Midnite Mine Superfund Site
100 Percent Design

Appendix Q – Remedial Action Site-Wide Monitoring Plan

June 2015

Prepared for:

Dawn Mining Company
PO Box 250
Ford, Washington 990413

and

Newmont USA Limited
6363 South Fiddler's Green Circle
Greenwood Village, Colorado 80111

Prepared By:

MWH Americas, Inc.
2890 E. Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

TABLE OF CONTENTS

Q1.0 INTRODUCTION 1

Q1.1 SELECTED REMEDY SUMMARY 2
Q1.2 SITE WIDE MONITORING OBJECTIVES 5
Q1.3 SCHEDULE 5
Q1.4 PROCESS FOR UPDATING THIS SMP 5

Q2.0 KNOWN AND ANTICIPATED SITE CONDITIONS 6

Q2.1 PRE-REMEDIAL ACTION SITE HYDROGEOLOGY 6
Q2.1.1 Surface Water 7
Q2.1.2 Sediment 11
Q2.1.3 Groundwater 11
Q2.2 ANTICIPATED IMPACTS TO CONTAMINANT FATE AND TRANSPORT DURING REMEDY CONSTRUCITON 16
Q2.3 ANTICIPATED IMPACTS THAT COMPLETED REMEDY WILL HAVE ON CONTAMINANT FATE AND TRANSPORT 17
Q2.4 ANTICIPATED IMPACTS THAT COMPLETED REMEDY WILL HAVE ON HYDROGEOLOGIC CONDITIONS 18
Q2.5 AIR 20
Q2.5.1 Gamma Radiation and Radon 20
Q2.5.2 Anticipated Impacts that Remedy will have on Gamma Radiation and Radon 20
Q2.6 EXISTING MONITORING DATA 20

Q3.0 SITE-WIDE MONITORING DESIGN OVERVIEW 21

Q4.0 MONITORING PROGRAM 22

Q4.1 FIELD SAMPLING PLAN 23
Q4.2 QUALITY ASSURANCE PROJECT PLAN 24
Q4.3 HEALTH AND SAFETY PLAN 24
Q4.4 INSTITUTIONAL CONTROLS IMPLEMENTATION AND ASSURANCE PLAN 24
Q4.5 STORMWATER MANAGMENT PLAN 25

Q5.0 REPORTING 25

Q6.0 REFERENCES 26

FIGURES

Figure Q-1 Mine Features and Drainages
Figure Q-2 Conceptual Illustration of Principal Hydrogeologic Units
Figure Q-3 Pre-Remedy Hydrologic System Conceptual Flow Model
Figure Q-4 Post-Remedy Hydrologic System Conceptual Flow Model

LIST OF ACRONYMS

ARD	acid rock drainage
AQMP	Air Quality Monitoring Plan
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practice
BODR	Basis of Design Report
BPA	Backfilled Pit Area
BPDP	Backfilled Pit Dewatering Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminant of Concern
DMC	Dawn Mining Company LLC
DQO	Data Quality Objective
EPA	Environmental Protection Agency
FSP	Field Sampling Plan
gpm	gallons per minute
HASP	Health and Safety Plan
IC	institutional control
ICIAP	Institutional Control Implementation and Assurance Plan
JSA	Job Safety Analysis
MA	Mined Area
Mgal	million gallons
Newmont	Newmont USA Limited
NPDES	National Pollutant Discharge Elimination System
PCP	Pollution Control Pond
PIA	potentially impacted area
PMP	Performance Monitoring Plan
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAWP	Remedial Action Work Plan
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision

Site	Midnite Mine Superfund Site
SMP	Site-wide Monitoring Plan
SOP	Standard Operating Procedure
SWMP	Stormwater Management Plan
SWRP	South Waste Rock Pile
Tribe	Spokane Tribe of Indians
WTP	Water Treatment Plant

Q1.0 INTRODUCTION

This Site-wide Monitoring Plan (SMP) describes the overall goals and procedures for monitoring environmental media (i.e., surface water, groundwater, sediment, and air) during and after the remedial action (RA) at the Midnite Mine Superfund Site (Site) located outside of Wellpinit, Washington. A summary of the Selected Remedy for the Site is presented below in Section Q1-1. This SMP is an appendix to the *Midnite Mine Superfund Site Basis of Design Report* (BODR), which presents the background and supporting information relevant to the Site and the planned RAs. The BODR contains the engineering drawings, plans, and specifications for the RA. Upon approval of the Final BODR, this SMP will become a component of the Remedial Action Work Plan (RAWP), which presents the construction activities for implementing the Selected Remedy at the Site.

This SMP was prepared in accordance with the following documents:

- *Statement of Work for the Remedial Design and Remedial Action for the Midnite Mine Superfund Site* (EPA, 2011).
- *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988)
- *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (OSWER Directive Number 9200.4-17P).
- *Monitored Natural Attenuation of Inorganic Contaminants in Ground Water - Technical Basis for Assessment, Volumes 1-3* (EPA/600/R-07/139; EPA/600/R-07/140; and EPA/600/R-10/093).

The purpose of this SMP is to describe monitoring of environmental media during remedy implementation to determine if contaminants from the mined area (MA) are being released to down gradient or downwind areas. Following implementation of the Selected Remedy, this SMP will be revised to include monitoring of groundwater, surface water, soil, sediment, and radon (flux and airborne), as necessary to evaluate the effectiveness of the remedy in meeting the Performance Standards, Remedial Action Objectives, and cleanup levels. Baseline data collected historically will be compared with SMP data collected during the active remediation to evaluate changing conditions throughout the remedial process.

This SMP does not include monitoring or sampling information for the Water Treatment Plant (WTP) influent and effluent. That information is included in the existing NPDES permit and will be part of the modified permit when it is finalized. This SMP includes the following supporting documents:

- Field Sampling Plan (FSP) – The FSP describes the field-specific equipment and procedures for site-wide monitoring of surface water, sediment, and groundwater. The FSP includes the sampling/monitoring locations, rationale, and frequencies. The FSP will be updated as necessary during the RA such that sampling locations and frequencies can be added or deleted to meet the data quality objectives (DQOs) as the RA progresses. Additional details regarding the FSP are presented below in Section Q5.1.
- Quality Assurance Project Plan (QAPP) – The QAPP provides the policy, organization, functional activities, and quality assurance/quality control (QA/QC) protocols to be followed during implementation of the SMP to assure that the resulting data are of sufficient quality to support the data end uses. The QAPP presents the detailed DQOs for the various data collection activities and includes the Standard Operating Procedures (SOPs). Additional details regarding the QAPP are presented below in Section Q5.2.

When RA construction activities begin, this SMP will replace the *Performance Monitoring Plan for the Phase I RD/RA: Interim Water Management for the Midnite Mine* (PMP; AES, 2011). The bulk of the monitoring protocols and many of the sampling locations previously established and approved in the PMP remain unchanged in this SMP. However, this SMP includes necessary revisions to accommodate monitoring during and following the RA to meet the objectives described in Section Q1.2. Additional details regarding the monitoring approach are presented below in Section Q3.0.

