent temperature will be monitored at the discharge location following installation of the discharge point and operation of the new water treatment plant. The maximum size of the chronic mixing zone for chemicals is approximately 190 feet from the diffuser port and 280 feet wide at the downstream terminus. It is anticipated that the temperature mixing zone would be smaller than the chemical mixing zone. The ambient temperature in Lake Roosevelt at the

proposed discharge location is outside of bull trout preferred range and exceeds their temperature tolerance from May through September. Any temperature differential in the mixing zone is expected to be relatively small and would not substantially change overall habitat condition for bull trout in Lake Roosevelt.

In addition, bull trout are highly mobile and would likely concentrate in those areas of the lake that are most suitable. The effects of the discharge of WTP effluent into Lake Roosevelt are expected to be localized and limited to the mixing zone. Other components of the project action would further improve water quality in the Blue Creek drainage as it flows to Lake Roosevelt, including the access roads and drainage clean up. Storm water runoff would no longer come into contact with contaminated sediments in the mine drainages and along the access roads once they are cleaned up. The change in the discharge location to Lake Roosevelt or the temporary construction is not expected to obstruct any potential migratory corridors or cause injury/mortality, due to temperature, dissolved oxygen, turbidity, habitat loss, or impact forage food availability.

Construction activities associated with remediation at the mine site and the new discharge pipeline could temporarily increase turbidity in Blue Creek and Lake Roosevelt. Although erosion control measures will be employed, such as the use of silt fence, straw bales, wattles, mulch, and revegetation, some erosion and turbidity could occur during high run-off events until native revegetation becomes established. Turbidity would be temporary and localized. Bull trout have not been found to occur within Blue Creek or the Blue Creek Inlet and are unlikely to be affected by this temporary turbidity.

7.0 CONCLUSION AND DETERMINATION

Of the species analyzed in this BA, the project action has the potential to affect only bull trout. For Canada lynx, grizzly bear and Ute ladies'-tresses, the action area is outside of the species range or suitable habitat does not occur within the action area. Thus, those species will not be affected by the project action.

The USFWS has documented a number of bull trout in Lake Roosevelt each year, but has determined that there are no spawning populations in Lake Roosevelt and any individuals present are likely accidental dam wash-over. Most records have been attributed to reports on the Upper Columbia River. The Blue Creek Pipeline would be installed approximately 3,540 linear feet in Lake Roosevelt. The pipe would be buried in two phases: first during the seasonal low lake water; and second during an extreme low lake water event.

The disturbance of the lake bottom during low water events would likely have a negligible impact on any bull trout in the area. Best management practices will be used as part of the construction, which will include erosion control devices such as silt fence or wattles to minimize the potential for temporary turbidity cause by the disturbance of the lake bottom. Erosion control measures would be used throughout the drainage clean up. A spill prevention controls and countermeasure plan will be prepared and implemented to minimize any inadvertent discharge into Lake Roosevelt. Following sediment clean up at the drainages, the bare soil would be stabilized and revegetated with native riparian species. The new discharge location would not likely affect those isolate individual bull trout in Lake Roosevelt since the effluent would be the same as current discharge and the new location would improve dilution.

Based on the potential presence of isolated bull trout within the project action area, the action "may affect, but would not likely adversely affect" bull trout. Lake Roosevelt provides poor habitat for bull trout because it lacks the necessary habitat constituents and water quality. The limited population present in the lake and installation of the pipeline during low lake level events make the chance of any incidental "take" extremely unlikely.

Because direct take and indirect take are unlikely as a result of this project action, no mitigation beyond the measures incorporated in the project action is being proposed.

8.0 LITERATURE CITED

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ATTACHMENT A

Agency Communication Log

Date	Agency	Form	Summary
3/15/2012	USFWS	Generic Countywide letter	USFWS Stevens County Listed Species: Canada Lynx Grizzly Bear Utes Ladies' Tresses Orchid Bull Trout
3/26/2013	WA DFW, Priority Habitats and Species Report	Online Database Search	No ESA in project area
4/23/2013	NOAA Fisheries Service Habitat Program, Steve Landino	Mailed Letter	Request data on T&E anadromous fish
4/23/2013	Spokane Tribe DNR, Brian Crossley	Mailed Letter	Request T&E fish species
4/23/2013	WA Natural Heritage Program, John Gamon	Mailed Letter	Request T&E plant species
4/23/2013	USFWS, Mark Miller	Mailed Letter	Request T&E species and eagle data
4/23/2013	WA Dept. Fish and Wildlife, Priority Habitat and Species, Lori Guggenmos	Mailed Letter	Request T&E species and eagle data
4/23/2013	Spokane Tribe DNR, Katie Eaton	Mailed Letter	Request T&E wildlife species and eagle data
5/1/2013	STI DNR, Katie Eaton	email	No terrestrial ESA known to be present on the Reservation and no known eagle nests known with project area.
5/6/2013	WA NHP, Jasa Holt	email	No rare plants or high quality native ecosystems in vicinity of project.
5/15/2013	STI Water and Fish Manager - Casey Flanagan	email	Described fish present in Blue Creek Watershed
5/30/2013	STI Water and Fish Manager - Casey Flanagan	email	Provided 2000 annual report and BPA report
6/3/2013	WA Dept. Fish and Wildlife, Priority Habitat and Species, Lori Guggenmos	Mailed letter	Bull Trout record in Blue Creek Inlet
6/14/2013	Eastern Washington University, Dr. Allan Scholz	email	Follow up on STI IRMP bull trout citation
6/17/2013	Eastern Washington University, Dr. Allan Scholz	email	He has not collected bull trout at the mouth of Blue Creek

Date	Agency	Form	Summary
7/12/2013	NOAA, National Marine Fisheries, Steve Landino to Frankie Johnson	call	She suggested contacting Dale Bambrick of NOAA
7/15/2013	USFWS, Michelle Ames	call	Follow up on species specific list and data, she provided overview of species geography and issues, suggested I speak to Julie Campbell for more on Bull Trout.
7/15/2013	NOAA, National Marine Fisheries, Dale Bambrick to Justin Yeager	call	He stated that they don't regulate fish above the Chief Joseph Dam
7/15/2013	USFWS, Julie Campbell	call	Reaffirmed, no Bull Trout spawning habitat in Lake Roosevelt and any incidental records are likely from Lake
1/21/2014	STI DNR Lake Roosevelt Fisheries, Brent Nichols	call	Left v-mail
1/22/2014	STI DNR Lake Roosevelt Fisheries, Brent Nichols	call	Does not have any records of Bull Trout in and around the project area, suggested that I review the reports at CBFish.org with the title search "Lake Roosevelt fisheries evaluation"
1/22/2014	WA DFW, Andrew Weiss	email	Does not have a source for Blue Creek Bull Trout record, suggested that the source could be from a mapping review party in Spokane 2006/2007 and suggested that I call WA DFW District 1 Biologist, Bill Baker.
1/22/2014	Columbia Basin Fish and Wildlife Program	CBFish.org Lake Roosevelt Fisheries Annual Reports covering fish data between 1989 and 2009	Gill Net Survey 1993 to 2004 - No bull trout recorded Electrofishing 1989 to 2009 - Bull trout recorded <1% abundance in 1989 <1% abundance in 1990 <1% abundance in 1994 <1% abundance in 1995 two bull trout in 2000 one bull trout 2001 one bull trout in 2002 Big Sheep Creek fish trap recorded 1 bull trout in 2004.
1/23/2014	WA DFW, Bill Baker	call	Left v-mail
1/24/2014	WA DFW, Bill Baker	call	No viable population in Lake Roosevelt, would rely on Spokane Tribes and Al Scholz records than DFW

ATTACHMENT B

NPDES Permit Application

Please print or type in the unshaded areas only.

Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S		T/A	C
F	WA980978753		D
1	2 — 13	14	15

LABEL ITEMS	
I. EPA I.D. NUMBER	PLEASE PLACE LABEL IN THIS SPACE
III. FACILITY NAME	
V. FACILITY MAILING ADDRESS	
VI. FACILITY LOCATION	

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)		X	
	16	17	18		19	20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X			D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)		X	
	22	23	24		25	26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)		X		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
	28	29	30		31	32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
	34	35	36		37	38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X	
	40	41	42		43	44	45

III. NAME OF FACILITY

C 1 SKIP MIDNITE MINE

15 16 – 29 30 69

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
C 2 William S. LYLE	(509) 285-4511
15 16 45	46 48 49 51 52- 55

V. FACILTY MAILING ADDRESS

A. STREET OR P.O. BOX

C 3 PO BOX 250

15 16 45

B. CITY OR TOWN	C. STATE	D. ZIP CODE
C 4 FORD	WA	99013
15 16 40	41 42	47 51

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

C 5 6834 FORD-WELLPINIT ROAD

15 16 45

B. COUNTY NAME

STEVENS COUNTY

46 70

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
C 6 SPOKANE RESERVATION	WA	99129	
15 16 40	41 42	47 51	52 -54

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
C 7 1094 (specify) Uranium - Radium-Vanadium Ores	C 7 (specify)
C. THIRD	**D. FOURTH**
C 7 (specify)	C 7 (specify)

VIII. OPERATOR INFORMATION

A. NAME: C 8 DAWN MINING COMPANY LLC

B. Is the name listed in Item VIII-A also the owner? ☑ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box: if "Other," specify.)*

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*

P (specify)

D. PHONE *(area code & no.)*: C A (509) 258-4511

E. STREET OR P.O. BOX: PO BOX 250

F. CITY OR TOWN: C B FORD

G. STATE: WA

H. ZIP CODE: 99013

IX. INDIAN LAND

Is the facility located on Indian lands? ☑ YES ☐ NO

X. EXISTING ENVIRONMENTAL PERMITS

	C	T	I	
A. NPDES *(Discharges to Surface Water)*	9	N		WA-002572-1
D. PSD *(Air Emissions from Proposed Sources)*	9	P		
B. UIC *(Underground Injection of Fluids)*	9	U		
E. OTHER *(specify)*	9			(specify)
C. RCRA *(Hazardous Wastes)*	9	R		
E. OTHER *(specify)*	9			10-2009-0026 (specify) CERCLA

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

Midnite Mine is an inactive open-pit uranium mine located on the Spokane Indian Reservation in rural Stevens County. Uranium-bearing rock exposed due to mining are a source of radiation, and acid rock drainage has mobilized heavy metals.

Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, 42 USC §9601 et seq., Environmental Protection Agency (EPA) Region 10 issued a Unilateral Administrative Order (UAO) for Phase I Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2009-0026 as described in the Consent Decree, CIVIL ACTION NO. CV-05-020-JLQ.

The nature of the business is to implement the Remedial Action that disposes of the contaminated mine waste rock, proto-ore, and soil and treats contaminated surface water and groundwater. Part of the Remedial Action requires the construction of a new water treatment plant (WTP) to replace the existing WTP. The new WTP will discharge treated water to the Spokane Arm of Lake Roosevelt.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
William S. Lyle, Vice President	William S. Lyle	March 20, 2013

COMMENTS FOR OFFICIAL USE ONLY

C

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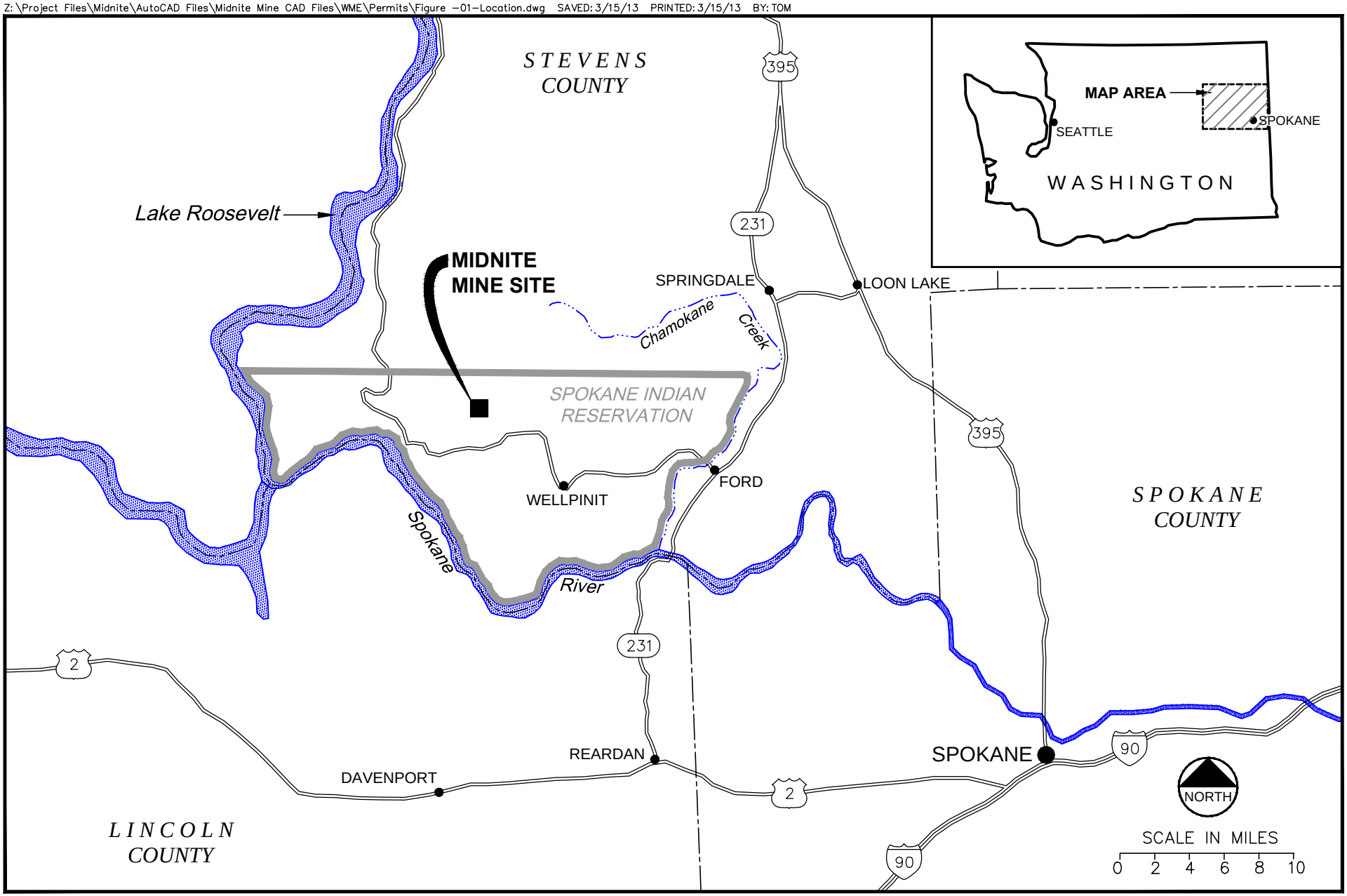

March 2013

WORTHINGTON
MILLER
ENVIRONMENTAL, LLC.

Figure 1
Midnite Mine Site Location Map

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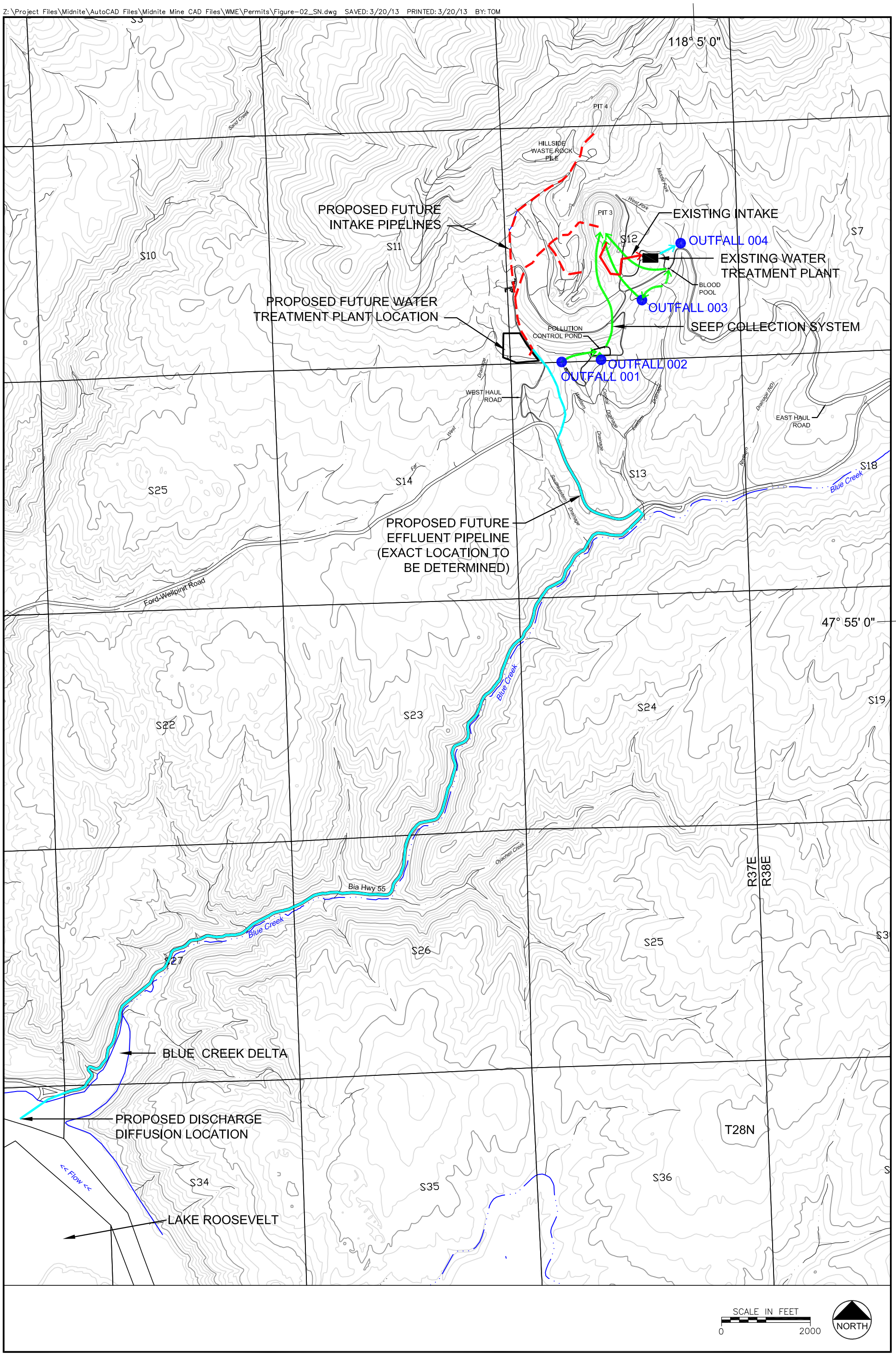


WORTHINGTON MILLER ENVIRONMENTAL, LLC.

FIGURE 2
EXISTING AND PROPOSED FUTURE WATER TREATMENT FACILITIES
MIDNITE MINE SITE

Date:	MARCH 2013
Project:	MIDNITE
File:	FIGURE-02

Please print or type in the unshaded areas only.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
WA980978753

Form Approved.
OMB No. 2040-0086.
Approval expires 3-31-98.

FORM **2C** NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURE OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (*list*)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (*name*)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	
001	47.00	55.00	59.72	118.00	5.00	50.22	Pollution Control Pond to Pit 3
002	47.00	55.00	59.84	118.00	5.00	37.34	Pollution Control Pond to Pit 3
003	47.00	56.00	12.81	118.00	5.00	23.11	Pit 3
004	47.00	56.00	19.70	118.00	5.00	13.96	Eastern Drainage - trib to Blue Creek
005	47.00	53.00	13.16	118.00	8.00	56.80	Spokane Arm of Lake Roosevelt

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO. (*list*)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (*list*)	b. AVERAGE FLOW (*include units*)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Captures stream and groundwater seep	18 to 1,000 gpm	Captured water transferred to Pollution Control Pond and pumped to Pit 3 for storage prior to	4-A	
	(mine affected water)		treatment.		
002	Captures groundwater seep	few gpm	Captured water transferred to Pollution Control Pond and pumped to Pit 3 for storage prior to	4-A	
	(mine affected water)		treatment		
003	Captures groundwater seep	up to 50 gpm	Captured water pumped to Pit 3 for storage prior to treatment.	4-A	
	(mine affected water)				
004/005	Water Treatment Plant (from Pit 3)	- not stormwater dependent			
	-Uranium Removal - IX (future)	70 MGal/yr	Ion Exchange/Sorption	2-J	1-X
	-Barium Chorlide	70 MGal/yr	Chemical Precipitation	2-C	
	-Lime	70 MGal/yr	Chemical Precipitation	2-C	2K
004/005	Surface water discharge	70 MGal/yr	Discharge to Lake Roosevelt (formerly Blue Creek).	4-A	

OFFICIAL USE ONLY (*effluent guidelines sub-categories*)

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☑ YES (*complete the following table*) ☐ NO (*go to Section III*)

1. OUTFALL NUMBER (*list*)	2. OPERATION(*s*) CONTRIBUTING FLOW (*list*)	3. FREQUENCY a. DAYS PER WEEK (*specify average*)	3. FREQUENCY b. MONTHS PER YEAR (*specify average*)	4. FLOW a. FLOW RATE (*in mgd*) 1. LONG TERM AVERAGE	4. FLOW a. FLOW RATE (*in mgd*) 2. MAXIMUM DAILY	4. FLOW B. TOTAL VOLUME (*specify with units*) 1. LONG TERM AVERAGE	4. FLOW B. TOTAL VOLUME (*specify with units*) 2. MAXIMUM DAILY	4. FLOW C. DURATION (*in days*)
001	Groundwater Seep	7	12	0.13	1.4	49 Mgal/yr	1.4 Mgal	365
002	Groundwater Seep	7	12	0.018	0.004	7 Mgal/yr	0.004Mgal	365
003	Groundwater Seep	7	12	0.038	0.07	14 Mgal/yr	0.07 Mgal	365
004/005	Treatment of water	7	12	0.19	0.78	70 Mgal/yr	0.78 Mgal	365
	* Existing WTP approx. 120 days/yr New WTP anticipated 365 days/yr							

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☑ YES (*complete Item III-B*) ☐ NO (*go to Section IV*)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (*or other measure of operation*)?

☐ YES (*complete Item III-C*) ☑ NO (*go to Section IV*)

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (*specify*)	2. AFFECTED OUTFALLS (*list outfall numbers*)

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operations of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☑ YES (*complete the following table*) ☐ NO (*go to Item IV-B*)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS a. NO.	2. AFFECTED OUTFALLS b. SOURCE OF DISCHARGE	3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE a. REQUIRED	4. FINAL COMPLIANCE DATE b. PROJECTED
Midnite Mine Consent Decree CERCLA Action No. 10-2009-0026	004/005	Midnite Mine Water Treatment Plant	Midnite Mine Remediation - Construct new WTP and move outfall 004 to Spokane Arm of Lake Roosevelt.		12/18/2015
	001/002/003	Ground Water Seeps	Water collection points will change as remedy is implemented.		

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (*or other environmental projects which may affect your discharges*) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

 CONTINUE ON PAGE 3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
WA980978753

CONTINUED FROM PAGE 2

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided.
NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
Strontium	Uranium Mine Contaminant		
Uranium	Uranium Mine Contaminant		
Vanadium	Uranium Mine Contaminant (See data in analyte table)		

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ YES (*list all such pollutants below*) ☑ NO (*go to Item VI-B*)

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☑ YES (*identify the test(s) and describe their purposes below*) ☐ NO (*go to Section VIII*)

The Whole Effluent Toxicity Testing Report (GEI, 2012) shows that acute testing has been consistently within limits. The hypothesis testing and the power standard were used for the administratively suspended NPDES permit (No. WA-002572-1). The results of the test showed no toxicity of either of the acute tests and control performance criteria were detected. There were no significant effects on chronic Ceriodaphnia dubia survival test. However, there were effects on reproduction. An IC25 (Inhibition Concentration) of >100% effluent and a No Observable Effect Concentration (NOEC) of 70% effluent were determined and control performance criteria were met. There were no significant effects in the chronic Pimephales promelas test and control performance criteria were met.

The power standard of ≤ 29% was met for both acute tests. The power standard of ≤ 39% was met for the chronic P. promelas test for both survival and growth as well as for the C. dubia test for survival. The percent difference for C. dubia reproduction was 45% which is above the power standard of 39%. No observed effects (NOEL) and lowest observed effect (LOEL) at 100% effluent. The power standard is a calculated relative percent standard (RPD) between the reproduction or growth controls and 86% effluent as required in the Permit. See attached for full report.

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☑ YES (*list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below*) ☐ NO (*go to Section IX*)

A. NAME	B. ADDRESS	C. TELEPHONE (*area code & no.*)	D. POLLUTANTS ANALYZED (*list*)
Energy Laboratories, Inc.	2393 Salt Creek Hwy. Casper, WY 8260 2325 Kerzell Lane Casper, WY 82601	(307) 235-0515	Gross Alpha, Gross Beta, Gross Gamma, Pb 210, Total Ra 226, Total Th, Isotopic Uranium, Isotopic and Total H-3
ACZ Laboratories	2773 Downhill Drive Steamboat Springs, CO 80487	(800) 334-5493	Al, Sb, AS, Ba, Be, Bi, B, Bt, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, K, Se, SiO2, S, Ag, Na, Sr-90, Sr, Tl, Sn, Ti, U, V, Zn, CaCO3, Br, Cl, F, NO3No2, pH, P, SO4, TDS, TSS, HCO3, CO3, Cl, F, OH, NO2+NO3, NO3, NO2, pH
GEI Consultants, Inc.	4601 DTC Blvd Suite 900 Denver, CO 80237	(303) 662-0100	Whole Effluent Toxicity Testing

IX. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. NAME & OFFICIAL TITLE (*type or print*)	B. PHONE NO. (*area code & no.*)
William S. Lyle, Vice President	(509) 258-4511
C. SIGNATURE	**D. DATE SIGNED**
William S. Lyle	March 20, 2013

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (*use the same format*) instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER (*copy from Item 1 of Form 1*): WA980978753

V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO. 004/005

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	2. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	2. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	2. EFFLUENT b. MAXIMUM 30 DAY VALUE (2) MASS	2. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	2. EFFLUENT c. LONG TERM AVRG. VALUE (2) MASS	2. EFFLUENT d. NO. OF ANALYSES	3. UNITS (*specify if blank*) a. CONCEN-TRATION	3. UNITS b. MASS	4. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	4. INTAKE b. NO. OF ANALYSES
a. Biochemical Oxygen Demand (*BOD*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
b. Chemical Oxygen Demand (*COD*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c. Total Organic Carbon (*TOC*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d. Total Suspended Solids (*TSS*)	7	13.7	NA	NA	5.5 [a]	11.6	6	mg/L	kg	<5 [a]	11.6	6
e. Ammonia (*as N*)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
f. Flow May-Oct 2011/2012	VALUE 779,800		VALUE NA		VALUE 70 Mgal/yr		244	Mgal/yr		VALUE 70 Mgal/yr		244
g. Temperature (*winter*)	VALUE NA		VALUE NA		VALUE NA		0	°C		VALUE NA		0
h. Temperature (*summer*) Jun-Oct	VALUE 21.9		VALUE NA		VALUE 17.3		5	°C		VALUE 15.8		5
i. pH	MINIMUM 5.7	MAXIMUM 7.0	MINIMUM NA	MAXIMUM NA			6	STANDARD UNITS				

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X" a. BELIEVED PRESENT	2. MARK "X" b. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	3. EFFLUENT a. MAXIMUM DAILY VALUE (2) MASS	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT b. MAXIMUM 30 DAY VALUE (2) MASS	3. EFFLUENT c. LONG TERM AVRG. VALUE (*if available*) (1) CONCENTRATION	3. EFFLUENT c. LONG TERM AVRG. VALUE (2) MASS	3. EFFLUENT d. NO. OF ANALYSES	4. UNITS a. CONCEN-TRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	5. INTAKE a. LONG TERM AVERAGE VALUE (2) MASS	5. INTAKE b. NO. OF ANALYSES
a. Bromide (24959-67-9)	X		0.4	1,022	NA	NA	<0.2 [a]	<555.9	6	mg/L	g	<0.2 [a]	590.1	6
b. Chlorine, Total Residual		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
c. Color		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
d. Fecal Coliform		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
e. Fluoride (16984-48-8)	X		1.7	3.3	NA	NA	1.4 [a]	2.8	6	mg/L	kg	1.7	3.6	6
f. Nitrate-Nitrite (*as N*)	X		0.38	971	NA	NA	0.35 [a]	494	6	mg/L	g	0.38 [a]	609	6

See Page V-9 for footnotes.

CONTINUE ON REVERSE

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (*if available*)	2. MARK "X"		3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (*as N*)		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
h. Oil and Grease		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
i. Phosphorus (as P), Total (7723-14-0)	X		0.05	98.04	NA	NA	0.025	49.22	6	mg/L	g	<0.01 [a]	25.17	6
j. Radioactivity														
(1) Alpha, Total	X		84.2	NA	NA	NA	22.6 [b]	NA	17	pCi/L	NA	11,432	NA	6
(2) Beta, Total	X		41.6	NA	NA	NA	27.2	NA	6	pCi/L	NA	4,770 [b]	NA	6
(3) Radium, Total	X		NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]	NA [d]
(4) Radium 226, Total	X		0.75	1.99	NA	NA	0.30 [b]	0.80	17	pCi/L	µg	22.0 [b]	0.8	6
k. Sulfate (*as SO_4*) (14808-79-8)	X		2,200	5,534	NA	NA	1,859	4,112	17	mg/L	kg	1,965	4,306	6
l. Sulfide (*as S*)		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
m. Sulfite (*as SO_3*) (14265-45-3)		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n. Surfactants		X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
o. Aluminum, Total (7429-90-5)	X		130	342	NA	NA	70 [a]	175	17	µg/L	g	23,500	50911	6
p. Barium, Total (7440-39-3)	X		78	192	NA	NA	68	138	6	µg/L	g	<6 [a]	16.0	6
q. Boron, Total (7440-42-8)	X		30	66.4	NA	NA	<20 [a]	<41.1	6	µg/L	g	<20 [a]	44	6
r. Cobalt, Total (7440-48-4)	X		3.4	7.9	NA	NA	2.7	5.5	6	µg/L	g	499	1,096	6
s. Iron, Total (7439-89-6)	X		50	111	NA	NA	<40 [a]	<78	6	µg/L	g	107 [b]	241	6
t. Magnesium, Total (7439-95-4)	X		111	218	NA	NA	89	178	6	mg/L	kg	203	439	6
u. Molybdenum, Total (7439-98-7)	X		8	17.7	NA	NA	6.2	12.3	6	µg/L	g	2 [a]	4.9	6
v. Manganese, Total (7439-96-5)	X		190	441	NA	NA	99 [b]	225	17	µg/L	g	35,270	76734	6
w. Tin, Total (7440-31-5)	X		<200	<511	NA	NA	NA [c]	NA [c]	6	µg/L	g	NA [c]	NA [c]	6
x. Titanium, Total (7440-32-6)	X		20	44.2	NA	NA	10 [a]	22.7	6	µg/L	g	10 [a]	26.7	6

See Page V-9 for footnotes.

CONTINUE ON PAGE V-3

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
WA980978753	004/005

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (*all 7 pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	X			<0.8	<2	NA	NA	NA [c]	NA [c]	6	µg/L	g	NA [c]	NA [c]	6
2M. Arsenic, Total (7440-38-2)	X			1.1	2.69	NA	NA	<1 [a]	<1.87	17	µg/L	g	<1 [a]	5.02	6
3M. Beryllium, Total (7440-41-7)	X			<0.2	<0.5	NA	NA	NA [c]	NA [c]	6	µg/L	g	16.9	37.1	6
4M. Cadmium, Total (7440-43-9)	X			<0.2	<0.5	NA	NA	NA [c]	NA [c]	6	µg/L	g	23.8	52.2	6
5M. Chromium, Total (7440-47-3)	X			1	2.6	NA	NA	<1 [a]	<2	6	µg/L	g	NA [c]	NA [c]	6
6M. Copper, Total (7440-50-8)	X			4	8.8	NA	NA	3	6.1	6	µg/L	g	89 [b]	194	6
7M. Lead, Total (7439-92-1)	X			5.5	12.2	NA	NA	<0.2 [a]	<2.4	6	µg/L	g	4.0 [b]	10.0	6
8M. Mercury, Total (7439-97-6)	X			0.0061	15.5	NA	NA	0.0044 [a]	7.7	17	µg/L	mg	0.001 [a]	4.96	6
9M. Nickel, Total (7440-02-0)	X			15	29	NA	NA	11	22	6	µg/L	g	798	1,752	6
10M. Selenium, Total (7782-49-2)	X			<1	<3	NA	NA	NA [c]	NA [c]	6	µg/L	g	NA [c]	NA [c]	6
11M. Silver, Total (7440-22-4)	X			<0.1	<0.3	NA	NA	NA [c]	NA [c]	6	µg/L	g	NA [c]	NA [c]	6
12M. Thallium, Total (7440-28-0)	X			0.4	2.6	NA	NA	<0.2 [a]	0.6	17	µg/L	g	<0.2 [a]	0.5	6
13M. Zinc, Total (7440-66-6)	X			14	32.5	NA	NA	9.5	19.7	6	µg/L	g	1,722	3,783	6
14M. Cyanide, Total (57-12-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15M. Phenols, Total			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS NA											

CONTINUE ON REVERSE

See Page V-9 for footnotes.

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Accrolein (107-02-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2V. Acrylonitrile (107-13-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3V. Benzene (71-43-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4V. Bis (*Chloro-methyl*) Ether (542-88-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5V. Bromoform (75-25-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6V. Carbon Tetrachloride (56-23-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7V. Chlorobenzene (108-90-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8V. Chlorodi-bromomethane (124-48-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9V. Chloroethane (75-00-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10V. 2-Chloro-ethylvinyl Ether (110-75-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11V. Chloroform (67-66-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12V. Dichloro-bromomethane (75-27-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13V. Dichloro-difluoromethane (75-71-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14V. 1,1-Dichloro-ethane (75-34-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15V. 1,2-Dichloro-ethane (107-06-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16V. 1,1-Dichloro-ethylene (75-35-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17V. 1,2-Dichloro-propane (78-87-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18V. 1,3-Dichloro-propylene (542-75-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19V. Ethylbenzene (100-41-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20V. Methyl Bromide (74-83-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21V. Methyl Chloride (74-87-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Page V-9 for footnotes.
CONTINUE ON PAGE V-5

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24V. Tetrachloro-ethylene (127-18-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
25V. Toluene (108-88-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
26V. 1,2-Trans-Dichloroethylene (156-60-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
27V. 1,1,1-Trichloro-ethane (71-55-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
28V. 1,1,2-Trichloro-ethane (79-00-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29V Trichloro-ethylene (79-01-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
30V. Trichloro-fluoromethane (75-69-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
31V. Vinyl Chloride (75-01-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2A. 2,4-Dichloro-phenol (120-83-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3A. 2,4-Dimethyl-phenol (105-67-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4A. 4,6-Dinitro-O-Cresol (534-52-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5A. 2,4-Dinitro-phenol (51-28-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6A. 2-Nitrophenol (88-75-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7A. 4-Nitrophenol (100-02-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8A. P-Chloro-M-Cresol (59-50-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9A. Pentachloro-phenol (87-86-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10A. Phenol (108-95-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11A. 2,4,6-Trichloro-phenol (88-05-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Page V-9 for footnotes.
CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2B. Acenaphtylene (208-96-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3B. Anthracene (120-12-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4B. Benzidine (92-87-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5B. Benzo (*a*) Anthracene (56-55-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6B. Benzo (*a*) Pyrene (50-32-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7B. 3,4-Benzo-fluoranthene (205-99-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8B. Benzo (*ghi*) Perylene (191-24-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9B. Benzo (*k*) Fluoranthene (207-08-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10B. Bis (*2-Chloro-ethoxy*) Methane (111-91-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11B. Bis (*2-Chloro-ethyl*) Ether (111-44-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12B. Bis (*2-Chloroisopropyl*) Ether (102-80-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13B. Bis (*2-Ethyl-hexyl*) Phthalate (117-81-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15B. Butyl Benzyl Phthalate (85-68-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16B. 2-Chloro-naphthalene (91-58-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18B. Chrysene (218-01-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19B. Dibenzo (*a,h*) Anthracene (53-70-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20B. 1,2-Dichloro-benzene (95-50-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21B. 1,3-Di-chloro-benzene (541-73-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Page V-9 for footnotes.

CONTINUE ON PAGE V-7

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
22B. 1,4-Dichloro-benzene (106-46-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
23B. 3,3-Dichloro-benzidine (91-94-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24B. Diethyl Phthalate (84-66-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
25B. Dimethyl Phthalate (131 -11-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
26B. Di-N-Butyl Phthalate (84-74-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
27B. 2,4-Dinitro-toluene (121-14-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
28B. 2,6-Dinitro-toluene (606-20-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29B. Di-N-Octyl Phthalate (117-84-0)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
30B. 1,2-Diphenyl-hydrazine (*as Azo-benzene*) (122-66-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
31B. Fluoranthene (206-44-0)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32B. Fluorene (86-73-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
33B. Hexachloro-benzene (118-74-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
34B. Hexachloro-butadiene (87-68-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
35B. Hexachloro-cyclopentadiene (77-47-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
36B Hexachloro-ethane (67-72-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
38B. Isophorone (78-59-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
39B. Naphthalene (91-20-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
40B. Nitrobenzene (98-95-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
41B. N-Nitro-sodimethylamine (62-75-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
42B. N-Nitrosodi-N-Propylamine (621-64-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Page V-9 for footnotes.

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (*continued*)															
43B. N-Nitro-sodiphenylamine (86-30-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
44B. Phenanthrene (85-01-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
45B. Pyrene (129-00-0)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
46B. 1,2,4-Tri-chlorobenzene (120-82-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2P. α-BHC (319-84-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3P. β-BHC (319-85-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4P. γ-BHC (58-89-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5P. δ-BHC (319-86-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6P. Chlordane (57-74-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7P. 4,4'-DDT (50-29-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8P. 4,4'-DDE (72-55-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9P. 4,4'-DDD (72-54-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10P. Dieldrin (60-57-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11P. α-Enosulfan (115-29-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12P. β-Endosulfan (115-29-7)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13P. Endosulfan Sulfate (1031-07-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14P. Endrin (72-20-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15P. Endrin Aldehyde (7421-93-4)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16P. Heptachlor (76-44-8)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

See Page V-9 for footnotes.

CONTINUE ON PAGE V-9

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)	OUTFALL NUMBER
WA980978753	004/005

CONTINUED FROM PAGE V-8

1. POLLUTANT AND CAS NUMBER (*if available*)	2. MARK "X"			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVRG. VALUE (*if available*)		d. NO. OF ANALYSES	a. CONCEN-TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
18P. PCB-1242 (53469-21-9)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
19P. PCB-1254 (11097-69-1)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
20P. PCB-1221 (11104-28-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21P. PCB-1232 (11141-16-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22P. PCB-1248 (12672-29-6)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
23P. PCB-1260 (11096-82-5)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
24P. PCB-1016 (12674-11-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
25P. Toxaphene (8001-35-2)			X	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

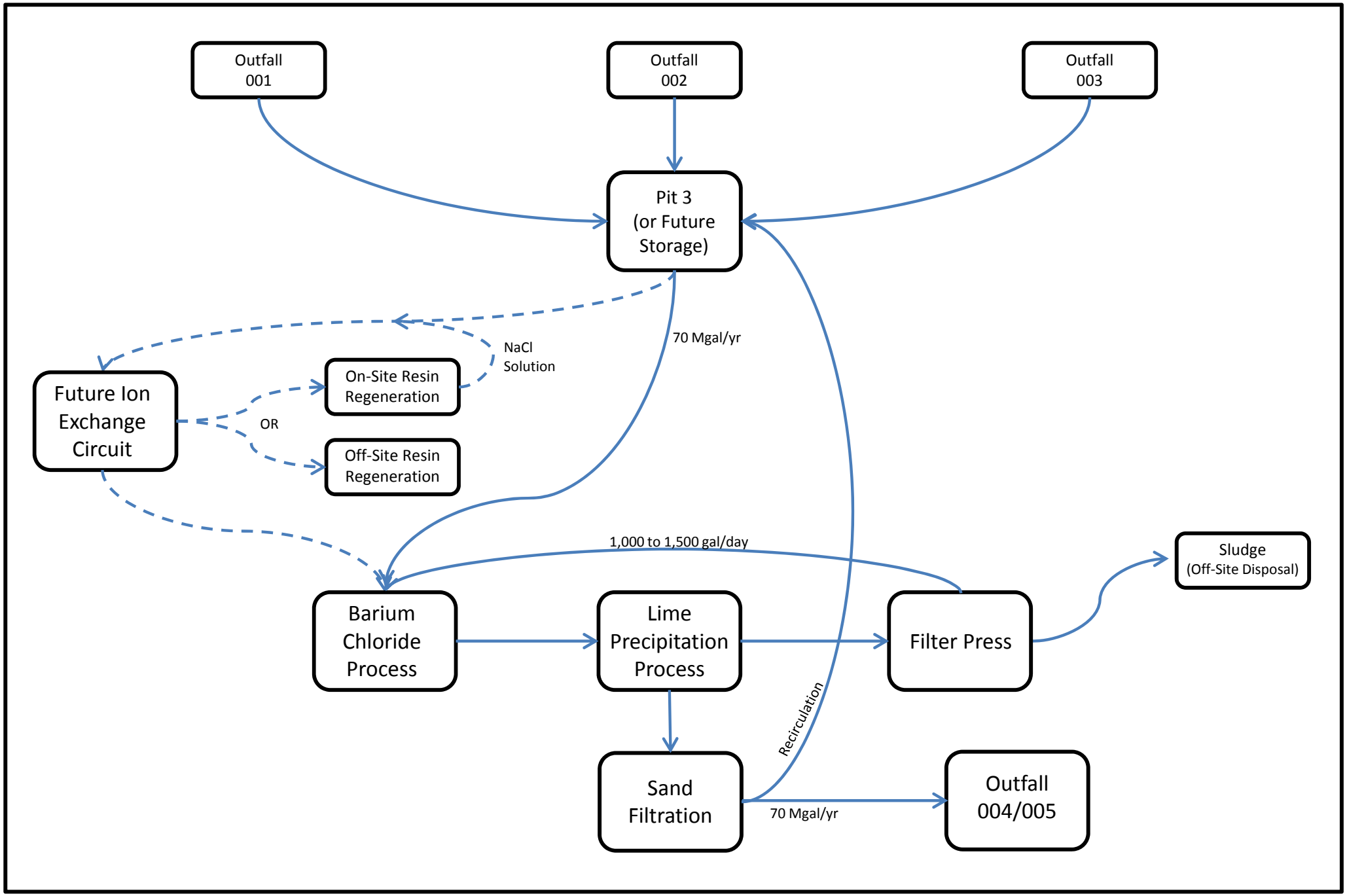
Arithmetic Mean used for all Long Term Values unless otherwise noted.

a - Median used due to non-parametric distribution.

b - Geometric mean used for log normal distribution.

c - No Long Term Value used because below detection limit.

d - Total Ra cannot be determined due to the number of non-detects for Ra226 and Ra228, refer to attached raw data.