Air Monitoring. Details of the environmental air monitoring plan are being developed, and an Air Quality Monitoring Plan (AQMP) has been submitted for Tribe and EPA review. When finalized, the AQMP will be included as an attachment to this SMP.

Q1.1 SELECTED REMEDY SUMMARY

The Selected Remedy for the Midnite Mine Superfund Site includes the following (EPA, 2006):

1) Containment of Mine Waste in Pits:

- Excavation of above-grade mine waste. Waste to be excavated includes waste rock, ore and proto-ore, stored mine cores, road gravel, contaminated soil, and pit and drainage sediments. It does not include waste rock in the Backfilled Pit Area.
- Consolidation of the excavated mine waste in Pit 3 and Pit 4 to create waste containment areas with a sump, drainage layer, and liner to channel groundwater entering the pits around the waste and into the sump at the bottom.
- Contouring the waste in Pits 3 and 4 and waste in the Backfilled Pit Area and construction of a stable vegetated cover designed to minimize surface water infiltration and meet radon and radiation cleanup levels for each waste containment area.

2) Water Collection and Treatment:

- As an interim action pending waste containment, continued collection and ex situ treatment of contaminated seeps and pit water, with on-site discharge of treated water in compliance with interim discharge limits.
- Following waste containment, removal of water that enters Pit 3, Pit 4, and the Backfilled Pit Area using pumping wells; collection of any remaining seeps that exceed surface water cleanup levels.
- Design and construction of a replacement water treatment plant and a conveyance for discharge of treated water to the Spokane River Arm of Lake Roosevelt.
- Long-term discharge of treated water to the Spokane River Arm under an NPDES permit.

3) Residuals Management:

- Disposal of water treatment sludge at the Dawn Millsite until alternate disposal is required by mill closure.
- Following mill closure, disposal of sludge at a licensed off-site facility, unless the sludge characteristics are modified to allow alternative disposal.

4) Surface Water and Sediment Management:

- Contouring, revegetation, and surface water management in the drainage basin to divert clean water away from waste containment areas while minimizing erosion.
- Construction of sediment controls in the mine drainages to prevent sediment transport downstream to Blue Creek.

- Monitoring of Blue Creek and delta areas to assess natural recovery and the need for active remediation.

5) Monitored Natural Attenuation of Groundwater:
   - Recovery of groundwater through natural flushing following source control.
   - Sampling of groundwater to verify recovery.
6) Institutional Controls and Access Restrictions:
   - Permanent institutional controls in waste containment areas and at the water treatment plant to prevent groundwater use and protect the integrity of the remedy.
   - Physical access restrictions such as an interim fence and a permanent boulder barrier around containment areas to prevent damage to soil covers and to reduce risk.
   - Interim institutional controls to prevent extraction or use of groundwater until cleanup levels are met.
   - Interim measures, such as signs, advisories, and community outreach, to minimize public uses of surface water, sediment, and affected food plants outside the waste containment area until cleanup levels are met.
7) Long-Term Site Management:
   - Long-term monitoring to assess the effectiveness of the remedy, including physical inspections, revegetation surveys, groundwater and surface water monitoring, radiation, and radon monitoring.
   - Operation and maintenance of the water treatment system, including process monitoring, routine maintenance, and periodic replacement.
   - Operation and maintenance of soil covers, wells and water conveyances, surface water controls, and all other elements of the remedy that require maintenance.
   - Remedy reviews every five years to assure that the remedy is protective of human health and the environment.
8) Contingent Actions:
   - Sediment cleanup in Blue Creek and Blue Creek delta if necessary.
   - Implementation of other enhancements to reduce ARD.

Q1.2 SITE WIDE MONITORING OBJECTIVES

The overall objectives of the site-wide monitoring are to:

- Determine if contaminants are released from the MA to down gradient or downwind areas during implementation of the Selected Remedy.
- Determine if cleanup levels are being achieved within a reasonable timeframe following implementation of the Selected Remedy.
- Provide sufficient data to support EPA determinations regarding ongoing remedy protection of human health and the environment through the 5-year review process.

This SMP (and its supporting documents) includes the proposed locations, rational, sampling and analytical methods, sample frequency, and reporting for environmental-media monitoring to achieve these objectives. The detailed DQO process applied in development of this SMP is described in Section Q2-3.0 of the QAPP. The 7-step DQO process defines the monitoring objectives, information needed, decisions and decision criteria, performance and acceptance criteria, and analytical approach that results in development of a detailed monitoring plan.

Q1.3 SCHEDULE

Site-wide monitoring will begin upon initiation of the RA and will continue until an end date determined by EPA. Data generated from the site-wide monitoring will be used to support EPA determinations regarding ongoing remedy protection of human health and the environment through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 5-year review process.

Q1.4 PROCESS FOR UPDATING THIS SMP

The RA construction activities are anticipated to occur during three main phases that occur over a 10-year duration. Therefore, this SMP (and the supporting FSP and QAPP) is a dynamic document that will be updated periodically to reflect changes to the site-wide monitoring network (and associated DQOs, procedures and protocols, as necessary) that occur as the phased RA progresses. Recommendations for updates will be made in the quarterly data reports (or in more frequent monthly reports, if necessary) in coordination with the EPA and the Tribe, and will be based on changing site conditions, results of data evaluations, or new data needs that may arise throughout the RA. Any changes to this SMP will require review and approval by EPA.

Q2.0 KNOWN AND ANTICIPATED SITE CONDITIONS

The following hydrogeologic discussion is summarized from information contained in the *Phase I Hydrologic Modeling for Midnite Mine RI/FS* (URS, 2002) and the Midnite Mine Remedial Investigation (RI) Report (EPA, 2005), with supplemental information from pre-remedial design investigations described in Section 3.0 of the BODR. This summary information provides the basis for understanding potential contaminant fate and transport, and for designing the site-wide monitoring network. The discussion below focuses on surface water and groundwater flow because these are the primary mechanisms for contaminant transport, and for contributing to sediment contamination and sediment distribution. Air as a media of concern is discussed separately in Section Q2.4 below.

Q2.1 PRE-REMEDIAL ACTION SITE HYDROGEOLOGY

In the Site area, the hydrogeologic system includes both natural features and features that have been altered as a result of the historic mining and interim remedial action activities. As shown on Figure Q-1, the Midnite Mine is located primarily within a watershed that is drained by three intermittent streams: the Western Drainage, Central Drainage, and Eastern Drainage (these drainages are described in more detail below). Within the MA, the upper reaches of the original Western Drainage and Central Drainage were excavated or filled with waste rock during the mining operations. South of the MA, the Western Drainage and Central Drainage flow into the Eastern Drainage, which in turn flows into Blue Creek. Blue Creek is a perennial stream that flows to the Spokane River Arm of Lake Roosevelt. Four other surface water drainages receive surface water runoff and/or groundwater migration from the MA (the Northeastern, Northern, Far West, and Southwestern drainages).