WORTHINGTON MILLER ENVIRONMENTAL, LLC

FIGURE 3
CONCEPTUAL EXISTING AND FUTURE PROCESS FLOW DIAGRAM

DATE: MARCH 2013
PROJECT: MIDNITE
FILE:

Attachment M-3

Air Emissions Inventory Calculations, Midnite Mine

Attachment M-3a

Criteria Pollutants – Potential to Emit (PTE)

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Criteria Pollutants - PTE
Table of Contents

Table	Title	Page
PTE Air Emissions Operation Narrative		1
General Assumptions		3

Criteria Pollutants - PTE

Table	Title	Page
Table 1	Estimated Potential to Emit (PTE) of Criteria Pollutants	5
Table 2	Secondary Summary of Estimated Actual Emissions of Criteria Pollutants (by Task)	6
Table 3	Estimated Potential to Emit (PTE) of Green House Gases (GHGs) by Year and by Task	10

Criteria Pollutants - PTE

Task	Title	Page
01100	Downhill Conveyor Unit	12
RC1	Radial Conveyor Unit 1	14
RC2	Radial Conveyor Unit 2	16
RC3	Radial Conveyor Unit 3	18
RC4	Radial Conveyor Unit 4	20
RC5	Radial Conveyor Unit 5	22
01220	Primary Jaw Crusher	24
01240	Secondary Cone Crusher	26
01310	Primary Screening (Grizzly)	28
01320	Secondary Screening Performed with Crusher	30
01340	Tertiary Screening	32
02110	Pit 4 Pump Generator	34
02120	Pit 3 Pump Generator	35
02125	BPA Pump Generator	36
02130	South Pond Pump Generator	37
02210	East Seep Pump Station	38
02220	Blood Pool Pump Station	39
02230	PCP Pump Station	40
02240	Western Drainage Alluvial GW Wells	41
05100	Lime Silo	42
05300	WTP Standby Generator	43

Air Emissions Source
Potential to Emit (PTE) Air Emissions Operation Narrative

Stationary Emission Sources	
Conveyor Units (275 hp diesel)	BPA Pump Generator (1.5 hp diesel)
Primary Jaw Crusher (225 tph, 225 hp diesel)	South Pond Pump Generator (30 hp diesel)
Secondary Cone Crusher (225 tph, 300 hp diesel)	East Seep Pump Station (12 hp diesel)
Primary Screening (Grizzly) (50 hp diesel)	Blood Pool Pump Station (24 hp diesel)
Secondary Screening Performed with Crusher	PCP Pump Station (135 hp diesel)
Tertiary Screening (50 hp diesel)	Western Drainage Alluvial GW Wells (47 hp diesel)
Pit 4 Pump Generator (150 hp yr 1 / 50 hp yr 2, 3, 4 diesel)	WTP (604 hp diesel, emergency generator)
Pit 3 Pump Generator (50 hp diesel)	Diesel Tanks (293,269 gpy)
Lime Silo (360 tpy)	Gasoline Tanks (586,539 gpy)

Rock Crushing Operation
A primary screener will be a double deck screen (Grizzly) similar to a Screen Machine Industries model SCALPER 107D that will separate material that will be processed through the crusher. The primary screener will be powered by a 50 hp diesel engine. The primary screen will feed a primary mobile jaw crusher with a capacity of 225 tons per hour capacity similar to a KPI-JCI model FT2640 JAW CRUSHER that will produce 3 inch material. The primary jaw crusher will be powered by a 225 hp diesel engine. The jaw crusher will feed material through a secondary screen that is attached to the secondary cone crusher similar to a Screen Machine model CST CONE CRUSHER. The secondary cone crusher and attached secondary screen will together be powered by a 300 hp diesel engine. A tertiary screen, similar to a Screen Machine Industries model SCALPER 107D, will separate the final material for the correct sized drain rock to be placed in the bottom of Pit 3 and 4. Up to five radial conveyors (60 ft by 30 in) will be used to stockpile the separated material each powered by a 50 hp diesel engine. A downhill conveyor approximately 1,500 ft long by 3 ft wide will transport the material from the processing and for stockpiling and will be powered by a 250 hp diesel engine. The exact configuration of the rock crushing process is known, but each conveyor was calculated with 2 transfer points as a conservative estimate for the PTE calculation.

The PTE was based on equipment processing capacity of 225 tons per hour at 8,760 hours per year resulting in a maximum of 1,971,000 tons of material that could be processed per year. All diesel engines would be specified will comply with an EPA Tier III or Tier IV emission standard. PTE were calculated for both dust and exhaust emissions using from AP-42, Compilation of Air Pollutant Emission Factors, fifth Edition, 1995, Volume I, Stationary Point and Area Sources (EPA, 1995) or other emission factors where available.

Power Generation and Pumps

Pit 4 - The Pit 4 Pump is currently a 150 hp diesel engine pump that will be used to dewater the sumps in Pit 4. After the first year of construction the pumps will be changed over to Grundfos submersible electric pumps (250S and 300S series) that will be powered by a 50 hp diesel engine in years 2, 3, and 4. However, for the purpose of the PTE calculation, the 150 hp will be used for all years using the maximum run time of 8,760 hours per year.

Pit 3 - The Pit 3 Pump Generator is a 50 hp diesel generator that will power a Grundfos submersible pump (250S and 300S series) to dewater the sumps in Pit 3. A maximum of 8,760 hours per year was used to calculate PTE emissions.

BPA - The BPA Pump will use is a 1.5 hp diesel generator that will power a Grundfos submersible pump (250S and 300S series) to operate the pumps from the BPA wells. A maximum of 8,760 hours per year was used to calculate PTE emissions.

South Pond - The South Pond Pump will use a 30 hp diesel generator to power a Grundfos submersible pump (250S and 300S series) to operate the pumps at the South Pond. A maximum of 8,760 hours per year was used for calculating the PTE emissions.

East Seep - The East Seep Pump Station uses an existing Kohler Power Systems 8.5Res, 8.5 kW. An equivalent 12 hp diesel generator using the AP 42 emission factors was used to determine PTE. A maximum of 8,760 hours per year was used for calculating the PTE emissions.

Blood Pool - The Blood Pool Pump Station uses an existing Kohler Power Systems 18Res, 18 kW. An equivalent 24 hp diesel generator using the AP 42 emission factors was used to determine PTE. A maximum of 8,760 hours per year was used for calculating the PTE emissions.

PCP - The PCP Pump Station uses an existing 135 hp, 100 kW Cummins diesel generator to power the pumps. A maximum of 8,760 hours per year was used for calculating the PTE emissions.

Western Drainage – The Western Drainage Alluvial Groundwater Wells will use an existing 47 hp Lima Silver Eagle 35 kW diesel generator to power the pumps. A maximum of 8,760 hours per year was used for calculating the PTE emissions.

WTP – The WTP standby generator will use a 604 hp diesel generator for emergency backup power for the WTP. The generator is considered to be an emergency generator since the pump station will primarily be powered by a power line. A maximum of 500 hours per year was used for calculating the PTE emissions for emergency use and routine maintenance.

Lime Silo - The water treatment plant lime silo has a 30 ton capacity and will be filled pneumatically from a tanker once per month for a total of 360 tons per year. The silo will be protected by a bag house which will prevent the majority of dust emissions from escaping.

Diesel Fuel Tank – The diesel fuel tank holds approximately 6,000 gallons of diesel fuel to refuel construction equipment and support vehicles. The fuel tank will be refilled 52 times per year for a total of 293,269 gallons per year.

Gasoline Fuel Tank – The gasoline fuel tank holds approximately 6,000 gallons of diesel fuel to refuel construction equipment and support vehicles. The fuel tank will be refilled 104 times per year for a total of 586,539 gallons per year.

Midnite Mine

Estimated Potential to Emit (PTE) - Criteria Pollutants

8/5/2014

	General Assumptions
(1)	Although a variety of constituents may be calculated within the AP 42 emissions factors, they are not all included in the total estimated emissions calculations. The calculations include greenhouse gases and the typically permitted criteria pollutants (NOx, SOx, CO, lead, ozone, and Particulate Matter)(EPA, 2009).
(2)	Where multiple values were available for Particulate Matter, PM10 was reported because it is the largest permitted quantity of PM.
(3)	Emission factors for methane and nitrous oxide are not included in AP 42 for diesel internal combustion engines. These factors were taken from the EPA Greenhouse Gas Emission Factors Hub. (See http://www.epa.gov/climateleadership/inventory/ghg-emissions.html)
(4)	The activities associated with the remedial action will not emit lead, ozone, or fluorinated gases. These are listed as criteria pollutants and presented in the calculations herein, but emission factors of "0" have been used in the calculations (per AP 42).
(5)	Volatile organic compounds (VOC) are shown in the criteria pollutant summary sheet and are assumed to be equivalent to the total organic compounds (TOC) found in AP 42. As they are not actual criteria pollutants, the total combined values are not included in the grand totals of that summary.
(6)	Conveyor transfer points are locations where conveyors are allowed to let material fall to either the ground, another conveyor, or into a machine. Each conveyor (both radial conveyor and radial convey) is assumed to have two transfer points, one for loading and another for off loading for a total of six conveyors (one downhill conveyor and five radial conveyors).
(7)	AP 42 does not provide an emission factor for dust generated by primary and secondary crushing processes. Dust emissions associated with crushing are only quantified for tertiary crushing (defined as typically being crushing down to a maximum size of 1-inch) and "fines." The maximum particle size of the material to be crushed at Midnite will be 3-inches (secondary crushing). Therefore, dust emissions from the crushing process at Midnite will be negligible. See AP 42 Chapter 11.19.2. (EPA, 2009)
(8)	Because PM2.5 is not included in many of the calculations, it is assumed to be 15% of PM10 conveyor dust, 50% of PM10 crushing and screening dust, and 100% of PM10 engine emissions. For engine emissions, it is assumed that no dust larger than PM2.5 will be generated. This calculation is performed in the summary and not on the individual calculation sheets.
(9)	For the Potential To Emit (PTE), it is assumed that rock crusher will be allowed to run continuously for the life of the project. However, the actual crushers operation is estimated to be will only be on-site for approximately 125 days during Phase I (December 2015) and 455 days during phase II (July 2017).
(10)	It is assumed that PM2.5 emissions are equivalent to 15% of the PM10 generated by conveyor activities, 50% of the PM10 generated by crushing and screening activities, and 100% of the PM10 generated by engine emissions (i.e. no dust larger than PM2.5 is emitted).
(11)	It was assumed that diesel generators will provide power to pumps where electrical power is impractical (i.e., Pit 4, BPA pumpback wells, South Pond, and Pit 3 after Phase 2 has started). The other pumps will likely have their power primarily from a powerline and likely require their emergency generators to run less than one week per year. However, since then specific timing of the powerline installation will not be able to be confirmed until the contractor provides input, all generators (except for the WTP) will be assumed to be non-emergency status for the purpose of the Potential To Emit calculation with a 8,760 hours per year run time. The number of hours required for generator operation was calculated from the estimated pump size and the volume of water to be pumped during a given year. Power to the existing WTP is from an existing powerline and the newly constructed WTP will be powered by a powerline as part of the construction. The generator at the WTP will be for emergency purpose only and PTE was calculated at 500 hours per year.
(12)	The WTP generator is considered to be an emergency generator since it would primarily be powered by a powerline and would only be run during power failures or for exercise and maintenance. Other generators such as the East Seep, Blood Pool, and PCP are anticipated to only operate less than 500-hours annually; however, their primary power source cannot be confirmed until input on specific construction details and specific sequencing is provided by the contractor.
(13)	Silo and fuel tank emissions were calculated using the EPA TANKS software, as recommended in AP 42. Because specific speciation of the fuels is not known at this stage, only total emissions can be calculated.
(14)	The liquid propane tanks are pressurized tanks and will not be allowed to breath or vent to atmosphere. Emissions are considered to be negligible.

General Assumptions Continued.

(15)	The HCl silo will be a vertical fixed roof tank. The TANKS software (and AP 42) does not allow for calculations with inorganic liquids. However, TANKS advises that "it is possible to use the model if the inorganic liquid has a measurable vapor pressure and data are available for one of the vapor pressure options in the chemical database. Emission estimates produced by the model will be of unknown accuracy due to the absence of confirmatory testing for emissions from inorganic liquid storage tanks." The closest vapor pressure to a 35% HCl concentration is that of Trichloroethane (1,1,1). HCl silo emissions were assumed to be equivalent to those of Trichloroethane and calculated as such.
(16)	AP 42 does not provide emission factors for lime storage silos. Therefore it was assumed that total PM and PM10 emissions would be equivalent to those of a cement silo. To estimate PM2.5 emissions, it was assumed that lime particle size distributions are equivalent to those for processed, non-metallic ore. These assumptions follow those made in a permit application submitted to the EPA in Hawaii. (Application number 0542-02, April 2006)
(17)	The LP tanks at the proposed Water Treatment Plant will be used only for heating the water treatment facilities (an exempt emissions source). The tanks will be pressurized tanks and will not be allowed to breathe. The tanks will be direct-piped to the water treatment facilities to eliminate transfer emissions. It is assumed that the tanks will be maintained in proper working condition (no leaks, etc.). As such, the only emissions associated with these tanks will occur during tank filling. It is assumed that emissions associated with filling the LP tanks will be negligible.
(18)	Unpaved roads around the site will be considered part of the construction work site and dust emissions from these roads are addressed by the Federal Air Rules for Indian Reservations (FARR).
(19)	Blasting will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that fugitive dust emissions will be controlled to comply with FARR requirements.
(20)	Minimal building demolition will take place during the RA. Similar to blasting, building demolition will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that fugitive dust emissions will be controlled to comply with FARR requirements.
(21)	To avoid rockfall hazards in the pits, scaling will take place to effectively remove hazardous loose debris from the pit walls. Similar to blasting, pit wall scaling will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that fugitive dust emissions will be controlled to comply with FARR requirements.
(22)	Vehicle emissions associated with construction work are considered a mobile source and, therefore, are not addressed herein.
(23)	Pit sediments will be removed from the pits in a wet, near-saturated state and placed into geo-tubes for dewatering before being encapsulated within the waste containment areas. At no time will the sediments be handled in a loose and dry state that would generate dust emissions. Therefore, it is assumed that dust emissions and associated HAPs generated by handling of pit sediments will be negligible and are not included in the emissions calculations presented herein.
(24)	In order to calculate the HAP constituents generated by the construction activity dust, it is assumed that the percent by weight for each HAP found in the soil will directly correlate to its percent by weight found in the total fugitive dust Particulate Matter.

AP 42 Documents may be found at the following link:
http://www.epa.gov/ttnchie1/ap42/

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Table 1: Estimated Potential to Emit of Criteria Pollutants

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Grand Total										
	NOx Uncontrolled										
	Lbs	436,933	436,933	436,933	436,933	436,933	436,933	436,933	436,933	436,933	436,933
	Tons	218	218	218	218	218	218	218	218	218	218
	CO										
	Lbs	93,729	93,729	93,729	93,729	93,729	93,729	93,729	93,729	93,729	93,729
	Tons	47	47	47	47	47	47	47	47	47	47
	SOx										
	Lbs	28,894	28,894	28,894	28,894	28,894	28,894	28,894	28,894	28,894	28,894
	Tons	14	14	14	14	14	14	14	14	14	14
	PM10										
	Lbs	175,407	175,407	175,407	175,407	175,407	175,407	175,407	175,407	175,407	175,407
	Tons	88	88	88	88	88	88	88	88	88	88
	PM2.5										
	Lbs	15,941	15,803	15,803	15,803	15,803	15,803	15,803	15,803	15,803	15,803
	Tons	8	8	8	8	8	8	8	8	8	8
	Ozone										
	Lbs	-	-	-	-	-	-	-	-	-	-
	Tons	-	-	-	-	-	-	-	-	-	-
	Lead										
	Lbs	-	-	-	-	-	-	-	-	-	-
	Tons	-	-	-	-	-	-	-	-	-	-
	VOC										
	Lbs	35,435	35,435	35,435	35,435	35,435	35,435	35,435	35,435	35,435	35,435
	Tons	18	18	18	18	18	18	18	18	18	18
	Maximum Criteria Pollutant Emissions (Tons)	**218**	**218**	**218**	**218**	**218**	**218**	**218**	**218**	**218**	**218**

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Table 2: Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task)

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
01000	**MATERIAL PROCESSING**										
01100	Downhill Conveyor Unit										
	Exhaust										
	NOx Uncontrolled (lbs)	67,890	67,890	67,890	67,890	67,890	67,890	67,890	67,890	67,890	67,890
	CO (lbs)	14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564
	SOx (lbs)	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490
	PM10 (lbs)	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818
	PM2.5 (lbs)	723	723	723	723	723	723	723	723	723	723
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	5,506	5,506	5,506	5,506	5,506	5,506	5,506	5,506	5,506	5,506
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
RC 1	Radial Conveyor 1										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	145	145	145	145	145	145	145	145	145	145
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
RC 2	Radial Conveyor 2										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	145	145	145	145	145	145	145	145	145	145
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
RC 3	Radial Conveyor 3										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	145	145	145	145	145	145	145	145	145	145
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
RC 4	Radial Conveyor 4										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	145	145	145	145	145	145	145	145	145	145
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
RC 5	Radial Conveyor 5										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	145	145	145	145	145	145	145	145	145	145
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194
01200	Crushers										
01220	Primary Jaw Crusher										
	Exhaust										
	NOx Uncontrolled (lbs)	81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468
	CO (lbs)	17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476
	SOx (lbs)	5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387
	PM10 (lbs)	5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782
	PM2.5 (lbs)	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	6,607	6,607	6,607	6,607	6,607	6,607	6,607	6,607	6,607	6,607
	Dust										
	PM10 (lbs)										
01240	Secondary Cone Crusher										
	Exhaust										
	NOx Uncontrolled (lbs)	61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101
	CO (lbs)	13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107
	SOx (lbs)	4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041
	PM10 (lbs)	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	PM2.5 (lbs)	2,168	2,168	2,168	2,168	2,168	2,168	2,168	2,168	2,168	2,168
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955
	Dust										
	PM10 (lbs)										

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Table 2 (continued): Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task)

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
01000	**MATERIAL PROCESSING Continued**										
01300	Screening										
01310	Primary Screening (Grizzly)										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	482	482	482	482	482	482	482	482	482	482
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
01320	Secondary Screening Performed with Crusher										
	Exhaust										
	NOx Uncontrolled (lbs)										
	CO (lbs)										
	SOx (lbs)										
	PM10 (lbs)										
	PM2.5 (lbs)										
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)										
	Dust										
	PM10 (lbs)	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
01340	Tertiary Screening										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	964	964	964	964	964	964	964	964	964	964
	PM2.5 (lbs)	482	482	482	482	482	482	482	482	482	482
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
	Dust										
	PM10 (lbs)	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Table 2 (continued): Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task)

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
02000	**FUEL-POWERED GENERATORS**										
02110	Pit 4 Pump Generator										
	Exhaust										
	NOx Uncontrolled (lbs)	40,734	40,734	40,734	40,734	40,734	40,734	40,734	40,734	40,734	40,734
	CO (lbs)	8,738	8,738	8,738	8,738	8,738	8,738	8,738	8,738	8,738	8,738
	SOx (lbs)	2,694	2,694	2,694	2,694	2,694	2,694	2,694	2,694	2,694	2,694
	PM10 (lbs)	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891
	PM2.5 (lbs)	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891	2,891
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304
02120	Pit 3 Pump Generator										
	Exhaust										
	NOx Uncontrolled (lbs)	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO (lbs)	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SOx (lbs)	898	898	898	898	898	898	898	898	898	898
	PM10 (lbs)	898	898	898	898	898	898	898	898	898	898
	PM2.5 (lbs)	135									
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
02125	BPA Pump Generator										
	Exhaust										
	NOx Uncontrolled (lbs)	407	407	407	407	407	407	407	407	407	407
	CO (lbs)	87	87	87	87	87	87	87	87	87	87
	SOx (lbs)	27	27	27	27	27	27	27	27	27	27
	PM10 (lbs)	27	27	27	27	27	27	27	27	27	27
	PM2.5 (lbs)	4									
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	33	33	33	33	33	33	33	33	33	33
02130	South Pond Pump Generator										
	Exhaust										
	NOx Uncontrolled (lbs)	8,147	8,147	8,147	8,147	8,147	8,147	8,147	8,147	8,147	8,147
	CO (lbs)	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748	1,748
	SOx (lbs)	539	539	539	539	539	539	539	539	539	539
	PM10 (lbs)	578	578	578	578	578	578	578	578	578	578
	PM2.5 (lbs)	578	578	578	578	578	578	578	578	578	578
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	661	661	661	661	661	661	661	661	661	661
02210	East Seep Pump Station										
	Exhaust										
	NOx Uncontrolled (lbs)	3,259	3,259	3,259	3,259	3,259	3,259	3,259	3,259	3,259	3,259
	CO (lbs)	699	699	699	699	699	699	699	699	699	699
	SOx (lbs)	215	215	215	215	215	215	215	215	215	215
	PM10 (lbs)	231	231	231	231	231	231	231	231	231	231
	PM2.5 (lbs)	231	231	231	231	231	231	231	231	231	231
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	264	264	264	264	264	264	264	264	264	264
02220	Blood Pool Pump Station										
	Exhaust										
	NOx Uncontrolled (lbs)	6,517	6,517	6,517	6,517	6,517	6,517	6,517	6,517	6,517	6,517
	CO (lbs)	1,398	1,398	1,398	1,398	1,398	1,398	1,398	1,398	1,398	1,398
	SOx (lbs)	431	431	431	431	431	431	431	431	431	431
	PM10 (lbs)	463	463	463	463	463	463	463	463	463	463
	PM2.5 (lbs)	463	463	463	463	463	463	463	463	463	463
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	529	529	529	529	529	529	529	529	529	529
02230	PCP Pump Station										
	Exhaust										
	NOx Uncontrolled (lbs)	36,661	36,661	36,661	36,661	36,661	36,661	36,661	36,661	36,661	36,661
	CO (lbs)	7,864	7,864	7,864	7,864	7,864	7,864	7,864	7,864	7,864	7,864
	SOx (lbs)	2,424	2,424	2,424	2,424	2,424	2,424	2,424	2,424	2,424	2,424
	PM10 (lbs)	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602
	PM2.5 (lbs)	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602	2,602
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	2,973	2,973	2,973	2,973	2,973	2,973	2,973	2,973	2,973	2,973
02240	Western Drainage Alluvial GW Wells										
	Exhaust										
	NOx Uncontrolled (lbs)	12,763	12,763	12,763	12,763	12,763	12,763	12,763	12,763	12,763	12,763
	CO (lbs)	2,738	2,738	2,738	2,738	2,738	2,738	2,738	2,738	2,738	2,738
	SOx (lbs)	844	844	844	844	844	844	844	844	844	844
	PM10 (lbs)	906	906	906	906	906	906	906	906	906	906
	PM2.5 (lbs)	906	906	906	906	906	906	906	906	906	906
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Table 2 (continued): Secondary Summary of Estimated Potential to Emit of Criteria Pollutants (by Task)

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
03000	**FUEL TRANSFER**										
03100	Fuel Farm - (Calculated in EPA TANKS)										
03110	Diesel Tanks (lbs)	11	11	11	11	11	11	11	11	11	11
03120	Gasoline Tanks (lbs)	907	907	907	907	907	907	907	907	907	907
05000	**WATER TREATMENT PLANT**										
	Silos										
05100	Lime Silo (lbs)	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
05200	HCl Silo - *(Calculated in EPA TANKS)* (lbs)	399	399	399	399	399	399	399	399	399	399
05300	WTP Standby Generators										
	Exhaust										
	NOx Uncontrolled (lbs)	9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362
	CO (lbs)	2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008
	SOx (lbs)	619	619	619	619	619	619	619	619	619	619
	PM10 (lbs)	664	664	664	664	664	664	664	664	664	664
	PM2.5 (lbs)	664	664	664	664	664	664	664	664	664	664
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	759	759	759	759	759	759	759	759	759	759

Table 3: Estimated Potential to Emit of Green House Gases (GHGs) by Year and by Task

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	CO_2 (Tons)	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984
	CO_2 Equivalent (Tons)	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984	7,984
	N_2O (Tons)	0	0	0	0	0	0	0	0	0	0
	CO_2 Equivalent (Tons)	0	0	0	0	0	0	0	0	0	0
	CH_4 (Tons)	0	0	0	0	0	0	0	0	0	0
	CO_2 Equivalent (Tons)	0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6) (Tons)										
	CO_2 Equivalent (Tons)	-	-	-	-	-	-	-	-	-	-
	Total Combined GHG CO2 Equivalents (Tons)	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**	**7,984**
01000	**MATERIAL PROCESSING**										
01100	Conveyor Units										
	Exhaust										
	CO2 (lbs)	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
RC 1	Radial Conveyor 1										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
RC 2	Radial Conveyor 2										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
RC 3	Radial Conveyor 3										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
RC 4	Radial Conveyor 4										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
RC 5	Radial Conveyor 5										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
01200	Crushers										
01220	Primary Jaw Crusher										
	Exhaust										
	CO2 (lbs)	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
01240	Secondary Cone Crusher										
	Exhaust										
	CO2 (lbs)	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
01300	Screening										
01310	Primary Screening (Grizzly)										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
01320	Secondary Screening Performed with Crusher										
	Exhaust										
	CO2 (lbs)										
	N2O (lbs)										
	CH4 (lbs)										
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
01340	Tertiary Screening										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										

Midnite Mine

Estimated Potential To Emit (PTE) - GHGs

8/5/2014

Table 3 (continued): Estimated Potential to Emit of Green House Gases (GHGs) by Year and by Task

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
02000	**FUEL-POWERED GENERATORS**										
02110	Pit 4 Pump Generator										
	Exhaust										
	CO2 (lbs)	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02120	Pit 3 Pump Generator										
	Exhaust										
	CO2 (lbs)	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02125	BPA Pump Generator										
	Exhaust										
	CO2 (lbs)	15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02130	South Pond Pump Generator										
	Exhaust										
	CO2 (lbs)	302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02210	East Seep Pump Station										
	Exhaust										
	CO2 (lbs)	120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02220	Blood Pool Pump Station										
	Exhaust	241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776
	CO2 (lbs)	0	0	0	0	0	0	0	0	0	0
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)										
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02230	PCP Pump Station										
	Exhaust										
	CO2 (lbs)	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
02240	Western Drainage Alluvial GW Wells										
	Exhaust										
	CO2 (lbs)	473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										
05000	**WATER TREATMENT PLANT**										
05300	WTP Standby Generators										
	Exhaust										
	CO2 (lbs)	347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300
	N2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF6)* (lbs)										

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Downhill Conveyor Unit
Task #: 01100

Description of Emissions Source:

The downhill conveyor unit used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760
	Engine power	hp		250	250	250	250	250	250	250	250	250	250
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		67,890	67,890	67,890	67,890	67,890	67,890	67,890	67,890	67,890	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564	14,564
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490	4,490
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818	4,818
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500	2,518,500
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		1014	1014	1014	1014	1014	1014	1014	1014	1014	1014
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		5,506	5,506	5,506	5,506	5,506	5,506	5,506	5,506	5,506	5506
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a single downhill conveyor and a radial conveyor between each process (5 total).
(5) Downhill conveyor is 1500' x 36".
(6) Engine sizing to operate downhill conveyor is roughly 250 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Downhill Conveyor Unit
Task #: 01100

Description of Emissions Source:

The downhill conveyor unit used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 1
Task #: RC 1

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a radial conveyor between each process (5 total).
(5) Radial conveyors are 60' x 30".
(6) Engine sizing to operate radial conveyors are each 50 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 1
Task #: RC 1

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 2
Task #: RC 2

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a radial conveyor between each process (5 total).
(5) Radial conveyors are 60' x 30".
(6) Engine sizing to operate radial conveyors are each 50 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 2
Task #: RC 2

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1971000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 3
Task #: RC 3

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a radial conveyor between each process (5 total).
(5) Radial conveyors are 60' x 30".
(6) Engine sizing to operate radial conveyors are each 50 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 3
Task #: RC 3

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1971000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 4
Task #: RC 4

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a radial conveyor between each process (5 total).
(5) Radial conveyors are 60' x 30".
(6) Engine sizing to operate radial conveyors are each 50 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 4
Task #: RC 4

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 5
Task #: RC 5

Description of Emissions Source:

The radial conveyor unit will be used to transport and stockpile processed material or waste material as part of the crushing operation. Each radial conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a radial conveyor between each process (5 total).
(5) Radial conveyors are 60' x 30".
(6) Engine sizing to operate radial conveyors are each 50 hp.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Radial Conveyor 5
Task #: RC 5

Description of Emissions Source:

Conveyor units used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Transfer Points	#		2	2	2	2	2	2	2	2	2	2
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826	11,826
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		51	51	51	51	51	51	51	51	51	51
	Subtotal	lb/yr		16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162	16,162
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		32	32	32	32	32	32	32	32	32	32
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		32	32	32	32	32	32	32	32	32	32
	Total	lb/yr		16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194	16,194

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Primary Jaw Crusher
Task #: 01220

Description of Emissions Source:

Jaw crusher used to perform initial crushing of Hillside Waste Rock Pile material in the material processing area for further crushing and screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760	8,760
	Engine power	hp		300	300	300	300	300	300	300	300	300	300
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468	81,468
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476	17,476
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387	5,387
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782	5,782
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200	3,022,200
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217	1,217
	TOC	Emission Factor (lb/hp-hr)	0.002514										
		lb/yr		6,607	6,607	6,607	6,607	6,607	6,607	6,607	6,607	6,607	6607
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E+01	5E+01	5E+01	5E+01	5E+01	5E+01	5E+01	5E+01	5E+01	5E+01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Crusher sizing assumes KPI-JCI model FT2640 JAW CRUSHER
(5) Max engine sizing to operate FT2640 JAW CRUSHER model is roughly 225 hp

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Primary Jaw Crusher
Task #: 01220

Description of Emissions Source:

Jaw crusher used to perform initial crushing of Hillside Waste Rock Pile material in the material processing area for further crushing and screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Secondary Crushing	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
Secondary Crushing (Controlled)	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
	Total	lb/yr											

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Secondary Cone Crusher
Task #: 01240

Description of Exhaust Emissions Source:

Cone crusher used to further crush Hillside Waste Rock Pile material in the material processing area before final screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		225	225	225	225	225	225	225	225	225	225
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101	61,101
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107	13,107
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041	4,041
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336	4,336
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650	2,266,650
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		913	913	913	913	913	913	913	913	913	913
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4,955	4955
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01	4E+01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Crusher sizing assumes Screen Machine model CST CONE CRUSHER
(5) Max engine sizing to operate CST CONE CRUSHER model is roughly 300 hp
(6) The screen at the inlet to the cone crusher will provide secondary screening.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Secondary Cone Crusher
Task #: 01240

Description of Exhaust Emissions Source:

Cone crusher used to further crush Hillside Waste Rock Pile material in the material processing area before final screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Secondary Crushing	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
Secondary Crushing (Controlled)	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
	Total	lb/yr											

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Primary Screening (Grizzly)
Task #: 01310

Description of Exhaust Emissions Source:

Double deck screen used to perform primary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913	2,913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Screen sizing assumes Screen Machine Industries model SCALPER 107D
(5) Engine sizing to operate SCALPER 107D model is roughly 50 hp
(6) Dust emission was reported as uncontrolled

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Primary Screening (Grizzly)
Task #: 01310

Description of Exhaust Emissions Source:

Double deck screen used to perform primary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
Screening (Controlled)	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		99	99	99	99	99	99	99	99	99	99
	Subtotal	lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Secondary Screening Performed with Crusher
Task #: 01320

Description of Exhaust Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be powered as part of the Secondary Crusher Unit and no separate engine will be required.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr											
	Engine power	hp											
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr											
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr											
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr											
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr											
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr											
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr											
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr											
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr											
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr											
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr											
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr											
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr											
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr											
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr											
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr											
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr											
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr											
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr											

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Exhaust is not considered because a screen is built into the Screen Machine cone crusher (Task 01240) and will not require an independent engine
(5) Dust emission was reported as uncontrolled

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Secondary Screening Performed with Crusher
Task #: 01320

Description of Exhaust Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be powered as part of the Secondary Crusher Unit and no separate engine will be required.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
Screening (Controlled)	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		99	99	99	99	99	99	99	99	99	99
	Subtotal	lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Tertiary Screening
Task #: 01340

Description of Exhaust Emissions Source:

Double deck screen used to perform tertiary screening of Hillside Waste Rock Pile material in the material processing area after secondary crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		8,760	8,760	8,760	8,760	8760.00	8760.00	8760.00	8760.00	8760.00	8760.00
	Engine power	hp		50	50	50	50	50.00	50.00	50.00	50.00	50.00	50.00
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578	13,578
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2913	2913	2913	2913	2913	2913	2913	2913	2913	2913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Screen sizing assumes Screen Machine Industries model SCALPER 107D
(5) Engine sizing to operate SCALPER 107D model is roughly 50 hp
(6) Dust emission was reported as uncontrolled

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Tertiary Screening
Task #: 01340

Description of Exhaust Emissions Source:

Double deck screen used to perform tertiary screening of Hillside Waste Rock Pile material in the material processing area after secondary crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total PM	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750	492,750
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768
Screening (Controlled)	Throughput	Tons/yr		1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000	1,971,000
	Total PM	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942	3,942
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		99	99	99	99	99	99	99	99	99	99
	Subtotal	lb/yr		1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
	Total	lb/yr		15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768	15,768

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Pit 4 Pump Generator
Task #: 02110

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the Pit 4 dewatering sumps.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		150	150	150	150	150	150	150	150	150	150
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		40734	40734	40734	40734	40734	40734	40734	40734	40734	40734
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		8738	8738	8738	8738	8738	8738	8738	8738	8738	8738
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		2694	2694	2694	2694	2694	2694	2694	2694	2694	2694
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		2891	2891	2891	2891	2891	2891	2891	2891	2891	2891
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100	1,511,100
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		608	608	608	608	608	608	608	608	608	608
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3304
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		9E+00	9E+00	9E+00	9E+00	9E+00	9E+00	9E+00	9E+00	9E+00	9E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (10.8 gpm / 500 gpm).
(2) Pump engine based on existing Ford 15-D initially and then will transition to a generator to power to Grundfos submersible 250S and 300S series pumps.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Pit 3 Pump Generator
Task #: 02120

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the Pit 3 dewatering sumps.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8,760	8,760	8,760	8,760	8,760	8,760
	Engine power	hp		50	50	50	50	50	50	50	50	50	50
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		13578	13578	13578	13578	13,578	13,578	13,578	13,578	13,578	13,578
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2913	2913	2913	2913	2913	2913	2913	2913	2913	2913
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		898	898	898	898	898	898	898	898	898	898
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		964	964	964	964	964	964	964	964	964	964
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700	503,700
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		203	203	203	203	203	203	203	203	203	203
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1101
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (94.5 gpm / 500 gpm).
(2) Generator engine based on needs to operate Grundfos submersible 250S and 300S series pumps.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: BPA Pump Generator
Task #: 02125

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the BPA wells.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8,760	8,760	8,760	8,760	8,760	8,760
	Engine power	hp		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		407	407	407	407	407	407	407	407	407	407
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		87	87	87	87	87	87	87	87	87	87
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		27	27	27	27	27	27	27	27	27	27
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		29	29	29	29	29	29	29	29	29	29
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111	15,111
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		6	6	6	6	6	6	6	6	6	6
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		33	33	33	33	33	33	33	33	33	33
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		9E-02	9E-02	9E-02	9E-02	9E-02	9E-02	9E-02	9E-02	9E-02	9E-02
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (94.5 gpm / 500 gpm).
(2) Generator engine based on needs to operate Grundfos submersible 250S and 300S series pumps.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: South Pond Pump Generator
Task #: 02130

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the South Pond.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		30	30	30	30	30	30	30	30	30	30
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		8147	8147	8147	8147	8,147	8,147	8,147	8,147	8,147	8147
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		1748	1748	1748	1748	1,748	1,748	1,748	1,748	1,748	1748
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		539	539	539	539	539	539	539	539	539	539
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		578	578	578	578	578	578	578	578	578	578
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220	302,220
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		122	122	122	122	122	122	122	122	122	122
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		661	661	661	661	661	661	661	661	661	661
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year.
(2) Generator engine based on needs of Grundfos submersible 250S and 300S series pumps..

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: East Seep Pump Station
Task #: 02210

Description of Emissions Source:

Emissions due to diesel engines used to operate the pump from the East Seep.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		12	12	12	12	12	12	12	12	12	12
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		3259	3259	3259	3259	3259	3259	3259	3259	3259	3259
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		699	699	699	699	699	699	699	699	699	699
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		215	215	215	215	215	215	215	215	215	215
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		231	231	231	231	231	231	231	231	231	231
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888	120,888
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		49	49	49	49	49	49	49	49	49	49
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		264	264	264	264	264	264	264	264	264	264
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year.
(2) Pumps are powered by existing Kohler Power System 8.5Res, 8.5 kw Automatic start generator and diesel equivalent used for calculation.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Blood Pool Pump Station
Task #: 02220

Description of Emissions Source:

Emissions due to the diesel engine used to operate the pump at the Blood Pool station.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		24	24	24	24	24	24	24	24	24	24
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		6517	6517	6517	6517	6517	6517	6517	6517	6517	6517
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		1398	1398	1398	1398	1398	1398	1398	1398	1398	1398
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		431	431	431	431	431	431	431	431	431	431
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		463	463	463	463	463	463	463	463	463	463
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776	241,776
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		97	97	97	97	97	97	97	97	97	97
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		529	529	529	529	529	529	529	529	529	529
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00	4E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year.
(2) Pumps are powered by existing Kohler Power Systems 18Res, 18 kw Automatic start generator and emissions are based upon diesel equivalent.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: PCP Pump Station
Task #: 02230

Description of Emissions Source:

Emissions due to the diesel engine used to power the pump at the PCP pond.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		135	135	135	135	135	135	135	135	135	135
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		36661	36661	36661	36661	36661	36661	36661	36661	36661	36661
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		7864	7864	7864	7864	7864	7864	7864	7864	7864	7864
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		2424	2424	2424	2424	2424	2424	2424	2424	2424	2424
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		2602	2602	2602	2602	2602	2602	2602	2602	2602	2602
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990	1,359,990
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		548	548	548	548	548	548	548	548	548	548
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		2,973	2,973	2,973	2,973	2,973	2,973	2,973	2,973	2,973	2973
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00	8E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01	2E+01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01	1E+01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00	6E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year.
(2) Pumps are powered by existing 100 kw Cummins generator.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Western Drainage Alluvial GW Wells
Task #: 02240

Description of Emissions Source:

Emissions due to diesel engines used to operate pumps for the alluvial groundwater pumping wells.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		8760	8760	8760	8760	8760	8760	8760	8760	8760	8760
	Engine power	hp		47	47	47	47	47	47	47	47	47	47
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		12763	12763	12763	12763	12763	12763	12763	12763	12763	12763
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2738	2738	2738	2738	2738	2738	2738	2738	2738	2738
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		844	844	844	844	844	844	844	844	844	844
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		906	906	906	906	906	906	906	906	906	906
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478	473,478
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		191	191	191	191	191	191	191	191	191	191
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1035
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00	7E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00	3E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year.
(2) Pumps are powered by existing Lima Silver Eagle 35 kw diesel generator.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: Lime Silo (lbs)
Task #: 05100

Description of Emissions Source:

The water treatment plant lime silo will be filled pneumatically from a tanker once per month. The silo will be protected by a bag house which will prevent the majority of dust emissions from escaping. Those few that do will be emitted as fugitive dust particles.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Lime Silo	Throughput	Tons		360	360	360	360	360	360	360	360	360	360
	PM	Emission Factor (lb/hp-hr)	9.90E-04										
		lb/yr		3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04
	PM_{10}	Emission Factor (lb/hp-hr)	3.40E-04										
		lb/yr		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
	$PM_{2.5}$	Emission Factor (lb/hp-hr)	2.97E-04										
		lb/yr		1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04

Calculation Method(s):

Assumptions:

(1) Lime emissions are not provided in AP 42 for silo storage. Cement factors were used as a substitute.
(2) Cement factors are not included for PM2.5 in AP 42. Appendix B for processed non-metal ore was used to generate a ratio of PM2.5:PM10.
(3) Assumptions (1) and (2) were taken from a proposed air emissions permit application at the following link

Reference(s):

(1) Emission factors taken from Table 11.12-2 of AP 42 Volume 1.
(2) Emission conversion for PM10 to PM2.5 taken from Appendix B.2-14 of AP 42 Volume 1.

Midnite Mine

Estimated Potential To Emit (PTE) - Criteria Pollutants

8/5/2014

Task Name: WTP Standby Generators
Task #: 05300

Description of Emissions Source:

Emissions due to diesel engines used to provide backup emergency power at the Water Treatment Plant. Main power source will be from powerline.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	Hours of Operation	hr/yr		500	500	500	500	500	500	500	500	500	500
	Engine power	hp		604	604	604	604	604	604	604	604	604	604
Diesel Fuel	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362	9,362
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008	2,008
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		619	619	619	619	619	619	619	619	619	619
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		664	664	664	664	664	664	664	664	664	664
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300	347,300
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		140	140	140	140	140	140	140	140	140	140
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		759	759	759	759	759	759	759	759	759	759
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01	9E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01	6E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00	5E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		8E-02	8E-02	8E-02	8E-02	8E-02	8E-02	8E-02	8E-02	8E-02	8E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01

Calculation Method(s):

Assumptions:

(1) Emergency redundant power supply.
(2) Engine emission factors are used for <600 hp due to the fact that engine sizing is not yet determined and smaller engines provide higher factors.

Reference(s):

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1.

Attachment M-3b

Criteria Pollutants - Estimated Actual Emissions

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

Criteria Pollutants - Estimated Actual Emissions
List of Tables

Table	Title
Table 1	Estimated Actual Emissions of Criteria Pollutants
Table 2	Secondary Summary of Estimated Actual Emissions of Criteria Pollutants (by Task)
Table 3	Estimated Actual Emissions of Green House Gases (GHGs) by Year and by Task

Criteria Pollutants - Estimated Actual Emissions
List of Task-Specific Worksheets

Task	Title
01100	Conveyor Units
01220	Primary Jaw Crusher
01240	Secondary Cone Crusher
01310	Primary Screening (Grizzly)
01320	Secondary Screening Performed with Crusher
01340	Tertiary Screening
02110	Pit 4 Pump Generator
02120	Pit 3 Pump Generator
02125	BPA Pump Generator
02130	South Pond Pump Generator
02210	East Seep Pump Station
02220	Blood Pool Pump Station
02230	PCP Pump Station
02240	Western Drainage Alluvial GW Wells
05100	Lime Silo (lbs)
05300	WTP Standby Generators

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

	General Assumptions
(1)	Although a variety of constituents may be calculated within the AP 42 emissions factors, they are not all included in the total estimated emissions calculations. The calculations include greenhouse gases, hazardous air pollutants, and criteria pollutants (EPA, 2009).
(2)	Unpaved roads around the site will be considered part of the construction work site and dust emissions from these roads are addressed by the Federal Air Rules for Reservations (FARR).
(3)	Where multiple values were available for Particulate Matter, nothing larger than PM_{10} was reported because it is the largest permitted quantity of PM.
(4)	Conveyor transfer points are locations where conveyors are allowed to let material fall to the ground. The material processing equipment assumed herein will have two transfer points: one immediately following the downhill conveyor, and one at the outfall of the radial conveyor after rock processing has taken place.
(5)	Silo and fuel tank emissions were calculated using the EPA TANKS software, as recommended in AP 42. Because specific speciation of the fuels is not known at this stage, only total emissions can be calculated.
(6)	It was assumed that diesel generators will provide power to pumps where electrical power is impractical (Pit 4, BPA pumpback wells, South Pond, and Pit 3 after Phase 2 has started). The number of hours required for generator operation was calculated from the estimated pump size and the volume of water to be pumped during a given year. Typical operation of the backup generators for pumps will operate non-stop for 1 week per year.
(7)	AP 42 does not provide an emission factor for dust generated by primary and secondary crushing processes. Dust emissions associated with crushing are only quantified for tertiary crushing (defined as typically being crushing down to a maximum size of 1-inch) and "fines." The maximum particle size of the material to be crushed at Midnite will be 3-inches (secondary crushing). Therefore, dust emissions from the crushing process at Midnite will be negligible. See AP 42 Chapter 11.19.2. (EPA, 2009)
(8)	Blasting will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(9)	Minimal building demolition will take place during the RA. Similar to blasting, building demolition will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(10)	To avoid rockfall hazards in the pits, scaling will take place to effectively remove hazardous loose debris from the pit walls. Similar to blasting, pit wall scaling will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(11)	Vehicle emissions associated with construction work are considered a mobile source and, therefore, are not addressed herein.
(13)	The liquid propane tanks are pressurized tanks and will not be allowed to breath or vent to atmosphere. Emissions are considered to be negligible.
(14)	AP 42 does not provide emission factors for lime storage silos. Therefore it was assumed that total PM and PM_{10} emissions would be equivalent to those of a cement silo. To estimate $PM_{2.5}$ emissions, it was assumed that lime particle size distributions are equivalent to those for processed, non-metallic ore. These assumptions follow those made in a permit application submitted to the EPA in Hawaii. (Application number 0542-02, April 2006)
(15)	Pit sediments will be removed from the pits in a wet, near-saturated state and placed into geo-tubes for dewatering before being encapsulated within the waste containment areas. At no time will the sediments be handled in a loose and dry state that would generate dust emissions. Therefore, it is assumed that dust emissions and associated hazardous air pollutants (HAPs) generated by handling of pit sediments will be negligible and are not included in the emissions calculations presented herein.
(16)	Emission factors for methane and nitrous oxide are not included in AP 42 for diesel internal combustion engines. These factors were taken from the EPA Greenhouse Gas Emission Factors Hub. (See http://www.epa.gov/climateleadership/inventory/ghg-emissions.html)
(17)	The activities associated with the remedial action will not emit lead, ozone, or flourinated gases. These are listed as criteria pollutants and presented in the calculations herein, but emission factors of "0" have been used in the calculations (per AP 42).
(18)	The liquid propane (LP) tanks at the proposed Water Treatment Plant will be used only for heating the water treatment facilities (an exempt emissions source). The tanks will be pressurized tanks and will not be allowed to breathe. The tanks will be direct-piped to the water treatment facilities to eliminate transfer emissions. It is assumed that the tanks will be maintained in proper working condition (no leaks, etc.). As such, the only emissions associated with these tanks will occur during tank filling. It is assumed that emissions associated with filling the LP tanks will be negligible.
(19)	Volatile organic compounds (VOC) are shown in the criteria pollutant summary sheet and are assumed to be equivalent to the total organic compounds (TOC). TOC was calculated according to the emission factors presented in AP 42.
(20)	It is assumed that $PM_{2.5}$ emissions are equivalent to 15% of the PM_{10} generated by conveyor activities, 50% of the PM_{10} generated by crushing and screening activities, and 100% of the PM_{10} generated by engine emissions (i.e. no dust larger than PM_{10} is emitted).