In addition to the placement of waste rock in the upper reaches of the Western and Central drainages, several site features and facilities constructed for mine water management have modified the natural surface-water drainage pattern. Two open pits (Pits 3 and 4) collect and impound surface water runoff from a large portion of the MA. These open pits create local groundwater sinks. Water management facilities include (1) the Pollution Control Pond (PCP); (2) seep water collection systems; (3) pipes and culverts that convey water from the seep collection points to Pit 3, from Pit 3 and Pit 4 to the WTP, and to the catchment areas; and (4) ditches that divert surface water flow around portions of the MA to other existing natural drainage channels.

All water in the MA and potentially impacted area (PIA) originates as precipitation. In undisturbed areas surrounding the MA, the majority of precipitation water is removed from the flow system by evapotranspiration or becomes surface water runoff. Within the MA, a major portion of the precipitation infiltrates and moves rapidly through the permeable waste rock and ore/protore stockpiles. The remainder of the precipitation falling on the MA runs off to the open pits, to existing surface water drainages, or to the PCP. Most of infiltrating precipitation within the MA moves as interflow within the unconsolidated materials at depths above the water table potentiometric surface (interflow is the lateral movement of water in the unsaturated zone that first returns to the surface or enters a stream prior to becoming groundwater). The interflow generally converges on the buried channels of the Western and Central drainages, and discharges to seeps and springs where the buried channels daylight at the toe of the South Waste Rock Pile (SWRP). A relatively small portion of the infiltrated water recharges the saturated-zone groundwater flow system, at depths below the potentiometric surface.

Groundwater generally flows from north to south beneath the site. Groundwater levels range from about 130 feet below the ground surface (bgs) on the Northwest Ridge to a few feet bgs along the drainages south of the MA. In the saturated zone below the potentiometric surface, groundwater generally flows from the higher elevations of the site toward the lower elevations, and converges toward the buried drainages and the hydraulic sinks created by the open pits. However, within the MA, groundwater flow directions also are strongly influenced by the topography of the post-mining land surface underlying the waste rock materials. In most of the MA, waste rock piles lie above the potentiometric surface, except in areas that have been excavated for mining and later backfilled (e.g., Pit 2, Pit 2 West, and Boyd Pit).

Q2.1.1 Surface Water

Q2.1.1.1 Surface Water Drainages

There are eight surface water drainages in the PIA that may receive surface water runoff (and associated sediments) or groundwater discharge from the MA. These surface water drainages are depicted on Figure Q-1 and are discussed below.

The **Western Drainage** currently emerges at the toe of the South Waste Rock Pile (SWRP) and then flows approximately 2,700 feet southeast, where it joins the Eastern Drainage. Prior to mining and waste rock placement, the Western Drainage existed within and drained the western portion of the MA (see Figure Q-1). Surface water contributions to the Western Drainage are

primarily from seeps from the SWRP (the Western Drainage and Western Drainage Junior seeps) and springs located along the reach between the seep collection system access road and the confluence with the Eastern Drainage. The Western Drainage receives stormwater from a ditch extending along the western and southwestern edge of the SWRP, direct runoff from the central portion of the SWRP, and shallow groundwater flow from the MA. Except during thunderstorms and spring runoff, surface water flow within the Western Drainage is largely fed by groundwater and typically begins about halfway between the seep collection system and the confluence with the Eastern Drainage. Sediments are present throughout the length of the Western Drainage channel and consist of light brown silt with some clay, sand, and cobbles. These sediments are scheduled to be removed as part of the RA.

The **Central Drainage** extends from just south of the PCP dam and continues in a southerly direction for about 1,800 feet to where it joins the Eastern Drainage. Prior to mining and waste rock placement, the Central Drainage existed within and drained the central portion of the MA (see Figure Q-1). The upper portion of the Central Drainage has two forks, the East Fork and the West Fork. Contributions are primarily from seeps from the SWRP (which are captured and treated at the WTP), springs located along the southern reach of the drainage, direct runoff from the surrounding land surface, and shallow groundwater flow. The drainage is typically dry from below the seep collection system to just above the confluence with the Eastern Drainage. Sediments are present throughout the length of the drainage channels and typically consist of light brown silts with cobbles. These sediments are scheduled to be removed as part of the RA.

The **Eastern Drainage** is located immediately east of the southeastern portion of the MA. The Eastern Drainage includes three tributary drainages that collect surface water from the MA: the East Dump Fork, East Seep Fork, and Lower Fork. The main channel of the Eastern Drainage extends from the National Pollutant Discharge Elimination System (NPDES) outfall pond, which is near the WTP east of the MA, downstream to the confluence with Blue Creek, which is approximately 6,700 feet to the south. Surface water is discharged to the Eastern Drainage from the (1) Northeastern Drainage, (2) NPDES outfall pond, (3) Central Drainage, (4) Western Drainage, and (5) various seeps located throughout the drainage. The Eastern Drainage receives direct runoff from waste rock deposited along the southeast MA boundary, and in its southern reach may receive groundwater discharge along its course. The Eastern Drainage typically has surface water flow for most of the year, partially from the WTP discharge from the

NPDES outfall pond. Sediments consist of dark brown silt, sand, and small cobbles; these sediments are scheduled for removal as part of the RA.

The **Northeastern Drainage** (the extension of the Eastern Drainage above the NPDES outfall pond) is located immediately east of the northern portion of the MA. The upper portion of the drainage has three forks: the East Fork, Middle Fork, and West Fork. Surface water entering the drainage is conveyed southward to the NPDES outfall pond. The drainage is often dry above the outfall pond except for several small seep areas. Surface and groundwater contributions to the drainage include:

- East Fork - Collects surface water from a small area east of the MA.
- Middle Fork - Collects MA surface water from areas east of Pit 4, including runoff from waste rock deposited at the top of the drainage.
- West Fork - Collects MA runoff from a bedrock ridge on the east side of Pit 3 and from an area of fill between Pits 3 and 4.

The **Northern Drainage** drains much of the area to the east of the MA and consists of three branches. In its upper reach, a short segment drains the small portion of the MA north of Pit 4. The Northern Drainage is typically dry for most of its length except during thunderstorms or spring snowmelt.

The **Far West Drainage** is located immediately west of the southern portion of the MA. The Far West Drainage drains areas west of the MA and a small area of the MA that falls outside the primary drainage basin where the MA is located. The eastern branch of the Far West Drainage also is known as Whitetail Creek – a poorly defined drainage feature – that traverses the Rhoads property to the southwest of the MA. Surface water runoff and groundwater enters the Far West Drainage from the extreme western portion of the MA between the North and the South Topsoil areas. The Far West Drainage receives direct runoff from the western portion of the Vehicle Shop and Mine Offices Area. The Far West Drainage is typically dry. Unlike the other PIA drainages, the Far West Drainage extends directly to Lake Roosevelt and does not enter Blue Creek.

The **Southwestern Drainage** is located southwest of the southern portion of the MA. Surface water runoff enters the Southwestern Drainage from the southwestern portion of the MA between the South Topsoil area and the Western Drainage. Potential MA surface water contributions to the drainage include:

- Runoff from a small area of the MA outside the drainage basin, where topsoil is located
- Runoff from the West Haul Road

The Southwestern Drainage extends to the south directly to Blue Creek and is typically dry.

Blue Creek is a perennial stream that is fed by springs, groundwater seepage into the streambed, numerous intermittent surface drainages, and flow from Turtle Lake. Blue Creek also receives surface water drainage from the Midnite Mine area via the Eastern Drainage, the main stem of the Northern Drainage below the East Haul Road, and the Southwestern Drainage. It flows in a southwesterly direction to the Spokane River Arm of Lake Roosevelt, approximately 3.5 miles from the Eastern Drainage.

Q2.1.1.2 Open Pits and Other Impoundments

This section describes the open pits and impoundments that are in place at the start of the RA. This section will be updated as the RA progresses and pits are backfilled, impoundments are taken off line, and new impoundments are constructed.

Surface water and associated sediments accumulate in four areas in the MA: (1) Pit 3, (2) Pit 4, (3) the PCP, and (4) the Blood Pool (see Figure Q-1). Water levels in each of these areas fluctuate seasonally. Following cessation of uranium mining in 1981, water levels increased in the open pits from groundwater inflow and precipitation/run-on (and from water pumped from the PCP to Pit 3 since 1983) until the pit dewatering and water treatment activities began in 1992. Currently, all water that accumulates in these impoundments is captured, treated on Site, and discharged to the Eastern Drainage. Water that discharges from seeps in southern part of the MA is currently collected and pumped back to Pit 3, then treated at the on-site WTP. At the WTP, the Pit 3 water is blended with water pumped from Pit 4 and treated during April to October of each year. The PCP serves as a catchment basin for (1) seep water that originates from the SWRP above the PCP, (2) stormwater from a large portion of the MA, and (3) seep water that is captured and pumped from the Western and Central Drainage seepage collection systems. The Blood Pool is an unlined depression located in the east-central portion of the Midnite Mine site. It intermittently collects seep water and a limited quantity of surface water runoff from the area near the WTP.

As described in URS (2002) and MGC (2011), Pit 3 is a hydraulic sink and forms a sub-basin that includes the up gradient Pit 4. Recharge, interflow, and bedrock groundwater flow within the capture zone of this hydraulic sink report to Pit 3. The Pit 4 lake has been characterized as

a flow-through lake, with outflow occurring on the southern or down gradient portion of the pit, and flow from Pit 4 appears to recharge Pit 3 through seeps in the Pit 3 walls and pit bottom.

Q2.1.2 Sediment

Sediments are present in the surface water drainages and impoundments described above. The Selected Remedy will include removing the mine-affected sediments from Pit 3, Pit 4, the PCP, and the Western, Central, and Eastern drainages. As discussed in Sections Q3.0 and Q4.0, this SMP includes monitoring sediments during and following the RA.

Q2.1.3 Groundwater

Groundwater flows within two principal geologic material types at the Midnite Mine: 1) regolith and 2) fractured bedrock. Groundwater flow in these material types is depicted conceptually on Figure Q-2 and is discussed below:

The **regolith** is an unconsolidated hydrogeologic unit consisting primarily of alluvium, but also includes colluvium, weathered bedrock, and moderate amounts of glacial outwash sediment. In the MA, the regolith also includes waste rock. The thickness of the unconsolidated material varies significantly across the site. The alluvium is relatively thin, and in the MA occurs within portions of the buried drainages. Some of the alluvial material was removed from portions of the Western Drainage and Eastern Drainage prior to waste rock placement (Peters, 1999). In upland areas of the watershed, alluvium is present as a thin veneer or is absent because of the steeper topographic relief. Alluvium is also present in the drainages south of the MA, effectively pinching-out south of the confluence of the Western Drainage and Eastern Drainage based on well logs (SMI, 1995). The alluvium thickens to 10 to 15 feet at the lower end of the Eastern Drainage. Surface materials in the PIA away from the MA consist of residual soils, alluvium, colluvium, sediments, and riparian sediments. The thicknesses of these materials range from zero on exposed bedrock surfaces to several tens of feet in the drainage bottoms.

The **waste rock** in the MA includes the major waste rock piles, and the ore and protore stockpiles. These materials were deposited on top of weathered and fractured igneous and metamorphic rocks that are generally less permeable than the overlying unconsolidated materials. Material particle sizes in the waste rock and ore/protore stockpiles range from silt and clay to large boulders. Site grading and compaction of the land surface in some areas of the MA, such as on the haul roads and haul truck staging areas, reduced the ground surface permeability which facilitates increased stormwater runoff and causes surface water to become

channelized in some areas. Conversely, much of the waste rock and stockpiled ore and protore material is of coarse texture, which results in high infiltration rates.

Based on water levels measured in piezometers installed in the waste rock piles, the SWRP and Hillside Waste Rock Pile are generally unsaturated. Waste rock from the mining operations was deposited across several existing drainages in the MA (the northern extensions of the Western, Central, and Eastern drainages). The saturated thickness of the waste rock is generally less than 2 feet in these buried drainages within the MA. In areas that were excavated below the local water table, such as the backfilled pits, saturated thicknesses of the waste rock range from approximately 15 to 30 feet. All of the ore/protore stockpiles in the MA are above the water table and therefore are generally unsaturated. A primary component of the RA is to remove and consolidate the waste rock in Pits 3 and 4.

The **bedrock** hydrogeologic unit consists of unweathered metasedimentary rocks of the Precambrian Togo Formation, quartz monzonite, and various igneous dikes. Adjacent to the contact between the Togo Formation and the quartz monzonite, some of the bedrock has been hydrothermally altered.

Groundwater flow within the bedrock occurs primarily through secondary porosity features (fractures, joints, faults, and lithologic contacts). The fractures have a relatively high density and vary widely in orientation. Within the quartz monzonite and igneous dikes, fracturing is pervasive throughout the rock matrix. Fractures within the metasediments are commonly present along relict bedding planes, cleavage planes, foliation, and other zones of weakness in the rocks. The fractures are typically heterogeneous in spacing, orientation, size, and degree of interconnection. Fracture apertures are typically less than ¼ -inch. Generally, fractures are most prevalent near the land surface and are assumed to decrease in number and size with depth because of increasing confining pressure.

In the upper zones, the shallowest aquifer perches on the top of the bedrock, or the bedrock may be sufficiently exfoliated such that there is a hydraulic connection with the overlying saturated alluvium/colluvium or waste rock. These predominantly horizontal fractures in the exfoliated zones (which extend to depths of approximately 50 feet) store and transmit the majority of water representing the shallow aquifer (Kirschner, 2014). However, at depth, groundwater flow within the un-weathered bedrock is through discrete fractures, joints, and faults. While conditions vary from boring to boring, several generalizations can be made concerning the lithologic and hydrogeologic conditions in the bedrock down gradient of the MA.