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

Table 1: Estimated Actual Emissions of Criteria Pollutants

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Grand Total										
NO_x Uncontrolled										
Lbs	31,945	4,574	42,239	61,700	8,717	8,717	8,717	8,717	8,717	6,221
Tons	16	2	21	31	4	4	4	4	4	3
CO										
Lbs	6,853	981	9,061	13,236	1,870	1,870	1,870	1,870	1,870	1,335
Tons	3	0	5	7	1	1	1	1	1	1
SO_x										
Lbs	2,112	302	2,793	4,080	576	576	576	576	576	411
Tons	1	0	1	2	0	0	0	0	0	0
PM_{10}										
Lbs	12,365	325	18,067	27,235	606	606	606	606	606	429
Tons	6	0	9	14	0	0	0	0	0	0
$PM_{2.5}$										
Lbs	1,113	325	1,375	1,918	431	431	431	431	431	254
Tons	1	0	1	1	0	0	0	0	0	0
Ozone										
Lbs	-	-	-	-	-	-	-	-	-	-
Tons	-	-	-	-	-	-	-	-	-	-
Lead										
Lbs	-	-	-	-	-	-	-	-	-	-
Tons	-	-	-	-	-	-	-	-	-	-
VOC										
Lbs	2,591	371	3,426	5,004	707	707	707	707	707	505
Tons	1	0	2	3	0	0	0	0	0	0
Maximum Criteria Pollutant Emissions (Tons)	**16**	**2**	**21**	**31**	**4**	**4**	**4**	**4**	**4**	**3**

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

Table 2: Secondary Summary of Estimated Actual Emissions of Criteria Pollutants (by Task)

TASK #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
01000	**MATERIAL PROCESSING**										
01100	Conveyor Units										
	Exhaust										
	NO_x Uncontrolled (lbs)	8,184		11,509	17,455						
	CO (lbs)	1,756		2,469	3,744						
	SO_x (lbs)	541		761	1,154						
	PM_{10} (lbs)	581		817	1,239						
	$PM_{2.5}$ (lbs)	87		123	186						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	664		933	1,416						
	Dust										
	PM_{10} (lbs)	3,860		5,760	8,736						
01200	Crushers										
01220	Primary Jaw Crusher										
	Exhaust										
	NO_x Uncontrolled (lbs)	8,928		12,555	19,042						
	CO (lbs)	1,915		2,693	4,085						
	SO_x (lbs)	590		830	1,259						
	PM_{10} (lbs)	634		891	1,351						
	$PM_{2.5}$ (lbs)	317		446	676						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	724		1,018	1,544						
	Dust										
	PM_{10} (lbs)										
01240	Secondary Cone Crusher										
	Exhaust										
	NO_x Uncontrolled (lbs)	6,696		9,416	14,281						
	CO (lbs)	1,436		2,020	3,064						
	SO_x (lbs)	443		623	944						
	PM_{10} (lbs)	475		668	1,014						
	$PM_{2.5}$ (lbs)	238		334	507						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	543		764	1,158						
	Dust										
	PM_{10} (lbs)										
01300	Screening										
01310	Primary Screening (Grizzly)										
	Exhaust										
	NO_x Uncontrolled (lbs)	1,488		2,093	3,174						
	CO (lbs)	319		449	681						
	SO_x (lbs)	98		138	210						
	PM_{10} (lbs)	106		149	225						
	$PM_{2.5}$ (lbs)	53		74	113						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	121		170	257						
	Dust										
	PM_{10} (lbs)	3,758		5,609	8,507						
01320	Secondary Screening Performed with Crusher										
	Exhaust										
	NO_x Uncontrolled (lbs)										
	CO (lbs)										
	SO_x (lbs)										
	PM_{10} (lbs)										
	$PM_{2.5}$ (lbs)										
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)										
	Dust										
	PM_{10} (lbs)	1,240		1,850	2,806						
01340	Tertiary Screening										
	Exhaust										
	NO_x Uncontrolled (lbs)	1,488		2,093	3,174						
	CO (lbs)	319		449	681						
	SO_x (lbs)	98		138	210						
	PM_{10} (lbs)	106		149	225						
	$PM_{2.5}$ (lbs)	53		74	113						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	121		170	257						
	Dust										
	PM_{10} (lbs)	1,240		1,850	2,806						

Table 2 (continued): Secondary Summary of Estimated Actual Emissions of Criteria Pollutants (by Task)

TASK #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
02000	**FUEL-POWERED GENERATORS**										
02110	Pit 4 Pump Generator										
	Exhaust										
	NO_x Uncontrolled (lbs)	880	293	293	293						
	CO (lbs)	189	63	63	63						
	SO_x (lbs)	58	19	19	19						
	PM_{10} (lbs)	62	21	21	21						
	$PM_{2.5}$ (lbs)	62	21	21	21						
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	71	24	24	24						
02120	Pit 3 Pump Generator										
	Exhaust										
	NO_x Uncontrolled (lbs)					2,566	2,566	2,566	2,566	2,566	2,566
	CO (lbs)					551	551	551	551	551	551
	SO_x (lbs)					170	170	170	170	170	170
	PM_{10} (lbs)					170	170	170	170	170	170
	$PM_{2.5}$ (lbs)										
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)					208	208	208	208	208	208
02125	BPA Pump Generator										
	Exhaust										
	NO_x Uncontrolled (lbs)					77	77	77	77	77	77
	CO (lbs)					17	17	17	17	17	17
	SO_x (lbs)					5	5	5	5	5	5
	PM_{10} (lbs)					5	5	5	5	5	5
	$PM_{2.5}$ (lbs)										
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)					6	6	6	6	6	6
02130	South Pond Pump Generator										
	Exhaust										
	NO_x Uncontrolled (lbs)					1,792	1,792	1,792	1,792	1,792	
	CO (lbs)					384	384	384	384	384	
	SO_x (lbs)					119	119	119	119	119	
	PM_{10} (lbs)					127	127	127	127	127	
	$PM_{2.5}$ (lbs)					127	127	127	127	127	
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)					145	145	145	145	145	
02210	East Seep Pump Station										
	Exhaust										
	NO_x Uncontrolled (lbs)	62	62	62	62	62	62	62	62	62	62
	CO (lbs)	13	13	13	13	13	13	13	13	13	13
	SO_x (lbs)	4	4	4	4	4	4	4	4	4	4
	PM_{10} (lbs)	4	4	4	4	4	4	4	4	4	4
	$PM_{2.5}$ (lbs)	4	4	4	4	4	4	4	4	4	4
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	5	5	5	5	5	5	5	5	5	5
02220	Blood Pool Pump Station										
	Exhaust										
	NO_x Uncontrolled (lbs)	125	125	125	125	125	125	125	125	125	125
	CO (lbs)	27	27	27	27	27	27	27	27	27	27
	SO_x (lbs)	8	8	8	8	8	8	8	8	8	8
	PM_{10} (lbs)	9	9	9	9	9	9	9	9	9	9
	$PM_{2.5}$ (lbs)	9	9	9	9	9	9	9	9	9	9
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	10	10	10	10	10	10	10	10	10	10
02230	PCP Pump Station										
	Exhaust										
	NO_x Uncontrolled (lbs)	703	703	703	703	703	703	703	703	703	
	CO (lbs)	151	151	151	151	151	151	151	151	151	
	SO_x (lbs)	46	46	46	46	46	46	46	46	46	
	PM_{10} (lbs)	50	50	50	50	50	50	50	50	50	
	$PM_{2.5}$ (lbs)	50	50	50	50	50	50	50	50	50	
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	57	57	57	57	57	57	57	57	57	
02240	Western Drainage Alluvial GW Wells										
	Exhaust										
	NO_x Uncontrolled (lbs)	245	245	245	245	245	245	245	245	245	245
	CO (lbs)	53	53	53	53	53	53	53	53	53	53
	SO_x (lbs)	16	16	16	16	16	16	16	16	16	16
	PM_{10} (lbs)	17	17	17	17	17	17	17	17	17	17
	$PM_{2.5}$ (lbs)	17	17	17	17	17	17	17	17	17	17
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	20	20	20	20	20	20	20	20	20	20

Table 2 (continued): Secondary Summary of Estimated Actual Emissions of Criteria Pollutants (by Task)

TASK #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
03000	**FUEL TRANSFER**										
03100	Fuel Farm - (Calculated in EPA TANKS)										
03110	Diesel Tanks (lbs)	11	11	11	11	11	11	11	11	11	11
03120	Gasoline Tanks (lbs)	907	907	907	907	907	907	907	907	907	907
05000	**WATER TREATMENT PLANT**										
	Silos										
05100	Lime Silo (lbs)	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
05200	HCl Silo - *(Calculated in EPA TANKS)* (lbs)	399	399	399	399	399	399	399	399	399	399
05300	WTP Standby Generators										
	Exhaust										
	NO_x Uncontrolled (lbs)	3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146
	CO (lbs)	675	675	675	675	675	675	675	675	675	675
	SO_x (lbs)	208	208	208	208	208	208	208	208	208	208
	PM_{10} (lbs)	223	223	223	223	223	223	223	223	223	223
	$PM_{2.5}$ (lbs)	223	223	223	223	223	223	223	223	223	223
	Ozone (lbs)										
	Lead (lbs)										
	VOC (lbs)	255	255	255	255	255	255	255	255	255	255

Table 3: Estimated Actual Emissions of Green House Gases (GHGs) by Year and by Task

TASK #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
	CO_2 (Tons)	590	83	781	1,142	159	159	159	159	159	113
	CO_2 Equivalent (Tons)	590	83	781	1,142	159	159	159	159	159	113
	N_2O (Tons)	0	0	0	0	0	0	0	0	0	0
	CO_2 Equivalent (Tons)	0	0	0	0	0	0	0	0	0	0
	CH_4 (Tons)	0	0	0	0	0	0	0	0	0	0
	CO_2 Equivalent (Tons)	0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6) (Tons)										
	CO_2 Equivalent (Tons)										
	Total Combined GHG CO_2 Equivalents (Tons)	**590**	**83**	**781**	**1,142**	**159**	**159**	**159**	**159**	**159**	**113**
01000	**MATERIAL PROCESSING**										
01100	Conveyor Units										
	Exhaust										
	CO_2 (lbs)	303,600		426,938	647,522						
	N_2O (lbs)	0		0	0						
	CH_4 (lbs)	0		0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
01200	Crushers										
01220	Primary Jaw Crusher										
	Exhaust										
	CO_2 (lbs)	331,200		465,750	706,388						
	N_2O (lbs)	0		0	0						
	CH_4 (lbs)	0		0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
01240	Secondary Cone Crusher										
	Exhaust										
	CO_2 (lbs)	248,400		349,313	529,791						
	N_2O (lbs)	0		0	0						
	CH_4 (lbs)	0		0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
01300	Screening										
01310	Primary Screening (Grizzly)										
	Exhaust										
	CO_2 (lbs)	55,200		77,625	117,731						
	N_2O (lbs)	0		0	0						
	CH_4 (lbs)	0		0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
01320	Secondary Screening Performed with Crusher										
	Exhaust										
	CO_2 (lbs)										
	N_2O (lbs)										
	CH_4 (lbs)										
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
01340	Tertiary Screening										
	Exhaust										
	CO_2 (lbs)	55,200		77,625	117,731						
	N_2O (lbs)	0		0	0						
	CH_4 (lbs)	0		0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										

Table 3 (continued): Estimated Actual Emissions of Green House Gases (GHGs) by Year and by Task

ITEM #	DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
02000	**FUEL-POWERED GENERATORS**										
02110	Pit 4 Pump Generator										
	Exhaust										
	CO_2 (lbs)	32,640	10,880	10,880	10,880						
	N_2O (lbs)	0	0	0	0						
	CH_4 (lbs)	0	0	0	0						
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02120	Pit 3 Pump Generator										
	Exhaust										
	CO_2 (lbs)					95,199	95,199	95,199	95,199	95,199	95,199
	N_2O (lbs)					0	0	0	0	0	0
	CH_4 (lbs)					0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02125	BPA Pump Generator										
	Exhaust										
	CO_2 (lbs)					2,856	2,856	2,856	2,856	2,856	2,856
	N_2O (lbs)					0	0	0	0	0	0
	CH_4 (lbs)					0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02130	South Pond Pump Generator										
	Exhaust										
	CO_2 (lbs)					66,488	66,488	66,488	66,488	66,488	
	N_2O (lbs)					0	0	0	0	0	
	CH_4 (lbs)					0	0	0	0	0	
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02210	East Seep Pump Station										
	Exhaust										
	CO_2 (lbs)	2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318
	N_2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH_4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02220	Blood Pool Pump Station										
	Exhaust	4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637
	CO_2 (lbs)	0	0	0	0	0	0	0	0	0	0
	N_2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH_4 (lbs)										
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02230	PCP Pump Station										
	Exhaust										
	CO_2 (lbs)	26,082	26,082	26,082	26,082	26,082	26,082	26,082	26,082	26,082	
	N_2O (lbs)	0	0	0	0	0	0	0	0	0	
	CH_4 (lbs)	0	0	0	0	0	0	0	0	0	
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
02240	Western Drainage Alluvial GW Wells										
	Exhaust										
	CO_2 (lbs)	9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080
	N_2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH_4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										
05000	**WATER TREATMENT PLANT**										
05300	WTP Standby Generators										
	Exhaust										
	CO_2 (lbs)	116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693
	N_2O (lbs)	0	0	0	0	0	0	0	0	0	0
	CH_4 (lbs)	0	0	0	0	0	0	0	0	0	0
	F-Gases *(HFCs, PFCs, SF_6)* (lbs)										

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Conveyor Units

Task #: 01100

Description of Emissions Source:

Conveyor units used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		960		1,350	2,048						
	Engine power	hp		275		275	275						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		8,184		11,509	17,455						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		1,756		2,469	3,744						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		541		761	1,154						
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		581		817	1,239						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		303,600		426,938	647,522						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0		0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0		0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		122		172	261						
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		664		933	1,416						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E+00		2E+00	4E+00						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		8E-01		1E+00	2E+00						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		5E-01		7E-01	1E+00						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E+00		7E+00	1E+01						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		7E-02		1E-01	2E-01						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00		3E+00	5E+00						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+00		2E+00	3E+00						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E-01		2E-01	4E-01						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-01		4E-01	7E-01						

Calculation Method(s):

Assumptions:

(1) Operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Conveyor sizing assumes a single downhill conveyor and a radial conveyor between each process (5 total)
(5) Downhill conveyor is 1500' x 36" and radial conveyors are 60' x 30"
(6) Engine sizing to operate downhill conveyor is roughly 250 hp and radial conveyors are each 50 hp

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Conveyor Units

Task #: 01100

Description of Emissions Source:

Conveyor units used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Conveyor Transfer Point	Throughput	Tons/yr		469,760		701,100	1,063,335						
	Transfer Points	#		2		2	2						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.003										
		lb/yr		2,819		4,207	6,380						
	Total PM_{10}	Emission Rate (lb/ton-yr)	1.10E-03										
		lb/yr		1,033		1,542	2,339						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	0.000013										
		lb/yr		12	-	18	28	-	-	-	-	-	-
	Subtotal	lb/yr		3,852		5,749	8,719						
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		469,760		701,100	1,063,335						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		8		11	17						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		8	-	11	17	-	-	-	-	-	-
	Total	lb/yr		3,860		5,760	8,736						

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Primary Jaw Crusher

Task #: 01220

Description of Emissions Source:

Jaw crusher used to perform initial crushing of Hillside Waste Rock Pile material in the material processing area for further crushing and screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		960		1,350	2,048						
	Engine power	hp		300		300	300						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		8,928		12,555	19,042						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		1,915		2,693	4,085						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		590		830	1,259						
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		634		891	1,351						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		331,200		465,750	706,388						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0		0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0		0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		133		188	284						
	TOC	Emission Factor (lb/hp-hr)	0.002514										
		lb/yr		724		1,018	1,544						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E+00		3E+00	4E+00						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		8E-01		1E+00	2E+00						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		6E-01		8E-01	1E+00						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E+00		7E+00	1E+01						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		8E-02		1E-01	2E-01						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00		3E+00	5E+00						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E+00		2E+00	3E+00						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E-01		3E-01	4E-01						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-01		5E-01	7E-01						

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Crusher sizing assumes KPI-JCI model FT2640 JAW CRUSHER
(5) Max engine sizing to operate FT2640 JAW CRUSHER model is roughly 225 hp

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Primary Jaw Crusher

Task #: 01220

Description of Emissions Source:

Jaw crusher used to perform initial crushing of Hillside Waste Rock Pile material in the material processing area for further crushing and screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Secondary Crushing	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
Secondary Crushing (Controlled)	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
	Total	lb/yr											

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Secondary Cone Crusher
Task #: 01240

Description of Exhaust Emissions Source:

Cone crusher used to further crush Hillside Waste Rock Pile material in the material processing area before final screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		960		1350	2048						
	Engine power	hp		225		225	225						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		6,696		9,416	14,281						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		1,436		2,020	3,064						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		443		623	944						
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		475		668	1,014						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		248,400		349,313	529,791						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0		0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0		0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		100		141	213						
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		543		764	1,158						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E+00		2E+00	3E+00						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E-01		9E-01	1E+00						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		4E-01		6E-01	9E-01						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E+00		5E+00	8E+00						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		6E-02		8E-02	1E-01						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E+00		3E+00	4E+00						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E+00		2E+00	2E+00						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E-01		2E-01	3E-01						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-01		4E-01	5E-01						

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Crusher sizing assumes Screen Machine model CST CONE CRUSHER
(5) Max engine sizing to operate CST CONE CRUSHER model is roughly 300 hp
(6) The screen at the inlet to the cone crusher will provide secondary screening

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Secondary Cone Crusher
Task #: 01240

Description of Emissions Source:

Cone crusher used to further crush Hillside Waste Rock Pile material in the material processing area before final screening. The crusher will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Secondary Crushing	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
Secondary Crushing (Controlled)	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr											
	Total	lb/yr											

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Primary Screening (Grizzly)
Task #: 01310

Description of Exhaust Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		960		1350	2048						
	Engine power	hp		50		50	50						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		1,488		2,093	3,174						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		319		449	681						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		98		138	210						
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		106		149	225						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		55,200		77,625	117,731						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0		0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0		0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		22		31	47						
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		121		170	257						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E-01		4E-01	7E-01						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E-01		2E-01	3E-01						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		1E-01		1E-01	2E-01						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		9E-01		1E+00	2E+00						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-02		2E-02	3E-02						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E-01		6E-01	8E-01						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		3E-01		4E-01	5E-01						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-02		4E-02	7E-02						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		6E-02		8E-02	1E-01						

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Screen sizing assumes Screen Machine Industries model SCALPER 107D
(5) Engine sizing to operate SCALPER 107D model is roughly 50 hp
(6) Dust emission was reported as uncontrolled

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Primary Screening (Grizzly)
Task #: 01310

Description of Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		469,760		701,100	1,063,335						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		117,440		175,275	265,834						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		3,758		5,609	8,507						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		3,758		5,609	8,507						
Screening (Controlled)	Throughput	Tons/yr		469,760		701,100	1,063,335						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		940		1,402	2,127						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		348		519	787						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		23		35	53						
	Subtotal	lb/yr		348		519	787						
	Total	lb/yr		3,758		5,609	8,507						

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Secondary Screening Performed with Crusher

Task #: 01320

Description of Exhaust Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr											
	Engine power	hp											
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr											
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr											
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr											
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr											
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr											
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr											
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr											
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr											
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr											
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr											
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr											
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr											
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr											
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr											
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr											
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr											
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr											
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr											

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Secondary crushing and screening are performed by a single piece of equipment (the Screen Machine cone crusher). Exhaust emissions associated with these tasks are calculated as part of secondary crushing (Task 01240) and are not presented in this task
(5) Dust emission was reported as uncontrolled

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Secondary Screening Performed with Crusher

Task #: 01320

Description of Emissions Source:

Double deck screen used to perform secondary screening of Hillside Waste Rock Pile material in the material processing area after initial crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		38,752		57,825	87,701						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		1,240		1,850	2,806						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		1,240		1,850	2,806						
Screening (Controlled)	Throughput	Tons/yr		155,008		231,300	350,805						
	Total Particulate Matter	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		310		463	702						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		115		171	260						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		8		12	18						
	Subtotal	lb/yr		115		171	260						
	Total	lb/yr		1,240		1,850	2,806						

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Tertiary Screening

Task #: 01340

Description of Exhaust Emissions Source:

Double deck screen used to perform tertiary screening of Hillside Waste Rock Pile material in the material processing area after secondary crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		960		1,350	2,048						
	Engine power	hp		50		50	50						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		1,488		2,093	3,174						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		319		449	681						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		98		138	210						
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		106		149	225						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		55,200		77,625	117,731						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0		0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0		0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		22		31	47						
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		121		170	257						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E-01		4E-01	7E-01						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E-01		2E-01	3E-01						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		1E-01		1E-01	2E-01						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		9E-01		1E+00	2E+00						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-02		2E-02	3E-02						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		4E-01		6E-01	8E-01						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		3E-01		4E-01	5E-01						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-02		4E-02	7E-02						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		6E-02		8E-02	1E-01						

Calculation Method(s):

Assumptions:

(1) Normal operation for 10-hr days, 7-days per week
(2) Operating throughput assumes daily operation without any breaks
(3) Truck loading/unloading will occur at the start and end of the conveyor process
(4) Screen sizing assumes Screen Machine Industries model SCALPER 107D
(5) Engine sizing to operate SCALPER 107D model is roughly 50 hp
(6) Dust emission was reported as uncontrolled

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1
(2) Processing emission factors taken from Table 11.19.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Tertiary Screening

Task #: 01340

Description of Emissions Source:

Double deck screen used to perform tertiary screening of Hillside Waste Rock Pile material in the material processing area after secondary crushing has occurred. The screen will be operated using a diesel engine and will also generate fugitive dust during operation.