For example, lithologic logs for bedrock wells drilled in the Western and Central drainages generally indicate a relatively thick unsaturated zone within the bedrock, with groundwater encountered in fractures at deeper depths. Water levels measured in these wells are close to the ground surface, indicating a relatively significant upward gradient (e.g., confining head pressures on the order of 80 to 100 feet at the fracture zones screened in wells MWWD-01 and MWCD-01, which are located just south of the Mined Area in the Western and Central drainages, respectively).

Other large-scale geologic features at the mine site also appear to significantly influence groundwater flow in the bedrock. For example, the intensely fractured and altered contact zone between the metasedimentary rocks and quartz monzonite appears to channel water from Pit 4 to Pit 3. Seeps are associated with this contact zone on the north highwall of Pit 3. Dikes in the bedrock may act to channel or restrict the flow of groundwater. Where dikes consist of un-fractured or weathered clay-rich material, these features restrict groundwater flow. Conversely, where dikes have intensely fractured contact zones, they are highly conductive. Water-bearing aplite dikes were encountered in several boreholes drilled during the RI for monitoring well installation.

Q2.1.4 Summary of the Conceptual Groundwater Flow Model

Using the available data for the Midnite Mine, a pre-remedy conceptual model of the groundwater flow system has been prepared to describe the movement of water throughout the site. Figure Q-3 illustrates the major features of the pre-remedy groundwater flow system.

Precipitation that falls on the site is subject to evaporation, evapotranspiration, runoff, or percolation. Recharge to the groundwater flow system is from percolation of precipitation. In areas surrounding the MA where bedrock is exposed at the ground surface or underlies thin soils with natural vegetation, the amount of water entering the groundwater flow system is about 10 percent of precipitation or less. In the MA, groundwater recharge rates are much higher, possibly as much as 80 percent of precipitation because of the coarse texture, high porosity, and large hydraulic conductivity of the waste rock and the relatively sparse vegetation cover.

Within the MA, a large portion of the infiltrating precipitation moves within unconsolidated materials as interflow at depths above the water table. These coarse-grained materials have hydraulic characteristics that allow rapid movement of water. After major precipitation events and during spring snowmelt events, interflow moves quickly downward and tends to accumulate

along the top of the bedrock. Much of this interflow moves down the slope of the bedrock surfaces and converges into buried drainages and bedrock depressions excavated by mining. Most of the interflow emerges as seeps at the toe of the SWRP and East Dump. Because most of this infiltration water moves as interflow quickly out of the unconsolidated materials to surface discharge points, only a relatively small portion of water infiltrating within the MA recharges the underlying fractured bedrock. Nevertheless, the bedrock does receive recharge in the higher elevation portions of the MA.

The available hydrogeologic data show that the groundwater flow system in the Midnite Mine vicinity exhibits the key features of a topographically driven flow system. In such flow systems, groundwater circulates through the subsurface along pathways from upland areas of recharge to lowland areas of discharge, typically stream valleys and drainages. A large amount of topographic relief increases the influence of surface topography on flow directions and accentuates groundwater flow. In the MA, the undulating topography and major groundwater sinks created by mining (e.g., Pit 3 and Pit 4) reflect superposition of local and intermediate flow systems. In addition to the lateral flow from higher to lower elevations across the site area, there are strong downward components of flow in recharge areas and strong upward flow components in discharge areas (see Figure Q-3). Site-specific groundwater-level data show that locations having upward and downward hydraulic gradients are consistent with the areal trends typically seen in a topographically driven groundwater flow system. Downward gradients are present in the recharge areas in the higher elevation areas along the Northwest Ridge and other parts of the northern MA. Upward gradients are found in the lower elevations of the Site.

Groundwater flow within the weathered and unweathered bedrock at the site and the surrounding area is through a continuum of interconnected fractures. Fractures are pervasive throughout the bedrock and are observed in most areas to have relatively close spacing, small apertures, and wide variation in orientations. Hydraulic conductivity in the more intensely fractured portions of the weathered bedrock is generally higher than that in the deeper unweathered bedrock. At depth, groundwater flow within the unweathered bedrock is through discrete fractures, joints and faults. An increased density of fracturing has been observed in the northern highwalls of the open pits along the contact zone between the Togo Formation and the quartz monzonite, which likely causes a zone of higher hydraulic conductivity that trends north-south between the pits. Additional zones of higher hydraulic conductivity may exist in the bedrock that is generally aligned with the surface water drainage channels, both natural and

buried, because such channels develop through geologic time due to preferential erosion of structural weaknesses in the rock.

Recharge to the backfilled pits occurs by infiltration of precipitation, interflow along the bedrock surface, and groundwater inflow from the surrounding bedrock. Groundwater flow within this area is consistent with the conceptual model for the site as a whole, in that the flow directions are controlled primarily by topography. Groundwater moves into the backfilled pits in areal patterns similar to those of surface water running into the open pits. Groundwater flows southward from the backfilled pits through the surrounding bedrock and over the lowest elevations of the buried bedrock rims of the pits, across the bedrock surface.

Currently, the seep flows and surface water runoff from the SWRP is captured by collection systems and pumped to the PCP. However, before the implementation of this pumpback system, seep flow and surface water runoff entered the drainages south of the MA.
A substantial portion of this flow percolated downward into the alluvial deposits and recharged the shallow groundwater system. After installation of the seep collection systems and for current conditions, the alluvium receives recharge from direct infiltration of surface water from snowmelt and runoff generated by occasional, intense rainfall. In areas having upward gradients, the alluvium also receives upward flow from the bedrock groundwater that converges laterally toward the drainages.

For the flow system as a whole, under long-term steady-state conditions, the recharge rate should approximate the amount of combined discharge from the system. Groundwater leaves the watershed in which the MA is located via:

- Evaporation from the ground surface, seeps, and open water bodies in Pit 3, Pit 4, and the PCP
- Transpiration by local vegetation in the drainages south of the MA
- Groundwater discharge to surface water drainage channels down gradient of the MA, which eventually lead to Blue Creek.
- Groundwater discharge to deeper unweathered bedrock.

Essentially no surface water flows from the MA southward beyond the seep collection systems located along the southern MA boundary. Although groundwater discharges into the drainages south of the MA, the rate of this seepage does not sustain stream flow in the majority of the

drainages during rainless periods. There are currently pump back wells in the drainages that are intercepting much of this alluvial groundwater and returning that water to Pit 3 for treatment. Nonetheless, groundwater discharge causes a small but steady base flow in the drainages southernmost reaches of the Central and Western Drainages. In the Eastern Drainage, there is an upward gradient and the groundwater table rises to groundwater surface, which indicates groundwater seepage. These groundwater discharge areas probably reflect the terminus of flow lines in the groundwater flow system that originates in the northern high-elevation areas of the MA.