Dust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Screening	Throughput	Tons/yr		155,008		231,300	350,805						
	Total PM	Emission Rate (lb/ton-yr)	0.25										
		lb/yr		38,752		57,825	87,701						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.008										
		lb/yr		1,240		1,850	2,806						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		1,240		1,850	2,806						
Screening (Controlled)	Throughput	Tons/yr		155,008		231,300	350,805						
	Total PM	Emission Rate (lb/ton-yr)	0.002										
		lb/yr		310		463	702						
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.00074										
		lb/yr		115		171	260						
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	5.00E-05										
		lb/yr		8		12	18						
	Subtotal	lb/yr		115		171	260						
	Total	lb/yr		1,240		1,850	2,806						

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Pit 4 Pump Generator

Task #: 02110

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the Pit 4 dewatering sumps.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		189	189	189	189						
	Engine power	hp		150	50	50	50						
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		880	293	293	293						
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		189	63	63	63						
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		58	19	19	19						
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		62	21	21	21						
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		32,640	10,880	10,880	10,880						
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0						
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0						
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		13	4	4	4						
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		71	24	24	24						
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		2E-01	6E-02	6E-02	6E-02						
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		8E-02	3E-02	3E-02	3E-02						
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		6E-02	2E-02	2E-02	2E-02						
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		5E-01	2E-01	2E-01	2E-01						
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		8E-03	3E-03	3E-03	3E-03						
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E-01	8E-02	8E-02	8E-02						
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E-01	5E-02	5E-02	5E-02						
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		2E-02	6E-03	6E-03	6E-03						
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-02	1E-02	1E-02	1E-02						

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (10.8 gpm / 500 gpm)

(2) Pump engine based on existing Ford 15-D initially and then transitioning to Grundfos submersible 250S and 300S series pumps

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Pit 3 Pump Generator

Task #: 02120

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the Pit 3 dewatering sumps.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr						1,656	1,656	1,656	1,656	1,656	1,656
	Engine power	hp						50	50	50	50	50	50
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr						2,566	2,566	2,566	2,566	2,566	2,566
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr						551	551	551	551	551	551
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr						170	170	170	170	170	170
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr						182	182	182	182	182	182
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr						95,199	95,199	95,199	95,199	95,199	95,199
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr						0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr						0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr						38	38	38	38	38	38
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr						208	208	208	208	208	208
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr						5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr						2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr						2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr						1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr						2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr						7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr						4E-01	4E-01	4E-01	4E-01	4E-01	4E-01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr						5E-02	5E-02	5E-02	5E-02	5E-02	5E-02
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr						1E-01	1E-01	1E-01	1E-01	1E-01	1E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (94.5 gpm / 500 gpm)

(2) Pump engine based on Grundfos submersible 250S and 300S series pumps

Reference:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: BPA Pump Generator

Task #: 02125

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the BPA wells.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr						1,656	1,656	1,656	1,656	1,656	1,656
	Engine power	hp						1.5	1.5	1.5	1.5	1.5	1.5
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr						77	77	77	77	77	77
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr						17	17	17	17	17	17
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr						5	5	5	5	5	5
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr						5	5	5	5	5	5
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr						2,856	2,856	2,856	2,856	2,856	2,856
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr						0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr						0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr						1	1	1	1	1	1
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr						6	6	6	6	6	6
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr						2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr						7E-03	7E-03	7E-03	7E-03	7E-03	7E-03
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr						5E-03	5E-03	5E-03	5E-03	5E-03	5E-03
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr						4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr						7E-04	7E-04	7E-04	7E-04	7E-04	7E-04
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr						2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr						1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr						2E-03	2E-03	2E-03	2E-03	2E-03	2E-03
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr						3E-03	3E-03	3E-03	3E-03	3E-03	3E-03

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on ratio of inflow to pumped flow (94.5 gpm / 500 gpm)

(2) Pump engine based on Grundfos submersible 250S and 300S series pumps

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: South Pond Pump Generator

Task #: 02130

Description of Emissions Source:

Emissions due to diesel engines used to operate the pumps from the South Pond.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr						1927.2	1927.2	1927.2	1927.2	1927.2	
	Engine power	hp						30	30	30	30	30	
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr						1,792	1,792	1,792	1,792	1,792	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr						384	384	384	384	384	
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr						119	119	119	119	119	
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr						127	127	127	127	127	
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr						66,488	66,488	66,488	66,488	66,488	
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr						0	0	0	0	0	
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr						0	0	0	0	0	
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr						27	27	27	27	27	
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr						145	145	145	145	145	
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr						4E-01	4E-01	4E-01	4E-01	4E-01	
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr						2E-01	2E-01	2E-01	2E-01	2E-01	
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr						1E-01	1E-01	1E-01	1E-01	1E-01	
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr						1E+00	1E+00	1E+00	1E+00	1E+00	
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr						2E-02	2E-02	2E-02	2E-02	2E-02	
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr						5E-01	5E-01	5E-01	5E-01	5E-01	
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr						3E-01	3E-01	3E-01	3E-01	3E-01	
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr						4E-02	4E-02	4E-02	4E-02	4E-02	
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr						7E-02	7E-02	7E-02	7E-02	7E-02	

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Pump engine based on Grundfos submersible 250S and 300S series pumps

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: East Seep Pump Station

Task #: 02210

Description of Emissions Source:

Emissions due to diesel engines used to operate the pump from the East Seep.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		168	168	168	168	168	168	168	168	168	168
	Engine power	hp		12	12	12	12	12	12	12	12	12	12
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		62	62	62	62	62	62	62	62	62	62
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		13	13	13	13	13	13	13	13	13	13
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		4	4	4	4	4	4	4	4	4	4
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		4	4	4	4	4	4	4	4	4	4
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318	2,318
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		1	1	1	1	1	1	1	1	1	1
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		5	5	5	5	5	5	5	5	5	5
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Pump engine based on existing Kohler Power System 8.5Res, 8.5 kw Automatic start generator

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Blood Pool Pump Station

Task #: 02220

Description of Emissions Source:

Emissions due to the diesel engine used to operate the pump at the Blood Pool station.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		168	168	168	168	168	168	168	168	168	168
	Engine power	hp		24	24	24	24	24	24	24	24	24	24
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		125	125	125	125	125	125	125	125	125	125
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		27	27	27	27	27	27	27	27	27	27
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		8	8	8	8	8	8	8	8	8	8
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		9	9	9	9	9	9	9	9	9	9
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637	4,637
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		2	2	2	2	2	2	2	2	2	2
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		10	10	10	10	10	10	10	10	10	10
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Pump engine based on existing Kohler Power Systems 18Res, 18 kw Automatic start generator

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: PCP Pump Station

Task #: 02230

Description of Emissions Source:

Emissions due to the diesel engine used to operate the pump at the PCP pond.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		168	168	168	168	168	168	168	168	168	
	Engine power	hp		135	135	135	135	135	135	135	135	135	
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		703	703	703	703	703	703	703	703	703	
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		151	151	151	151	151	151	151	151	151	
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		46	46	46	46	46	46	46	46	46	
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		50	50	50	50	50	50	50	50	50	
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		26,082	26,082	26,082	26,082	26,082	26,082	26,082	26,082	26,082	
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		11	11	11	11	11	11	11	11	11	
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		57	57	57	57	57	57	57	57	57	
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Pump engine based on existing 100 kw Cummins generator

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Western Drainage Alluvial GW Wells

Task #: 02240

Description of Emissions Source:

Emissions due to diesel engines used to operate pumps from the alluvial groundwater pumping wells.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		168	168	168	168	168	168	168	168	168	168
	Engine power	hp		47	47	47	47	47	47	47	47	47	47
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		245	245	245	245	245	245	245	245	245	245
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		53	53	53	53	53	53	53	53	53	53
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		16	16	16	16	16	16	16	16	16	16
	PM_{10}	Emission Factor (lb/hp-hr)	2.20E-03										
		lb/yr		17	17	17	17	17	17	17	17	17	17
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080	9,080
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	4.63E-04										
		lb/yr		4	4	4	4	4	4	4	4	4	4
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		20	20	20	20	20	20	20	20	20	20
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Pump engine based on existing Lima Silver Eagle 35 kw diesel generator

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: Lime Silo (lbs)

Task #: 05100

Description of Emissions Source:

The water treatment plant lime silo will be filled pneumatically from a tanker once per month. The silo will be protected by a bag house which will prevent the majority of emissions from escaping. Those few that do will be emitted as fugitive dust particles.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Lime Silo	Throughput	Tons		360	360	360	360	360	360	360	360	360	360
	PM	Emission Factor (lb/hp-hr)	9.90E-04										
		lb/yr		3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04	3.56E-04
	PM_{10}	Emission Factor (lb/hp-hr)	3.40E-04										
		lb/yr		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04
	$PM_{2.5}$	Emission Factor (lb/hp-hr)	2.97E-04										
		lb/yr		1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04	1.07E-04

Calculation Method(s):

Assumptions:

(1) Lime emissions are not provided in AP 42 for silo storage and cement factors were used as a substitute

(2) Cement factors are not included for $PM_{2.5}$ in AP 42 so Appendix B for processed non-metal ore was used to generate a ratio of $PM_{2.5}$:PM_{10}

(3) Assumptions (1) and (2) were taken from a proposed air emissions permit application at the following link:
http://yosemite.epa.gov/R9/air/EPSS.NSF/6924c72e5ea10d5e882561b100685e04/311d97b80bcdc7a30a2571e800135729/$FILE/0542R.pdf

References:

(1) Emission factors taken from Table 11.12-2 of AP 42 Volume 1

(2) Emission conversion for PM_{10} to $PM_{2.5}$ taken from Appendix B.2-14 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - Criteria Pollutants

04/07/2014

TASK-SPECIFIC WORKSHEET

Task Name: WTP Standby Generators

Task #: 05300

Description of Emissions Source:

Conveyor units used to transport Hillside Waste Rock Pile material to the material processing area for crushing and screening and to transport material between the crushing and screening units. Each conveyor will use a diesel engine that will produce emissions in addition to fugitive dust particles that are generated at the transfer points and during truck loading/unloading.

Exhaust

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Diesel Fuel	Hours of Operation	hr/yr		168	168	168	168	168	168	168	168	168	168
	Engine power	hp		604	604	604	604	604	604	604	604	604	604
	NO_x Uncontrolled	Emission Factor (lb/hp-hr)	0.031										
		lb/yr		3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146	3,146
	CO	Emission Factor (lb/hp-hr)	6.65E-03										
		lb/yr		675	675	675	675	675	675	675	675	675	675
	SO_x	Emission Factor (lb/hp-hr)	2.05E-03										
		lb/yr		208	208	208	208	208	208	208	208	208	208
	PM_{10}	Emission Factor (lb/hp-hr)	0.0022										
		lb/yr		223	223	223	223	223	223	223	223	223	223
	Ozone	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Lead	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	CO_2	Emission Factor (lb/hp-hr)	1.15										
		lb/yr		116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693	116,693
	N_2O	Emission Factor (lb/hp-hr)	4.63E-09										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	CH_4	Emission Factor (lb/hp-hr)	2.31E-08										
		lb/yr		0	0	0	0	0	0	0	0	0	0
	F-Gases (HFCs, PFCs, SF_6)	Emission Factor (lb/hp-hr)	0										
		lb/yr											
	Aldehydes	Emission Factor (lb/hp-hr)	0.000463										
		lb/yr		47	47	47	47	47	47	47	47	47	47
	TOC	Emission Factor (lb/hp-hr)	0.0025141										
		lb/yr		255	255	255	255	255	255	255	255	255	255
	Benzene	Emission Factor (lb/hp-hr)	6.53E-06										
		lb/yr		7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
	Toluene	Emission Factor (lb/hp-hr)	2.86E-06										
		lb/yr		3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
	Xylenes	Emission Factor (lb/hp-hr)	2.00E-06										
		lb/yr		2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
	Propylene	Emission Factor (lb/hp-hr)	1.81E-05										
		lb/yr		2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
	1,3-Butadiene	Emission Factor (lb/hp-hr)	2.74E-07										
		lb/yr		3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
	Formaldehyde	Emission Factor (lb/hp-hr)	8.26E-06										
		lb/yr		8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01
	Acetaldehyde	Emission Factor (lb/hp-hr)	5.37E-06										
		lb/yr		5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
	Acrolein	Emission Factor (lb/hp-hr)	6.48E-07										
		lb/yr		7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
	PAH	Emission Factor (lb/hp-hr)	1.18E-06										
		lb/yr		1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01

Calculation Method(s):

Assumptions:

(1) Normal hours of operation based on continuous operation for 1 week per year

(2) Engine emission factors are used for <600 hp due to the fact that engine sizing is not final yet and smaller engines provide higher factors

References:

(1) Engine emission factors taken from Table 3.3-1 of AP 42 Volume 1

Attachment M-3c

Hazardous Air Pollutants (HAPs) – Estimated Actual Emissions

Midnite Mine

Estimated Actual Emissions - HAPs

04/07/2013

Estimated HAP Emissions
List of Tables

Table	Title
Table 1	Summary of Total Estimated Actual Emissions of Hazardous Air Pollutants (HAPs) by Year
Table 2	Calculation of Hazardous Air Pollutant (HAP) Concentrations in Dust by Material Type
Table 3	Calculation of Waste Rock Earthwork Hazardous Air Pollutants (HAP) Emissions by Year
Table 4	Calculation of Ore/Protore Earthwork Hazardous Air Pollutant (HAP) Emissions by Year
Table 5	Calculation of Rhoads Cover Soil Hazardous Air Pollutant (HAP) Emissions by Year
Table 6	Calculation of Silo and Engine Hazardous Air Pollutants (HAP) Emissions by Year
Table 7	Calculation of Hazardous Air Pollutant (HAP) Emissions from Unpaved Roads and Material Processing by Year
Table 8	Calculation of Hazardous Air Pollutant (HAP) Emissions from Generators by Year
Table 9	Calculation of Fuel Transfer and WTP Hazardous Air Pollutant (HAP) Emissions by Year

Estimated HAP Emissions
List of Task-Specific Worksheets

Title
RA Construction - Unpaved Roads
RA Construction - Earthworks

Midnite Mine

Estimated Actual Emissions - HAPs

04/07/2013

	General Assumptions
(1)	Although a variety of constituents may be calculated within the AP 42 emissions factors, they are not all included in the total estimated emissions calculations. The calculations include greenhouse gases, hazardous air pollutants, and criteria pollutants (EPA, 2009).
(2)	Conveyor transfer points are locations where conveyors are allowed to let material fall to the ground. The material processing equipment assumed herein will have two transfer points: one immediately following the downhill conveyor, and one at the outfall of the radial conveyor after rock processing has taken place.
(3)	Silo and fuel tank emissions were calculated using the EPA TANKS software, as recommended in AP 42. Because speciation of the fuels is not known at this stage, only total emissions can be calculated.
(4)	Diesel generators will provide power to pumps where electrical power is impractical (Pit 4, BPA pumpback wells, South Pond, and Pit 3 after Phase 2 has started). The number of hours required for generator operation was calculated from the estimated pump size and the volume of water to be pumped during a given year. These generators are assumed to have a Potential To Emit (PTE) continuously. Typical operation of the emergency generators for pumps will operate non-stop for 1 week per year, and have a PTE a maximum of 500 hours per year.
(5)	Dust emissions associated with crushing are only quantified for tertiary crushing (defined as typically being crushing down to a maximum size of 1-inch) and "fines." The maximum particle size of the material to be crushed at Midnite will be 3-inches (secondary crushing). Therefore, dust emissions from the crushing process at Midnite will be negligible. See AP 42 Chapter 11.19.2. (EPA, 2009)
(6)	Blasting will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(7)	Minimal building demolition will take place during the RA. Similar to blasting, building demolition will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(8)	To avoid rockfall hazards in the pits, scaling will take place to effectively remove hazardous loose debris from the pit walls. Similar to blasting, pit wall scaling will be performed on an irregular basis and over short periods of time. Therefore, it was not considered to be a significant source of emissions. It is important to note that this work will be managed under the FARR to minimize emissions.
(9)	The HCl silo will be a vertical fixed roof tank. The TANKS software (and AP 42) does not allow for calculations with inorganic liquids. However, TANKS advises that "it is possible to use the model if the inorganic liquid has a measurable vapor pressure and data are available for one of the vapor pressure options in the chemical database. Emission estimates produced by the model will be of unknown accuracy due to the absence of confirmatory testing for emissions from inorganic liquid storage tanks." The closest vapor pressure to a 35% HCl concentration is that of Trichloroethane (1,1,1). HCl silo emissions were assumed to be equivalent to those of Trichloroethane and calculated as such.
(10)	Pit sediments will be removed from the pits in a wet, near-saturated state and placed into geo-tubes for dewatering before being encapsulated within the waste containment areas. At no time will the sediments be handled in a loose and dry state that would generate dust emissions. Therefore, it is assumed that dust emissions and associated HAPs generated by handling of pit sediments will be negligible and are not included in the emissions calculations presented herein.
(11)	Emission factors for methane and nitrous oxide are not included in AP 42 for diesel internal combustion engines. These factors were taken from the EPA Greenhouse Gas Emission Factors Hub. (See http://www.epa.gov/climateleadership/inventory/ghg-emissions.html)
(12)	In order to calculate the HAP emissions associated with construction activity dust, it is assumed that the concentration of each HAP found in the soil will directly correlate to its percent by weight found in the total fugitive dust Particulate Matter. Concentrations of HAPs present in ore/protore, waste rock, and cover soil were estimated based on analytical results presented in the RI/FS (URS, 2005).
(13)	The liquid propane (LP) tanks at the proposed Water Treatment Plant will be used only for heating the water treatment facilities (an exempt emissions source). The tanks will be pressurized tanks and will not be allowed to breathe. The tanks will be direct-piped to the water treatment facilities to eliminate transfer emissions. It is assumed that the tanks will be maintained in proper working condition (no leaks, etc.). As such, the only emissions associated with these tanks will occur during tank filling. It is assumed that emissions associated with filling the LP tanks will be negligible.
(14)	The mass of all radionuclides is assumed to be equivalent to the total calculated mass of uranium present in the dust.
(15)	It is assumed that the total dust emissions generated from construction activities is roughly equivalent to PM_{30}. The emission factors were used with preference to PM_{30}, but using PM_{10} where factors for larger sizes were not available.

Table 1: Summary of Total Estimated Actual Emissions of Hazardous Air Pollutants (HAPs) by Year

DESCRIPTION	Units	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Chloride	(Tons emitted)	3.35E-04	5.33E-04	1.67E-03	2.49E-03	1.79E-03	3.34E-03	3.14E-03	1.48E-03	8.70E-04	7.76E-04
Phosphorus	(Tons emitted)	0.34	0.54	1.69	2.52	1.81	3.38	3.18	1.50	0.88	0.79
Sulfate	(Tons emitted)	0.12	0.19	0.59	0.87	0.63	1.17	1.10	0.52	0.31	0.27
Antimony	(Tons emitted)										
Arsenic	(Tons emitted)	0.03	0.04	0.13	0.20	0.14	0.26	0.25	0.12	0.07	0.06
Beryllium	(Tons emitted)	9.98E-04	1.59E-03	4.98E-03	7.40E-03	5.33E-03	9.95E-03	9.34E-03	4.41E-03	2.59E-03	2.31E-03
Cadmium	(Tons emitted)	1.60E-04	2.54E-04	7.97E-04	1.18E-03	8.53E-04	1.59E-03	1.49E-03	7.06E-04	4.14E-04	3.70E-04
Chromium	(Tons emitted)	0.01	0.02	0.06	0.09	0.07	0.13	0.12	0.06	0.03	0.03
Cobalt	(Tons emitted)	9.39E-03	0.01	0.05	0.07	0.05	0.09	0.09	0.04	0.02	0.02
Lead	(Tons emitted)	0.02	0.02	0.08	0.11	0.08	0.15	0.14	0.07	0.04	0.04
Manganese	(Tons emitted)	0.68	1.09	3.42	5.08	3.66	6.82	6.41	3.03	1.78	1.58
Mercury	(Tons emitted)	3.19E-05	5.08E-05	1.59E-04	2.37E-04	1.71E-04	3.18E-04	2.99E-04	1.41E-04	8.29E-05	7.39E-05
Nickel	(Tons emitted)	0.01	0.02	0.06	0.09	0.07	0.13	0.12	0.06	0.03	0.03
Selenium	(Tons emitted)	2.16E-04	3.43E-04	1.08E-03	1.60E-03	1.15E-03	2.15E-03	2.02E-03	9.53E-04	5.59E-04	4.99E-04
Radionuclides	(Tons emitted)	0.06	0.10	0.31	0.46	0.33	0.62	0.58	0.28	0.16	0.14
Benzene	(Tons emitted)	3.60E-03	4.82E-04	4.78E-03	7.00E-03	9.18E-04	9.18E-04	9.18E-04	9.18E-04	9.18E-04	6.55E-04
Toluene	(Tons emitted)	1.58E-03	2.11E-04	2.10E-03	3.07E-03	4.03E-04	4.03E-04	4.03E-04	4.03E-04	4.03E-04	2.87E-04
Xylenes	(Tons emitted)	1.10E-03	1.47E-04	1.46E-03	2.14E-03	2.80E-04	2.80E-04	2.80E-04	2.80E-04	2.80E-04	2.00E-04
Propylene	(Tons emitted)	9.96E-03	1.33E-03	0.01	0.02	2.54E-03	2.54E-03	2.54E-03	2.54E-03	2.54E-03	1.81E-03
1,3-Butadiene	(Tons emitted)	1.51E-04	2.02E-05	2.00E-04	2.93E-04	3.85E-05	3.85E-05	3.85E-05	3.85E-05	3.85E-05	2.75E-05
Formaldehyde	(Tons emitted)	4.55E-03	6.09E-04	6.05E-03	8.85E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	8.29E-04
Acetaldehyde	(Tons emitted)	2.19E-03	3.96E-04	2.84E-03	4.11E-03	7.55E-04	7.55E-04	7.55E-04	7.55E-04	7.55E-04	5.39E-04
Acrolein	(Tons emitted)	3.57E-04	4.78E-05	4.74E-04	6.94E-04	9.10E-05	9.10E-05	9.10E-05	9.10E-05	9.10E-05	6.50E-05
PAH	(Tons emitted)	6.48E-04	8.68E-05	8.61E-04	1.26E-03	1.65E-04	1.65E-04	1.65E-04	1.65E-04	1.65E-04	1.18E-04
HCl [1]	(Tons emitted)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total Combined HAPs [2]	(Tons emitted)	**1.97**	**2.70**	**7.09**	**10.21**	**7.51**	**13.44**	**12.67**	**6.34**	**3.99**	**3.63**

[1] Speciation of HCl is not available at this time. All emissions from HCl silo have been conservatively assumed to be HCl (i.e. no water vapor emissions).