Q2.2 ANTICIPATED IMPACTS TO CONTAMINANT FATE AND TRANSPORT DURING REMEDY CONSTRUCITON

Implementation of the Selected Remedy will involve earthmoving activities that have the potential to release mine-related constituents of concern (COCs) to down gradient or downwind areas in the following ways:

- Generation of dust, which could mobilize COCs in ambient air and deposit COCs where the dust settles.
- Migration of COCs that are suspended or dissolved in stormwater that flows off of construction areas.
- Migration of COCs that are suspended or dissolved in groundwater that is exposed as a result of excavating and flows off of the construction areas as surface water.
- Migration of COCs that are suspended or dissolved in surface water that contacts native bedrock that is exposed as a result of excavating and flows off of the construction areas.

An overall premise to the remedial design is to prevent mine-affected environmental media (e.g., sediment, surface water, air) from migrating away from the construction areas by construction procedures and best management practices (BMPs). Examples of these construction procedures and BMPs include:

- Dust suppression will be an integral component of all RA construction activities.
- All surface water, stormwater, and snowmelt runoff within the RA construction areas will be captured and routed to the operating WTP.

- Stormwater management BMPs will be implemented and monitored in accordance with the Stormwater Management Plan (SWMP), which like this SMP becomes a component of the RAWP upon approval of the Final BODR. (Additional information regarding how this SMP interacts with the SWMP is discussed below in Section Q4.5.)

In the event that the RA construction procedures or BMPs fail or are inadequate, construction related COCs will migrate down gradient or downwind. Any stormwater/surface water that flows off of the RA construction areas will flow into the Western, Central, or Eastern drainages described in Section Q2.1.1. The monitoring network presented in the FSP is designed to monitor locations where mine-affected media is expected to occur in the event the BMPs fail or are inadequate.

Q2.3 ANTICIPATED IMPACTS THAT COMPLETED REMEDY WILL HAVE ON CONTAMINANT FATE AND TRANSPORT

This section describes the anticipated impacts that the remedy will have on contaminant fate and transport model based on the Remedial Design of the Selected Remedy. Figure Q-4 illustrates the major features of the post-remedy groundwater flow system.

As the remedy is implemented, the sources of contamination will be removed, consolidated in the pits, and hydraulically isolated (including sediments in the Western, Central, and Eastern drainages). The post-remedy surface topography (and subsurface bedrock topography) will continue to direct surface runoff and groundwater flow toward the natural drainages in the MA. In areas where mine wastes and contaminated sediments are removed, the precipitation and snowmelt will runoff or infiltrate, converge on the Western, Central, Eastern, and Far West drainages, and ultimately discharge to Blue Creek (or directly to Lake Roosevelt in the case of the Far West Drainage). However, this post-remedy flow will be un-impacted by mine wastes and contaminated sediments as they will no longer be present (or will be hydraulically isolated). Similarly, precipitation and snowmelt on the capped consolidated wastes will runoff or infiltrate and migrate laterally as interflow, and ultimately discharge to Blue Creek without contacting mine wastes. Water that accumulates in the consolidated wastes will be extracted, treated on-Site at the new WTP, and ultimately discharged via pipeline to Lake Roosevelt.

As acknowledged in the *Record of Decision* (ROD; EPA, 2006) COCs in surface water and 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 time required for surface water and groundwater cleanup levels to be achieved is unknown and can be better estimated after post-remedy monitoring is conducted for several years. Sediment cleanup levels should be achieved upon completion of the RA as the intent is to remove all mine-affected sediments. It is possible that mine-affected surface water that remains following the RA might transfer contaminants to the sediments in the remediated drainages. However, the impact that the remnant mine-affected surface water has on sediments following the RA is expected to be minimal (e.g., low concentrations of COCs) and relatively brief as natural attenuation processes occur in both the surface water and potentially impacted sediments. Also, the contribution of direct erosion of mine wastes to sediment contamination will be removed upon completion of the remedy as the wastes no longer will be exposed to erosional forces.

Q2.4 ANTICIPATED IMPACTS THAT COMPLETED REMEDY WILL HAVE ON HYDROGEOLOGIC CONDITIONS

The hydrogeologic conditions at the Site will gradually change from the current conditions (summarized above) to post-remedy conditions as the phased RA construction activities are completed. Currently (pre-remedy), the natural water balance in the MA watershed (i.e., long-term steady state conditions where the recharge rate approximates the amount of combined discharge from the flow system) is maintained because mine-affected water that is captured, treated and discharged to the Eastern Drainage within the MA watershed, and ultimately contributes to the combined discharge from the MA watershed to Blue Creek. The primary difference between current pre-remedy hydraulic conditions and post-remedy conditions is that the mine-affected water that is extracted from the consolidated wastes, underdrain systems, and the alluvial groundwater controls will be treated and discharged via pipeline to Lake Roosevelt outside of the MA watershed. As a result, the amount of combined water discharging from the MA watershed to Blue Creek following implementation of the remedy will be reduced by the volume of treated water that is discharged directly to Lake Roosevelt.

The amount of post-remedy water that will be treated and discharged to Lake Roosevelt is expected to be significantly less than the amount of water that currently is treated and discharged on-Site to the Eastern Drainage. This is because the bulk of post-remedy precipitation and snowmelt will be shed as surface water runoff that will not have contacted mine wastes, whereas much of the pre-remedy precipitation and snowmelt contacts mine wastes and requires treatment. The anticipated volumes of post-remedy water requiring

treatment will gradually decrease over time as the backfilled pits are dewatered and long-term steady state conditions are re-established. As described in the Water Balance section of BODR Appendix E, the long-term steady state volume of post-remedy water that will be treated and discharged to Lake Roosevelt is estimated to be 50 gpm or 26 million gallons per year (Mgal/yr). The sources of post remedy water that will need treatment are groundwater seepage into pits 3 and 4, the Backfilled Pit Area (BPA), and the three dewatering trenches installed to capture alluvial groundwater in the Far East, Central and Western drainages (see Appendix E of the BODR). This combined volume of post-remedy water requiring treatment (26 Mgal/yr) is approximately 12 percent of the overall volume of water estimated to discharge from the MA watershed (209 Mgal/yr) based on data collected during 1999 and 2000 as part of the RI (URS, 2002). These numbers should be considered estimates because they do not account for evapotranspiration.

The resulting impacts that the completed remedy will have on hydraulic conditions at the Site could include lower potentiometric surfaces near Pit 3, Pit 4, and within the BPA, and more variable stream flows in the creeks that emanate from the MA. These impacts will be better understood and documented following several years of post-remedy monitoring. The major post-remedy changes to the flow system downstream from the Mine Area will be:

1) Eliminating flow from the operation of the existing WTP to Blue Creek, which discharges approximately 60 Mgal/yr of treated water to the Eastern Drainage during the operational season (typically four days per week during April through November).

2) An increase in surface water runoff as clean water is shed from the remediated areas.

As a result, it is likely that the post-remedy flows will be more variable as the snow melts in the spring and the precipitation wanes in the summer months, which will result in a more intermittent flow in in the Eastern Drainage, as opposed to the relatively constant discharge from the existing WTP that occurs between April and October of each year. In addition, alluvial groundwater controls (consisting of paired extraction trenches and low-permeability barrier walls) will intercept shallow alluvial groundwater in the upper sections of the Western, Central, and Far Eastern drainages and temporarily reduce flow in the down gradient alluvial system. The groundwater extraction trenches are intended to intercept impacted alluvial groundwater from the Mine Area and will be abandoned once monitoring results indicate alluvial groundwater in the up gradient areas meet cleanup standards.

Q2.5 AIR

Q2.5.1 Gamma Radiation and Radon

Results of the RI indicate that Site gamma radiation and radon gas levels are elevated, as indicated by radon flux data, airborne radon measurements, and gamma survey information. Radiation surveys indicate overall elevated gamma radiation levels throughout the MA, with localized areas of significantly higher levels, primarily where ore and proto-ore is stockpiled. Radon levels are also elevated. Gamma-survey transects and samples along the haul roads and adjacent areas indicate elevated levels of radioactivity, caused by mine waste rock materials used in road construction and particulate transport from the road in dust and surface water runoff.

Q2.5.2 Anticipated Impacts that Remedy will have on Gamma Radiation and Radon

During the RA construction activities (i.e., when mine wastes actively are being excavated and consolidated in the pits), air monitoring will be performed in accordance with the AQMP. A draft AQMP is under review by EPA and the Tribe at the time of publication of the 100% design. When the AQMP is finalized it will be added to this SMP as an attachment. The potential for airborne contaminants should be eliminated upon completion of the RA as the cap over the consolidated wastes (which are the source of airborne contaminants) is designed to prevent significant concentrations of airborne contaminants from reaching the cap surface.

Q2.6 EXISTING MONITORING DATA

Dawn Mining Company LLC/Newmont USA Limited (DMC/Newmont) has conducted monitoring at the Midnite Mine under several different programs. From 1979 to approximately 2001, DMC/Newmont conducted a surface water and groundwater monitoring program according to the requirements specified in the Bureau of Land Management (BLM) letter dated May 28, 1982 (U.S. Department of Interior, 1982). DMC/Newmont performed monitoring pursuant to its 1995 NPDES permit (WA-002572-1) for the water treatment plant and monitoring to obtain operational data.

Monitoring was performed according to the *Work Plan for the Midnite Mine* (SMI, 1998) from approximately October 1998 through June 1999 for surface water and groundwater and in 1998 for sediment. As part of the Work Plan, surface water and groundwater monitoring was performed under the Backfilled Pit Dewatering Plan (BPDP) from approximately June 1999 through April 2001.

Between 2001 and 2011, an amended program for continued surface water and groundwater monitoring under the BPDP was performed, which incorporates some of the monitoring from the BPDP as well as the monitoring for the 1995 NPDES permit. In 2011, groundwater, surface water, and sediment monitoring began in accordance with the *Performance Monitoring Plan for the Phase I RD/RA: Interim Water Management for the Midnite Mine* (PMP; AES, 2011).

Existing surface water and groundwater data obtained from 1998 to 2010 were statistically evaluated in the PMP. The results of the statistical data evaluation were used to define action levels of indicator parameters for comparison of future data. The statistical evaluations (which have been updated to include more recent data), list of indicator parameters, and action levels have been carried forward for use in this SMP and are summarized in Section Q2-3.0 of the QAPP.

Q3.0 SITE-WIDE MONITORING DESIGN OVERVIEW

Site-wide monitoring during the RA construction will be performed to evaluate potential releases of COCs that may occur as a result of the earthmoving activities or temporary storage of mine-affected surface water. Because surface water and groundwater flow are the primary mechanisms for contaminant transport (including sediment deposition), monitoring will be performed where flows converge in the Western, Central, and Eastern drainages down gradient of the RA activities. Additional monitoring will be performed up- and cross-gradient of the consolidated wastes to provide baseline data for evaluating the Selected Remedy performance.

Post-remedy monitoring will be performed to determine if cleanup levels are being achieved within a reasonable timeframe following implementation of the Selected Remedy, and to provide data to support the CERCLA 5-year review process.

Water level monitoring will be performed during and following the RA construction to evaluate the effectiveness of the dewatering components of the Selected Remedy. These include dewatering wells in the Waste Containment Area (i.e., Pit 3, Pit 4, and the Backfilled Pits Area), and the Alluvial Groundwater Controls constructed in the drainages down gradient of the MA. This water level monitoring will initiate when the dewatering systems are constructed and come on-line, and is anticipated to continue as part of the long-term post-remedy monitoring.

Q4.0 MONITORING PROGRAM

Site-wide monitoring will be performed at locations down gradient of the RA activities as depicted in figures included in the FSP. The surface water, groundwater, and sediment sampling locations for the site-wide monitoring program are representative locations for the Potentially Impacted Area (PIA) as delineated in the ROD (EPA, 2006). In addition, the locations are consistent with sampling locations that have been monitored by DMC/Newmont according to previous Bureau of Land Management (BLM) requirements, by the EPA as described in the Midnite Mine Remedial Investigation (RI) Report (EPA, 2005), and according the PMP that preceded this SMP.

Many of the SMP monitoring locations will remain consistent with previously established monitoring locations: 1) for data comparability, 2) because previously established sampling locations are representative of potential releases that could occur as a result of RA activities, and 3) because previously established sampling locations are suitable for monitoring the effectiveness of the Selected Remedy following implementation. Some existing monitoring locations within the footprint of the RA earthwork activities will be eliminated as the RA progresses. For example, toe seeps that discharge from mine waste piles will be eliminated when those mining wastes are excavated. Likewise, monitoring locations may be added prior to initiating the RA or as the phased RA construction progresses. For example, new groundwater monitoring wells will be installed to monitor the effectiveness of the alluvial groundwater collection systems (low-permeability barrier/interception trench) after they are constructed. Therefore, the FSP will be updated, both as the RD and the RA progresses, to add and/or remove representative sampling locations as appropriate.

The site-wide monitoring program includes:

- Surface water sampling in the drainages down gradient to the MA that could be impacted by the RA activities; Blue Creek; existing seeps; and active impoundments and pits (including new surface water impoundments constructed and operated during the RA).
- Sediment sampling in the drainages down gradient of the MA that could be impacted by the RA activities.
- Groundwater monitoring – sampling and water-level monitoring in wells installed in regolith and bedrock in down gradient. Additional groundwater monitoring will be

performed up- and cross-gradient of the consolidated wastes to provide baseline data for evaluating the Selected Remedy performance.

- Air monitoring will be performed in accordance with the AQMP. At the time of publication of the 100% design, the AQMP was under review by EPA and the Tribe. When the AQMP is finalized, it will be added to this SMP as an attachment.
- Continuous-flow and field -parameter monitoring (pH, specific conductance, and temperature) at surface water sites in the Western, Central, and Mine drainages.
- Turbidity monitoring at surface water sites in the Western, Central, and Eastern drainages to comply with the requirements of the Stormwater Management Plan (BODR Appendix O).
- Flow and water-level monitoring of the active water management system.
- Visual inspections of the seep and surface water collection and pump-back stations.
- Precipitation and evaporation data collection.