[2] Gas and Diesel speciation are not available at this time. Total emissions calculated by TANKS software (EPA, 2012) have been added into the total combined HAP emissions.

Table 2: Calculation of Hazardous Air Pollutant (HAP) Concentrations in Dust by Material Type

WASTE ROCK

Sample ID		SMMA-01	SMMA-02	SMMA-03	SMMA-05	SMMA-06	SMMA-07	SMMA-08	SMMA-09	SMMA-10	SMMA-11	SMMA-12	SMMA-13	SMMA-14	SMMA-16	MEDIAN
Chloride	mg/kg	1.56	0.321	0.263	0.251	0.186	0.883	0.781	4.77	0.437	0.602	0.387	0.842	0.187	0.403	**0.42**
Phosphorus	mg/kg	493	378	490	293	279	310	467	346	279	470	472	517	577	383	**425**
Sulfate	mg/kg	333	1055	7.14	90.1	146	7.36	28.3	1.81	12.2	385	149	295	2655	1012	**148**
Antimony	mg/kg	0	0	0	0	0	0	0	0.78	0	0	0.65	0.72	0	0	**0**
Arsenic	mg/kg	35	62.7	8.5	29.8	56.3	16.9	22.9	18	18.2	31.2	120	71.4	120	137	**33.1**
Beryllium	mg/kg	1.2	1.2	0.85	1.5	1.7	2	1.5	1.4	1.1	1.3	0.51	0.99	0.53	1.5	**1.25**
Cadmium	mg/kg	0.18	0.33	0.7	0.04	0.16	0.22	0.26	0.04	0.24	0.37	0.04	0.18	0.15	0.62	**0.2**
Chromium	mg/kg	20.1	10	2.9	13.5	13.3	25.6	23.7	18.5	4.3	14.3	19.9	17.2	33.7	10.5	**15.8**
Cobalt	mg/kg	13.5	12.1	2.9	9.9	10.5	14.3	15.2	15	7.1	12.5	6.5	12.5	8.2	11.4	**11.8**
Lead	mg/kg	12	34.9	12.8	13.7	21.9	13	14.4	20.2	14.2	19.8	19.7	18.2	33.4	23.2	**19.0**
Manganese	mg/kg	1010	824	428	630	1740	1250	1270	450	8.5	2060	524	891	563	1220	**858**
Mercury	mg/kg	0.04	0.04	0.05	0.04	0.03	0.04	0.03	0.05	0.05	0.05	0.04	0.04	0.05	0.04	**0.04**
Nickel	mg/kg	17	14	3.1	15.5	17.5	20.3	23.2	19.5	8.4	15.1	7.5	17.1	8.4	16	**15.8**
Selenium	mg/kg	0.25	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.27	0.24	0.41	0.27	0.25	0.25	**0.27**
Uranium (Radionuclides)	mg/kg	83.8	69.8	114	208	211	69.2	68.7	137	94.6	70.4	42.9	72.6	56.4	306	**78.2**

RHOADS PROPERTY COVER SOIL

Sample ID		SMDWSW-04	SMDWSW-05	SMDWSW-06	SMDWSW-07	SMDWSW-08	SMDWSW-09	SMDWSW-10	SMDWSW-11	SMDWSW-12	SMDWSW-13	SMDWSW-14	SMDWSW-15	MEDIAN
Chloride	mg/kg	2.2	2.6	2.12	3.82	2.21	2.57	2.54	1.47	7.56	1.33	1.53	2.69	**2.38**
Phosphorus	mg/kg	329	375	364	283	327	335	400	393	456	367	353	351	**359**
Sulfate	mg/kg	5.97	6.95	6.13	7.46	17.8	6.48	8.7	5.39	7.78	5.48	6.55	6.33	**6.52**
Antimony	mg/kg	0.6	1.1	0.73	0.46	0.6	0.8	0.57	0.91	0.86	0.85	1.2	0.91	**0.83**
Arsenic	mg/kg	5.5	3.7	4.2	3.2	3.2	4.2	2	2.4	3.2	3.8	4.8	4.3	**3.75**
Beryllium	mg/kg	0.66	0.61	0.65	0.56	0.68	0.7	0.6	0.64	0.6	0.63	0.62	0.56	**0.63**
Cadmium	mg/kg	0.16	0.18	0.16	0.07	0.14	0.17	0.14	0.09	0.29	0.15	0.27	0.36	**0.16**
Chromium	mg/kg	8.5	11.3	13.9	8.4	9.4	11.9	6.6	6.7	9.4	10.9	11	10.2	**9.8**
Cobalt	mg/kg	5.9	7.8	8.1	6.2	5.8	8.3	4.6	5	5.7	6.8	6.8	6.1	**6.15**
Lead	mg/kg	13.6	14.4	12	12.8	10.7	14	11.4	11	16.1	12.5	12.9	15.3	**12.9**
Manganese	mg/kg	485	612	585	508	458	623	544	536	614	514	503	510	**525**
Mercury	mg/kg	0.06	0.06	0.04	0.04	0.05	0.05	0.04	0.08	0.05	0.05	0.05	0.1	**0.05**
Nickel	mg/kg	7.4	10	11.2	7.2	8.1	10.2	6.1	6.3	9	9.5	12.3	9.1	**9.05**
Selenium	mg/kg	0.76	0.51	0.22	0.24	0.25	0.28	0.28	0.28	0.25	0.26	0.25	0.28	**0.27**
Uranium (Radionuclides)	mg/kg	5.11	5.01	5.76	7.17	4.89	4.38	5.95	4.37	3.28	4.84	15.5	4.75	**4.95**

ORE/PROTORE

Sample ID		SMMA-14	CONCENTRATION USED
Chloride	mg/kg	0.187	**0.42**
Phosphorus	mg/kg	577	**577**
Sulfate	mg/kg	2655	**2655**
Antimony	mg/kg	0	**0**
Arsenic	mg/kg	120	**120**
Beryllium	mg/kg	0.53	**1.25**
Cadmium	mg/kg	0.15	**0.2**
Chromium	mg/kg	33.7	**33.7**
Cobalt	mg/kg	8.2	**11.8**
Lead	mg/kg	33.4	**33.4**
Manganese	mg/kg	563	**858**
Mercury	mg/kg	0.05	**0.05**
Nickel	mg/kg	8.4	**15.8**
Selenium	mg/kg	0.25	**0.27**
Uranium (Radionuclides)	mg/kg	56.4	**78.2**

Notes:
1. Samples presented were analyzed for constituents of concern and analytical results were presented in Appendix D of the RI/FS (URS, 2005)

2. Due to the small number of ore/protore samples analyzed, the concentrations used for the ore/protore emissions calculations were determined as the greater of: (1) the concentrations present in the ore/protore sample and (2) the median of theconcentrations present in the waste rock samples.

Table 3: Calculation of Waste Rock Earthwork Hazardous Air Pollutants (HAP) Emissions by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Total Dust Emissions (PM_{30}; lbs)	15,975	33,990	138,557	118,372	85,273	159,124	149,469	70,627	41,429	89,488
Total Dust Emissions (PM_{30}; tons)	7.99	17.00	69.28	59.19	42.64	79.56	74.73	35.31	20.71	44.74
Waste Rock Dust Emissions										
Volume Ratio of Total (%)	100%	75%	58%	100%	100%	100%	100%	100%	100%	41%
Weight (lbs)	15,975	25,386	79,671	118,372	85,273	159,124	149,469	70,627	41,429	36,952
Chloride										
% by Weight	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%
Lbs	1	1	3	5	4	7	6	3	2	2
Phosphorus										
% by Weight	4.250%	4.250%	4.250%	4.250%	4.250%	4.250%	4.250%	4.250%	4.250%	4.250%
Lbs	679	1,079	3,386	5,031	3,624	6,763	6,352	3,002	1,761	1,570
Sulfate										
% by Weight	1.475%	1.475%	1.475%	1.475%	1.475%	1.475%	1.475%	1.475%	1.475%	1.475%
Lbs	236	374	1,175	1,746	1,258	2,347	2,205	1,042	611	545
Antimony										
% by Weight										
Lbs										
Arsenic										
% by Weight	0.331%	0.331%	0.331%	0.331%	0.331%	0.331%	0.331%	0.331%	0.331%	0.331%
Lbs	53	84	264	392	282	527	495	234	137	122
Beryllium										
% by Weight	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%
Lbs	2	3	10	15	11	20	19	9	5	5
Cadmium										
% by Weight	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Lbs	0	1	2	2	2	3	3	1	1	1
Chromium										
% by Weight	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%
Lbs	25	40	125	186	134	251	235	111	65	58
Cobalt										
% by Weight	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%
Lbs	19	30	94	139	100	187	176	83	49	43
Lead										
% by Weight	0.190%	0.190%	0.190%	0.190%	0.190%	0.190%	0.190%	0.190%	0.190%	0.190%
Lbs	30	48	151	224	162	302	283	134	79	70
Manganese										
% by Weight	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%
Lbs	1,370	2,177	6,832	10,150	7,312	13,645	12,817	6,056	3,553	3,169
Mercury										
% by Weight	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Lbs	0	0	0	0	0	1	1	0	0	0
Nickel										
% by Weight	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%
Lbs	25	40	125	186	134	251	235	111	65	58
Selenium										
% by Weight	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%
Lbs	0	1	2	3	2	4	4	2	1	1
Radionuclides										
% by Weight	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%
Lbs	125	199	623	926	667	1,244	1,169	552	324	289
Total Waste Rock HAP Emissions (lbs)	**2,565**	**4,076**	**12,793**	**19,007**	**13,692**	**25,550**	**24,000**	**11,340**	**6,652**	**5,933**

Table 4: Calculation of Ore/Protore Earthwork Hazardous Air Pollutant (HAP) Emissions by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Total Dust Emissions (PM_{30}; lbs)	15,975	33,990	138,557	118,372	85,273	159,124	149,469	70,627	41,429	89,488
Total Dust Emissions (PM_{30}; tons)	7.99	17.00	69.28	59.19	42.64	79.56	74.73	35.31	20.71	44.74
Ore/Protore Dust Emissions										
Volume Ratio of Total (%)		25%	34%							
Weight (lbs)		8,604	47,154							
Chloride										
% by Weight	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%
Lbs		0	2							
Phosphorus										
% by Weight	5.770%	5.770%	5.770%	5.770%	5.770%	5.770%	5.770%	5.770%	5.770%	5.770%
Lbs		496	2,721							
Sulfate										
% by Weight	26.550%	26.550%	26.550%	26.550%	26.550%	26.550%	26.550%	26.550%	26.550%	26.550%
Lbs		2,284	12,519							
Antimony										
% by Weight										
Lbs										
Arsenic										
% by Weight	1.200%	1.200%	1.200%	1.200%	1.200%	1.200%	1.200%	1.200%	1.200%	1.200%
Lbs		103	566							
Beryllium										
% by Weight	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%	0.013%
Lbs		1	6							
Cadmium										
% by Weight	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Lbs		0	1							
Chromium										
% by Weight	0.337%	0.337%	0.337%	0.337%	0.337%	0.337%	0.337%	0.337%	0.337%	0.337%
Lbs		29	159							
Cobalt										
% by Weight	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%	0.118%
Lbs		10	55							
Lead										
% by Weight	0.334%	0.334%	0.334%	0.334%	0.334%	0.334%	0.334%	0.334%	0.334%	0.334%
Lbs		29	157							
Manganese										
% by Weight	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%	8.575%
Lbs		738	4,043							
Mercury										
% by Weight	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Lbs		0	0							
Nickel										
% by Weight	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%	0.158%
Lbs		14	74							
Selenium										
% by Weight	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%
Lbs		0	1							
Radionuclides										
% by Weight	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%	0.782%
Lbs		67	369							
Total Ore/Protore HAP Emissions (lbs)		**3,772**	**20,675**							

Table 5: Calculation of Rhoads Cover Soil Hazardous Air Pollutant (HAP) Emissions by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Total Dust Emissions (PM_{30}; lbs)	15,975	33,990	138,557	118,372	85,273	159,124	149,469	70,627	41,429	89,488
Total Dust Emissions (PM_{30}; tons)	7.99	17.00	69.28	59.19	42.64	79.56	74.73	35.31	20.71	44.74
Rhoads Cover Soil Dust Emissions										
Volume Ratio of Total (%)			8%							59%
Weight (lbs)			11,732							52,536
Chloride										
% by Weight	0.024%	0.024%	0.024%	0.024%	0.024%	0.024%	0.024%	0.024%	0.024%	0.024%
Lbs			3							12
Phosphorus										
% by Weight	3.585%	3.585%	3.585%	3.585%	3.585%	3.585%	3.585%	3.585%	3.585%	3.585%
Lbs			421							1,883
Sulfate										
% by Weight	0.065%	0.065%	0.065%	0.065%	0.065%	0.065%	0.065%	0.065%	0.065%	0.065%
Lbs			8							34
Antimony										
% by Weight	0.008%	0.008%	0.008%	0.008%	0.008%	0.008%	0.008%	0.008%	0.008%	0.008%
Lbs			1							4
Arsenic										
% by Weight	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%	0.038%
Lbs			4							20
Beryllium										
% by Weight	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%
Lbs			1							3
Cadmium										
% by Weight	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Lbs			0							1
Chromium										
% by Weight	0.098%	0.098%	0.098%	0.098%	0.098%	0.098%	0.098%	0.098%	0.098%	0.098%
Lbs			11							51
Cobalt										
% by Weight	0.062%	0.062%	0.062%	0.062%	0.062%	0.062%	0.062%	0.062%	0.062%	0.062%
Lbs			7							32
Lead										
% by Weight	0.129%	0.129%	0.129%	0.129%	0.129%	0.129%	0.129%	0.129%	0.129%	0.129%
Lbs			15							68
Manganese										
% by Weight	5.250%	5.250%	5.250%	5.250%	5.250%	5.250%	5.250%	5.250%	5.250%	5.250%
Lbs			616							2,758
Mercury										
% by Weight	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Lbs			0							0
Nickel										
% by Weight	0.091%	0.091%	0.091%	0.091%	0.091%	0.091%	0.091%	0.091%	0.091%	0.091%
Lbs			11							48
Selenium										
% by Weight	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%
Lbs			0							1
Radionuclides										
% by Weight	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%	0.050%
Lbs			6							26
Total Ore/Protore HAP Emissions (lbs)			**1,104**							**4,943**

Midnite Mine

Estimated Actual Emissions - HAPs

04/07/2013

Table 6: Calculation of Silo and Engine Hazardous Air Pollutants (HAP) Emissions by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Engine Emissions										
Benzene (lbs)	7	1	10	14	2	2	2	2	2	1
Toluene (lbs)	3	0	4	6	1	1	1	1	1	1
Xylenes (lbs)	2	0	3	4	1	1	1	1	1	0
Propylene (lbs)	20	3	26	39	5	5	5	5	5	4
1,3-Butadiene (lbs)	0	0	0	1	0	0	0	0	0	0
Formaldehyde (lbs)	9	1	12	18	2	2	2	2	2	2
Acetaldehyde (lbs)	4	1	6	8	2	2	2	2	2	1
Acrolein (lbs)	1	0	1	1	0	0	0	0	0	0
PAH (lbs)	1	0	2	3	0	0	0	0	0	0
Silo Emissions										
HCl (lbs)	399	399	399	399	399	399	399	399	399	399
Silo and Engine HAP Emissions (lbs)	**1,366**	**1,324**	**1,381**	**1,411**	**1,330**	**1,330**	**1,330**	**1,330**	**1,330**	**1,327**

Note: Detailed calculations of HAP emissions generated by WTP silos and engines are presented in the Estimated Actual Emissions - Criteria Pollutants task-specific worksheets.

Table 7: Calculation of Hazardous Air Pollutant (HAP) Emissions from Unpaved Roads and Material Processing by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
UNPAVED ROADS										
Dust										
PM30 (lbs)	5,067	29,874	102,227	88,023	73,377	130,686	125,676	57,781	37,742	83,040
LOADING/UNLOADING										
Truck Loading - Conveyor, crushed (controlled)										
Dust										
PM_{10} (lbs)	21	107	551	194	308	737	617	333	96	167
Truck Unloading - Fragmented Stone										
Dust										
PM_{10} (lbs)	3	17	88	31	49	118	99	53	15	27
Loading onto Storage Piles										
Dust										
PM_{10} (lbs)	786	3,992	20,621	7,269	11,539	27,583	23,077	12,460	3,576	6,254
MATERIAL PROCESSING										
Conveyor Units										
Exhaust										
Benzene (lbs)	2		2	4						
Toluene (lbs)	1		1	2						
Xylenes (lbs)	1		1	1						
Propylene (lbs)	5		7	10						
1,3-Butadiene (lbs)	0		0	0						
Formaldehyde (lbs)	2		3	5						
Acetaldehyde (lbs)	1		2	3						
Acrolein (lbs)	0		0	0						
PAH (lbs)	0		0	1						
Dust										
PM_{10} (lbs)	3,860		5,760	8,736						
Crushers										
Primary Jaw Crusher										
Exhaust										
Benzene (lbs)	2		3	4						
Toluene (lbs)	1		1	2						
Xylenes (lbs)	1		1	1						
Propylene (lbs)	5		7	11						
1,3-Butadiene (lbs)	0		0	0						
Formaldehyde (lbs)	2		3	5						
Acetaldehyde (lbs)										
Acrolein (lbs)	0		0	0						
PAH (lbs)	0		0	1						
Dust										
PM_{10} (lbs)										
Secondary Cone Crusher										
Exhaust										
Benzene (lbs)	2		3	4						
Toluene (lbs)	1		1	2						
Xylenes (lbs)	1		1	1						
Propylene (lbs)	5		7	11						
1,3-Butadiene (lbs)	0		0	0						
Formaldehyde (lbs)	2		3	5						
Acetaldehyde (lbs)	2		2	3						
Acrolein (lbs)	0		0	0						
PAH (lbs)	0		0	1						
Dust										
PM_{10} (lbs)										
Screening										
Primary Screening (Grizzly)										
Exhaust										
Benzene (lbs)	0		0	1						
Toluene (lbs)	0		0	0						
Xylenes (lbs)	0		0	0						
Propylene (lbs)	1		1	2						
1,3-Butadiene (lbs)	0		0	0						
Formaldehyde (lbs)	0		1	1						
Acetaldehyde (lbs)	0		0	1						
Acrolein (lbs)	0		0	0						
PAH (lbs)	0		0	0						
Dust										
PM_{10} (lbs)	3,758		5,609	8,507						
Secondary Screening Performed with Crusher										
Exhaust										
Benzene (lbs)										
Toluene (lbs)										
Xylenes (lbs)										
Propylene (lbs)										
1,3-Butadiene (lbs)										
Formaldehyde (lbs)										
Acetaldehyde (lbs)										
Acrolein (lbs)										
PAH (lbs)										
Dust										
PM_{10} (lbs)	1,240		1,850	2,806						
Tertiary Screening										
Exhaust										
Benzene (lbs)	0		0	1						
Toluene (lbs)	0		0	0						
Xylenes (lbs)	0		0	0						
Propylene (lbs)	1		1	2						
1,3-Butadiene (lbs)	0		0	0						
Formaldehyde (lbs)	0		1	1						
Acetaldehyde (lbs)	0		0	1						
Acrolein (lbs)	0		0	0						
PAH (lbs)	0		0	0						
Dust										
PM_{10} (lbs)	1,240		1,850	2,806						

Note: Detailed calculations of HAP emissions generated by unpaved road traffic and material processing are presented in the Estimated Actual Emissions - Criteria Pollutants task-specific worksheets.

Table 8: Calculation of Hazardous Air Pollutant (HAP) Emissions from Generators by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
FUEL-POWERED GENERATORS										
Pit 4 Pump Generator										
Exhaust										
Benzene (lbs)	2E-01	6E-02	6E-02	6E-02						
Toluene (lbs)	8E-02	3E-02	3E-02	3E-02						
Xylenes (lbs)	6E-02	2E-02	2E-02	2E-02						
Propylene (lbs)	5E-01	2E-01	2E-01	2E-01						
1,3-Butadiene (lbs)	8E-03	3E-03	3E-03	3E-03						
Formaldehyde (lbs)	2E-01	8E-02	8E-02	8E-02						
Acetaldehyde (lbs)	2E-01	5E-02	5E-02	5E-02						
Acrolein (lbs)	2E-02	6E-03	6E-03	6E-03						
PAH (lbs)	3E-02	1E-02	1E-02	1E-02						
Pit 3 Pump Generator										
Exhaust										
Benzene (lbs)					5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
Toluene (lbs)					2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
Xylenes (lbs)					2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
Propylene (lbs)					1E+00	1E+00	1E+00	1E+00	1E+00	1E+00
1,3-Butadiene (lbs)					2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Formaldehyde (lbs)					7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
Acetaldehyde (lbs)					4E-01	4E-01	4E-01	4E-01	4E-01	4E-01
Acrolein (lbs)					5E-02	5E-02	5E-02	5E-02	5E-02	5E-02
PAH (lbs)					1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
BPA Pump Generator										
Exhaust										
Benzene (lbs)					2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Toluene (lbs)					7E-03	7E-03	7E-03	7E-03	7E-03	7E-03
Xylenes (lbs)					5E-03	5E-03	5E-03	5E-03	5E-03	5E-03
Propylene (lbs)					4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
1,3-Butadiene (lbs)					7E-04	7E-04	7E-04	7E-04	7E-04	7E-04
Formaldehyde (lbs)					2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Acetaldehyde (lbs)					1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
Acrolein (lbs)					2E-03	2E-03	2E-03	2E-03	2E-03	2E-03
PAH (lbs)					3E-03	3E-03	3E-03	3E-03	3E-03	3E-03
South Pond Pump Generator										
Exhaust										
Benzene (lbs)					4E-01	4E-01	4E-01	4E-01	4E-01	
Toluene (lbs)					2E-01	2E-01	2E-01	2E-01	2E-01	
Xylenes (lbs)					1E-01	1E-01	1E-01	1E-01	1E-01	
Propylene (lbs)					1E+00	1E+00	1E+00	1E+00	1E+00	
1,3-Butadiene (lbs)					2E-02	2E-02	2E-02	2E-02	2E-02	
Formaldehyde (lbs)					5E-01	5E-01	5E-01	5E-01	5E-01	
Acetaldehyde (lbs)					3E-01	3E-01	3E-01	3E-01	3E-01	
Acrolein (lbs)					4E-02	4E-02	4E-02	4E-02	4E-02	
PAH (lbs)					7E-02	7E-02	7E-02	7E-02	7E-02	
East Seep Pump Station										
Exhaust										
Benzene (lbs)	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
Toluene (lbs)	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03
Xylenes (lbs)	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03	4E-03
Propylene (lbs)	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
1,3-Butadiene (lbs)	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04	6E-04
Formaldehyde (lbs)	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Acetaldehyde (lbs)	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
Acrolein (lbs)	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03
PAH (lbs)	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03
Blood Pool Pump Station										
Exhaust										
Benzene (lbs)	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
Toluene (lbs)	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02
Xylenes (lbs)	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03	8E-03
Propylene (lbs)	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
1,3-Butadiene (lbs)	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03	1E-03
Formaldehyde (lbs)	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
Acetaldehyde (lbs)	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Acrolein (lbs)	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03	3E-03
PAH (lbs)	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03
PCP Pump Station										
Exhaust										
Benzene (lbs)	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	
Toluene (lbs)	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	6E-02	
Xylenes (lbs)	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	
Propylene (lbs)	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	4E-01	
1,3-Butadiene (lbs)	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	6E-03	
Formaldehyde (lbs)	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	
Acetaldehyde (lbs)	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	
Acrolein (lbs)	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	1E-02	
PAH (lbs)	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	
Western Drainage Alluvial GW Wells										
Exhaust										
Benzene (lbs)	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02	5E-02
Toluene (lbs)	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Xylenes (lbs)	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02	2E-02
Propylene (lbs)	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01
1,3-Butadiene (lbs)	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03	2E-03
Formaldehyde (lbs)	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
Acetaldehyde (lbs)	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02	4E-02
Acrolein (lbs)	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03	5E-03
PAH (lbs)	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03	9E-03

Note: Detailed calculations of HAP emissions generated by fuel-powered generators are presented in the Estimated Actual Emissions - Criteria Pollutants task-specific worksheets.

Table 9: Calculation of Fuel Transfer and WTP Hazardous Air Pollutant (HAP) Emissions by Year

DESCRIPTION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
FUEL TRANSFER										
Fuel Farm - (Calculated in EPA TANKS)										
Diesel Tanks (lbs)	11	11	11	11	11	11	11	11	11	11
Gasoline Tanks (lbs)	907	907	907	907	907	907	907	907	907	907
WATER TREATMENT PLANT										
Silos										
Lime Silo - (No HAP emissions)										
HCl Silo - (Calculated in EPA TANKS)										
HCl (lbs)	399	399	399	399	399	399	399	399	399	399
WTP Standby Generators										
Exhaust										
Benzene (lbs)	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01	7E-01
Toluene (lbs)	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01	3E-01
Xylenes (lbs)	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01	2E-01
Propylene (lbs)	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00	2E+00
1,3-Butadiene (lbs)	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02	3E-02
Formaldehyde (lbs)	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01	8E-01
Acetaldehyde (lbs)	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01	5E-01
Acrolein (lbs)	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02	7E-02
PAH (lbs)	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01	1E-01

Note: Detailed calculations of HAP emissions generated by fuel transfers and the WTP standby generator are presented in the Estimated Actual Emissions - Criteria Pollutants task-specific worksheets.

TASK-SPECIFIC WORKSHEET

Task Name: RA Construction - Unpaved Roads

Description of Dust Emissions Source:

Particulate emissions due to travel over unpaved haul roads around the site.

Unpaved Road

			YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Unpaved Road	Coefficient, k	4.9										
	Silt content, s	%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%
	Coefficient, a	0.7										
	Mean vehicle weight, W	tons	48	48	77	53	47	78	98	78	38	26
	Coefficient, b	0.45										
	Emissions, E	lb/VMT (lbs per vehicle mile traveled)	0.52	0.52	0.65	0.55	0.52	0.65	0.72	0.65	0.47	0.40
	Length of roadway	miles	1	1.2	1.4	1.8	1.0	1.4	1.4	1.3	1.8	2.7
	Earthwork volumes	tons/yr	210,000	1,066,650	5,509,500	1,942,050	3,082,950	7,369,714	6,165,786	3,329,000	955,500	1,671,000
	Truck load volume	tons/load	44	44	100	44	44	100	100	100	44	44
	Passes per year	loads/yr * 2	9,655	49,041	110,190	89,290	141,745	147,394	123,316	66,580	43,931	76,828
	Annual Miles	(VMT/yr)	9,655	56,927	157,480	160,417	141,154	200,155	173,693	88,496	79,891	208,511
	PM_{30}	lb/yr	5,067	29,874	102,227	88,023	73,377	130,686	125,676	57,781	37,742	83,040
	Coefficient, k	1.5										
	Silt content, s	%	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
	Coefficient, a	0.9										
	Mean vehicle weight, W	tons	48	48	77	53	47	78	98	78	38	26
	Coefficient, b	0.45										
	Emissions, E	lb/VMT (lbs per vehicle mile traveled)	0.06	0.06	0.07	0.06	0.06	0.07	0.08	0.07	0.05	0.05
	Length of roadway	miles	1	1.2	1.4	1.8	1.0	1.4	1.4	1.3	1.8	2.7
	Earthwork volumes	tons/yr	210,000	1,066,650	5,509,500	1,942,050	3,082,950	7,369,714	6,165,786	3,329,000	955,500	1,671,000
	Truck load volume	tons/load	43.5	44	100	44	44	100	100	100	44	44
	Passes per year	loads/yr * 2	9,655	49,041	110,190	89,290	141,745	147,394	123,316	66,580	43,931	76,828
	Annual Miles	(VMT/yr)	9,655	56,927	157,480	160,417	141,154	200,155	173,693	88,496	79,891	208,511
	PM_{10}	lb/yr	574	3,382	11,573	9,965	8,307	14,795	14,227	6,541	4,273	9,401
	Total PM_{30}	lb/yr	5,067	29,874	102,227	88,023	73,377	130,686	125,676	57,781	37,742	83,040

Calculation Method(s):

Assumptions:

(1) Total emissions based on PM_{30} for unpaved roads and PM_{10} for loading/unloading
(2) Road lengths estimated from design drawings
(3) Silt content based on Table 13.2.2-1 for haul roads from Stone Processing
(4) Vehicle weights are estimated based on the cost estimate presented in the 60% BODR (MWH, 2013)
(5) Number of passes based on the total volume moved and the load capacity of trucks that were estimated in the cost estimate provided in the 60% BODR (MWH, 2013)
(6) Roads are not publicly accessible
(7) Roads in clean areas and roads surfaced with aggregate meting cleanup standards do not contribute to HAP emissions
(8) Truck loading will be similar to loading provided by conveyor

Reference(s):

(1) Fugitive Dust emission factors taken from Table 13.2.2-1 and Table 13.2.2-2 of AP 42 Volume 1

Midnite Mine

Estimated Actual Emissions - HAPs

04/07/2013

TASK-SPECIFIC WORKSHEET

Task Name: RA Construction - Earthworks

Description of Dust Emissions Source:

Particulate emissions due to earth moving activities during remediation.

Construction

				YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10
Truck Loading - Conveyor, crushed (controlled)	Throughput	Tons/yr		210,000	1,066,650	5,509,500	1,942,050	3,082,950	7,369,714	6,165,786	3,329,000	955,500	1,671,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.0001										
		lb/yr		21	107	551	194	308	737	617	333	96	167
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		21	107	551	194	308	737	617	333	96	167
Truck Unloading - Fragmented Stone	Throughput	Tons/yr		210,000	1,066,650	5,509,500	1,942,050	3,082,950	7,369,714	6,165,786	3,329,000	955,500	1,671,000
	Total Particulate Matter	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Total PM_{10}	Emission Rate (lb/ton-yr)	0.000016										
		lb/yr		3	17	88	31	49	118	99	53	15	27
	Total $PM_{2.5\ (Controlled)}$	Emission Rate (lb/ton-yr)	No Data										
		lb/yr											
	Subtotal	lb/yr		3	17	88	31	49	118	99	53	15	27
Loading onto Storage Piles	Particle Size Multiplier, k (PM30)		0.74										
	Mean Wind Speed, U	mph	15										
	Moisture Content, M	%	4										
	Emission Rate, E	lb/ton	0.003743										
	Throughput	Tons/yr		210,000	1,066,650	5,509,500	1,942,050	3,082,950	7,369,714	6,165,786	3,329,000	955,500	1,671,000
	Subtotal	lb/yr		786	3,992	20,621	7,269	11,539	27,583	23,077	12,460	3,576	6,254
	Total	lb/yr		810	4,116	21,260	7,494	11,897	28,438	23,793	12,846	3,687	6,448

Attachment M-3d

EPA TANKS Software – Summary of Inputs and Outputs

TANKS 4.0.9d
Emissions Report - Detail Format
Tank and Physical Characteristics

Identification

User Identification:	Diesel Tank
City:	Spokane
State:	Washington
Company:	
Type of Tank:	Horizontal Tank
Description:	Diesel Tank

Tank Dimensions

Shell Length (ft):	30.00
Diameter (ft):	10.00
Volume (gallons):	17,624.00
Turnovers:	52.00
Net Throughput(gal/yr):	916,448.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Data used in Emissions Calculations: Spokane, Washington (Avg Atmospheric Pressure = 13.51 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Diesel Tank - Horizontal Tank
Spokane, Washington

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	48.87	43.72	54.03	47.25	0.0043	0.0036	0.0053	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Diesel Tank - Horizontal Tank
Spokane, Washington

Annual Emission	
Standing Losses (lb):	2.0516
Vapor Space Volume (cu ft):	1,500.7608
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0362
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,500.7608
Tank Diameter (ft):	10.0000
Effective Diameter (ft):	19.5491
Vapor Space Outage (ft):	5.0000
Tank Shell Length (ft):	30.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0043
Daily Avg. Liquid Surface Temp. (deg. R):	508.5442
Daily Average Ambient Temp. (deg. F):	47.2292
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9192
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,216.5189
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0362
Daily Vapor Temperature Range (deg. R):	20.6286
Daily Vapor Pressure Range (psia):	0.0017
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0043
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0036
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0053
Daily Avg. Liquid Surface Temp. (deg R):	508.5442
Daily Min. Liquid Surface Temp. (deg R):	503.3870
Daily Max. Liquid Surface Temp. (deg R):	513.7013
Daily Ambient Temp. Range (deg. R):	20.6083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0043
Vapor Space Outage (ft):	5.0000
Working Losses (lb):	9.1593
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0043
Annual Net Throughput (gal/yr.):	916,448.0000
Annual Turnovers:	52.0000
Turnover Factor:	0.7436
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	11.2109

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Diesel Tank - Horizontal Tank
Spokane, Washington

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	9.16	2.05	11.21

TANKS 4.0.9d
Emissions Report - Detail Format
Tank and Physical Characteristics

Identification

User Identification:	Gasoline Tank
City:	Spokane
State:	Washington
Company:	
Type of Tank:	Horizontal Tank
Description:	Gasoline Tank

Tank Dimensions

Shell Length (ft):		10.00
Diameter (ft):		6.00
Volume (gallons):		2,115.00
Turnovers:		104.00
Net Throughput(gal/yr):		219,960.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Data used in Emissions Calculations: Spokane, Washington (Avg Atmospheric Pressure = 13.51 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Gasoline Tank - Horizontal Tank
Spokane, Washington

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 10)	All	48.87	43.72	54.03	47.25	4.1596	3.7431	4.6127	66.0000			92.00	Option 4: RVP=10, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Gasoline Tank - Horizontal Tank
Spokane, Washington

Annual Emission	
Standing Losses (lb):	253.0048
Vapor Space Volume (cu ft):	180.0913
Vapor Density (lb/cu ft):	0.0503
Vapor Space Expansion Factor:	0.1271
Vented Vapor Saturation Factor:	0.6019
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	180.0913
Tank Diameter (ft):	6.0000
Effective Diameter (ft):	8.7426
Vapor Space Outage (ft):	3.0000
Tank Shell Length (ft):	10.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0503
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.1596
Daily Avg. Liquid Surface Temp. (deg. R):	508.5442
Daily Average Ambient Temp. (deg. F):	47.2292
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9192
Tank Paint Solar Absorptance (Shell):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,216.5189
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1271
Daily Vapor Temperature Range (deg. R):	20.6286
Daily Vapor Pressure Range (psia):	0.8696
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.1596
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	3.7431
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	4.6127
Daily Avg. Liquid Surface Temp. (deg R):	508.5442
Daily Min. Liquid Surface Temp. (deg R):	503.3870
Daily Max. Liquid Surface Temp. (deg R):	513.7013
Daily Ambient Temp. Range (deg. R):	20.6083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.6019
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	4.1596
Vapor Space Outage (ft):	3.0000
Working Losses (lb):	654.3737
Vapor Molecular Weight (lb/lb-mole):	66.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	4.1596
Annual Net Throughput (gal/yr.):	219,960.0000
Annual Turnovers:	104.0000
Turnover Factor:	0.4551
Tank Diameter (ft):	6.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	907.3785

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Gasoline Tank - Horizontal Tank
Spokane, Washington

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 10)	654.37	253.00	907.38

TANKS 4.0.9d
Emissions Report - Detail Format
Tank and Physical Characteristics

Identification

User Identification:	HCl Silo
City:	Spokane
State:	Washington
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	HCl Silo

Tank Dimensions

Shell Height (ft):		11.50
Diameter (ft):		10.00
Liquid Height (ft) :		9.50
Avg. Liquid Height (ft):		9.50
Volume (gallons):		5,581.45
Turnovers:		12.00
Net Throughput(gal/yr):		66,977.35
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome	
Height (ft)		2.00
Radius (ft) (Dome Roof)		10.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Data used in Emissions Calculations: Spokane, Washington (Avg Atmospheric Pressure = 13.51 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

HCl Silo - Vertical Fixed Roof Tank
Spokane, Washington

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Trichloroethane (1,1,1)	All	48.87	43.72	54.03	47.25	1.2166	1.0513	1.4040	133.4200			133.42	Option 2: A=8.643, B=2136.6, C=302.8

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

HCl Silo - Vertical Fixed Roof Tank
Spokane, Washington

Annual Emission	
Standing Losses (lb):	140.0106
Vapor Space Volume (cu ft):	239.8082
Vapor Density (lb/cu ft):	0.0297
Vapor Space Expansion Factor:	0.0644
Vented Vapor Saturation Factor:	0.8355
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	239.8082
Tank Diameter (ft):	10.0000
Vapor Space Outage (ft):	3.0533
Tank Shell Height (ft):	11.5000
Average Liquid Height (ft):	9.5000
Roof Outage (ft):	1.0533
Roof Outage (Dome Roof)	
Roof Outage (ft):	1.0533
Dome Radius (ft):	10.0000
Shell Radius (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0297
Vapor Molecular Weight (lb/lb-mole):	133.4200
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.2166
Daily Avg. Liquid Surface Temp. (deg. R):	508.5442
Daily Average Ambient Temp. (deg. F):	47.2292
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	506.9192
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,216.5189
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0644
Daily Vapor Temperature Range (deg. R):	20.6286
Daily Vapor Pressure Range (psia):	0.3527
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.2166
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	1.0513
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	1.4040
Daily Avg. Liquid Surface Temp. (deg R):	508.5442
Daily Min. Liquid Surface Temp. (deg R):	503.3870
Daily Max. Liquid Surface Temp. (deg R):	513.7013
Daily Ambient Temp. Range (deg. R):	20.6083
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.8355
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	1.2166
Vapor Space Outage (ft):	3.0533
Working Losses (lb):	258.8432
Vapor Molecular Weight (lb/lb-mole):	133.4200
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.2166
Annual Net Throughput (gal/yr.):	66,977.3451
Annual Turnovers:	12.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	5,581.4454
Maximum Liquid Height (ft):	9.5000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	398.8538

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

HCl Silo - Vertical Fixed Roof Tank
Spokane, Washington

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Trichloroethane (1,1,1)	258.84	140.01	398.85

TANKS 4.0.9d
Emissions Report - Detail Format
Total Emissions Summaries - All Tanks in Report

Emissions Report for: Annual

Tank Identification			Losses (lbs)
Diesel Tank	Horizontal Tank	Spokane, Washington	11.21
Gasoline Tank	Horizontal Tank	Spokane, Washington	907.38
HCl Silo	Vertical Fixed Roof Tank	Spokane, Washington	398.85
Total Emissions for all Tanks:			1,317.44

Midnite Mine

PTE Emission Inventory for Regulated NSR Pollutants (9-3-14)

List of equipment and pollutant-emitting activities from Worthington Miller's *Attachment M-3a, Criteria Pollutants - Potential to Emit (PTE)* , August 5, 2014 and has not been verified.

Since facility is not in a "listed" source category, fugitive emissions are not included for permit applicability.

Emissions from nonroad vehicles are not included for permit applicability.

Diesel Engines < 600 hp

Description	Rating (hp)	Usage (hrs/year)
Downhill Conveyor Unit	250	8760
Radial Conveyor Unit 1	50	8760
Radial Conveyor Unit 2	50	8760
Radial Conveyor Unit 3	50	8760
Radial Conveyor Unit 4	50	8760
Radial Conveyor Unit 5	50	8760
Primary Jaw Crusher	225	8760
Secondary Cone Crusher	300	8760
Primary Screening	50	8760
Secondary Screening[1]	0	8760
Tertiary Screening	50	8760
Pit 4 Pump Generator	150	8760
Pit 3 Pump Generator	50	8760
BPA Pump Generator	1.5	8760
South Pond Generator	30	8760
East Seep Pump Station	12	8760
Blood Pool Pump Station	24	8760
PCP Pump Station	135	8760
Western Drainage Alluvial Wells	47	8760
Total rating of engines < 600 hp:	1574.5	

Emissions from Diesel Engines < 600 hp

	Emission Factor[2, 3] (lb/hp-hr)	Aggregate Rating (hp)	Hourly Emissions (lbs)	Annual Emissions (tons)
CO	0.00668	1574.5	10.52	46.07
NOx	0.031	1574.5	48.81	213.79
PM	0.0022	1574.5	3.46	15.17
PM_{10}	0.0022	1574.5	3.46	15.17
$PM_{2.5}$	0.0022	1574.5	3.46	15.17
SO_2	0.00205	1574.5	3.23	14.14
VOC	0.00247	1574.5	3.89	17.03

Footnotes

[1] Secondary screening is powered by the same engine that powers secondary cone crusher

[2] Emission factors from AP-42, Section 3.3, October 1996, Table 3.3-1

[3] Emission factor for PM and $PM_{2.5}$ assumed to be same as for PM_{10}

Diesel Engines > 600 hp

Description	Rating (hp)	Usage[4] (hrs/year)
WTP Standby Generator	604	500
Total rating of engines > 600 hp:	604	

Emissions from Diesel Engines > 600 hp

	Emission Factor[5, 6] (lb/hp-hr)	Aggregate Rating (hp)	Hourly Emissions (lbs)	Annual Emissions (tons)
CO	0.0055	604	3.32	0.83
NOx	0.024	604	14.50	3.62
PM	0.0007	604	0.42	0.11
PM_{10}	0.0007	604	0.42	0.11
$PM_{2.5}$	0.0007	604	0.42	0.11
SO_2	0.004045	604	2.44	0.61
VOC	0.000705	604	0.43	0.11

Emissions from Material Handling

Description	Rating (tons/hr)	No.	Emission Factors[7, 8, 9]			Annual Emissions (tons)		
			PM	PM10	PM2.5	PM	PM10	PM2.5
Conveyor Transfer Points	225	12	0.003	0.0011	0.0011	35.48	13.01	13.01
Primary Screening	225	1	0.025	0.0087	0.0087	24.64	8.57	8.57
Secondary Screening	225	1	0.025	0.0087	0.0087	24.64	8.57	8.57
Tertiary Screening	225	1	0.025	0.0087	0.0087	24.64	8.57	8.57
Truck unloading (x6)	225	6	0.000016	0.000016	0.000016	0.09	0.09	0.09
Lime Silo (tpy)	360	1	0.73	0.47	0.47	0.13	0.08	0.08
					Sub-total:	109.62	38.91	38.91

Footnotes

[4] *Calculating Potential to Emit (PTE) for Emergency Generators* , John S. Seitz, September 6,1995

[5] Emission factors from AP-42, Section 3.4, October 1996, Table 3.4-1

[6] Emission factor for $PM_{2.5}$ and PM_{10} assumed to be same as for PM

[7] Emission factors from AP-42, Section 11.19.2, August 2004, Table 11.19.2-2

[8] Where emission factors were not available for a particular species, assumed to be same as for PM or PM10

[9] Emission factors for lime silo based on emission factors for cement silo, AP-42, Section 11.12, June 2006, Table 11.12-2

Diesel Tanks[10]	0.0055	tpy
Gasoline Tanks[10]	0.4535	tpy

Footnotes

[10] Emissions from tanks from Worthington Miller's *Attachment M-3a, Criteria Pollutants - Potential to Emit (PTE)* , August 5, 2014 and has not been verified.

TOTAL EMISSIONS

CO	46.90	tpy
NOx	217.41	tpy
PM	124.89	tpy
PM10	54.19	tpy
PM2.5	54.19	tpy
SO2	14.75	tpy
VOC	17.60	tpy