The parameters to be analyzed under this SMP are listed in Tables Q2-4 and Q2-5 in the QAPP, and consist of the COCs for which cleanup levels were established in the ROD, with the addition of indicator parameters as described in Section Q2-3.0 of the QAPP. The sampling/monitoring activities are discussed in detail in the FSP.

Q4.1 FIELD SAMPLING PLAN

The FSP component of this SMP includes the guidance for all fieldwork by defining the sampling and data-gathering methods to meet the DQOs for monitoring surface water, sediment, and groundwater. This includes:

- Surface water, sediment, and groundwater monitoring networks
- Monitoring schedules, locations, and rationale
- Sample handling and analysis
- Sample collection and documentation
- QA/QC sampling requirements

The FSP will be updated as necessary throughout the RA to meet the overall DQOs. This will include adding or deleting sampling locations, revising sampling frequencies, and keeping the

requirements for monitoring the water collection system current with active impoundments, pits, and pump-back components.

Q4.2 QUALITY ASSURANCE PROJECT PLAN

The QAPP component of this SMP includes the following information to support implementation of the surface water, sediment, and groundwater monitoring programs:

- Data Quality Objectives (DQOs)
- Data quality indicators (precision, accuracy, completeness, representativeness, and comparability)
- Project and laboratory roles and responsibilities
- General requirements for sampling procedures, sample handling, field and laboratory chain-of-custody.
- Task-specific Standard Operating Procedures (SOPs)
- Document and recordkeeping
- Analytical procedures
- Field and laboratory quality control procedures
- Data reduction, validation and reporting
- Performance and system audits
- Data assessment procedures
- Corrective actions

Q4.3 HEALTH AND SAFETY PLAN

The Midnite Mine Superfund Site Remedial Action Health and Safety Plan (HASP) included in Appendix L of the BODR includes the health and safety requirements for site-wide monitoring activities. The Job Safety Analyses (JSAs) specific to the site-wide monitoring activities are included in the FSP.

Q4.4 INSTITUTIONAL CONTROLS IMPLEMENTATION AND ASSURANCE PLAN

The *Midnite Mine Superfund Site Institutional Control Implementation and Assurance Plan* (ICIAP; MWH, 2014) presents the plan to implement, maintain, and monitor institutional controls

(ICs) at the Site. The ICs are intended to protect the integrity of the remedy and to preclude uses of the Site that would result in unacceptable risks from exposure to contaminants in accordance with the ROD. The results of the site-wide monitoring will be used to evaluate the continuing need for the ICs, and to determine if the areas requiring groundwater and surface water ICs should be modified based on the areal extent of groundwater or surface water having constituents that exceed the cleanup levels established in the ROD. These evaluations will be included in the annual data transmittal report described below.

Q4.5 STORMWATER MANAGMENT PLAN

The *Midnite Mine Superfund Site Remedial Action Master Stormwater Management Plan* (MWH, 2015) describes the over-arching framework for how stormwater and surface water will be managed to limit the release of sediment, pollutants, and deleterious debris to downstream areas during and following the RA. The stormwater management approach is to contain and treat all potentially mine-affected stormwater. The only stormwater that will be released to any drainage outside of the MA will be from remediated areas. Therefore, the SWMP (contained in BODR Appendix O) includes inspections and monitoring that is intended to prevent sediment loading from remediated areas to the receiving waters. SWMP monitoring includes pH and turbidity field screening, and is performed daily whenever visual inspections indicate that stormwater is flowing off the remediated areas. The SWMP inspections and monitoring will be performed separately from the inspections and monitoring requirements described in this SMP. The surface water monitoring described in this SMP will complement the SWMP monitoring by providing chemical and radiological data where stormwater from the remediated areas converges in the down gradient drainages.

Q5.0 REPORTING

Monitoring trip reports will be submitted within 30 days following completion of monitoring activities. The SMP monitoring trip summary reports shall describe monitoring activities conducted; descriptions of deviations and rationale for deviations from the QAPP, FSP, and SMP; conditions observed in the field that require maintenance or other action; and a tabulation of field-collected data (such as, discharge measurement, water level readings, field instrument readings).

Once analytical data are available, the monitoring data (laboratory analytical results and any field measurements and notes) will be compiled, validated, and evaluated according to the

QAPP. The QAPP includes the decision logic to be followed in the event action levels are exceeded. A monitoring data report summarizing the quarterly sampling round will be submitted 30 days following receipt of final analytical data from the laboratory. The annual fourth quarter monitoring data report will summarize all of the data collected during the preceding year. One electronic and one hard copy of the report will be submitted to the EPA at the following addresses:

Karen Keeley
EPA Region 10 (ECL – 122)
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

One hard copy of the report will be submitted to the Spokane Tribe of Indians to one of the following addresses:

Regular Mail
Spokane Tribe of Indians
Natural Resources Department
Attn: Randy Connolly, Superfund Coordinator
PO Box 480
Wellpinit, Washington 99040

or

Express Mail
Spokane Tribe of Indians
Natural Resources Department
Attn: Randy Connolly, Superfund Coordinator
6290-B Ford-Wellpinit Road
Wellpinit, Washington 99040

Q6.0 REFERENCES

Advanced Environmental Sciences (AES), 2011. Performance Monitoring Plan for the Phase I RD/RA: Interim Water Management for the Midnite Mine – Revision 3. Prepared for Dawn Mining Company and Newmont USA Limited. July.

Kirschner, F.E., 2014. Email communication to Vance Drain (February 28) and comments received on the Midnite Mine Superfund Site 60% Site Wide Monitoring Plan. March 14.

Miller Geotechnical Consultants (MGC), 2011. Midnite Mine Design Investigation Report – Groundwater Investigations, Revision 2. Prepared on behalf of Newmont USA Limited and Dawn Mining Company for U.S. EPA Region 10. June 9.

MWH Americas, Inc. (MWH), 2014. Midnite Mine Superfund Site Institutional Control Implementation and Assurance Plan, Revision 1. Prepared for Dawn Mining Company, LLC and Newmont USA Limited. February 21.

MWH Americas, Inc. (MWH), 2015. Midnite Mine Superfund Site 100 Percent Design Master Stormwater Management Plan. Prepared for Dawn Mining Company, LLC and Newmont USA Limited. June.

Peters, D.C. 1999. Interpretation of Historical Aerial Photographs (IHAP) of the Midnite Mine. Report #STIBLM-I, Prepared for the Spokane Tribe of Indians. 137 pp.

Shepherd Miller, Inc. (SMI). 1995. Alluvial Aquifer Investigation Plan for the Midnite Mine. 48 p.

Shepherd Miller, Inc. (SMI), 1998. Work Plan for the Midnite Mine. Prepared for Dawn Mining Company. September 28.

URS Corporation, 2002. Phase I Hydrologic Modeling for Midnite Mine RI/FS. Prepared for EPA Region 10. August.

U.S. Department of Interior. 1982. Letter to Dawn Mining Company regarding the mine-drainage monitoring program. May 28.

U.S. Environmental Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Interim Final. EPA/540/G-89/004. October.

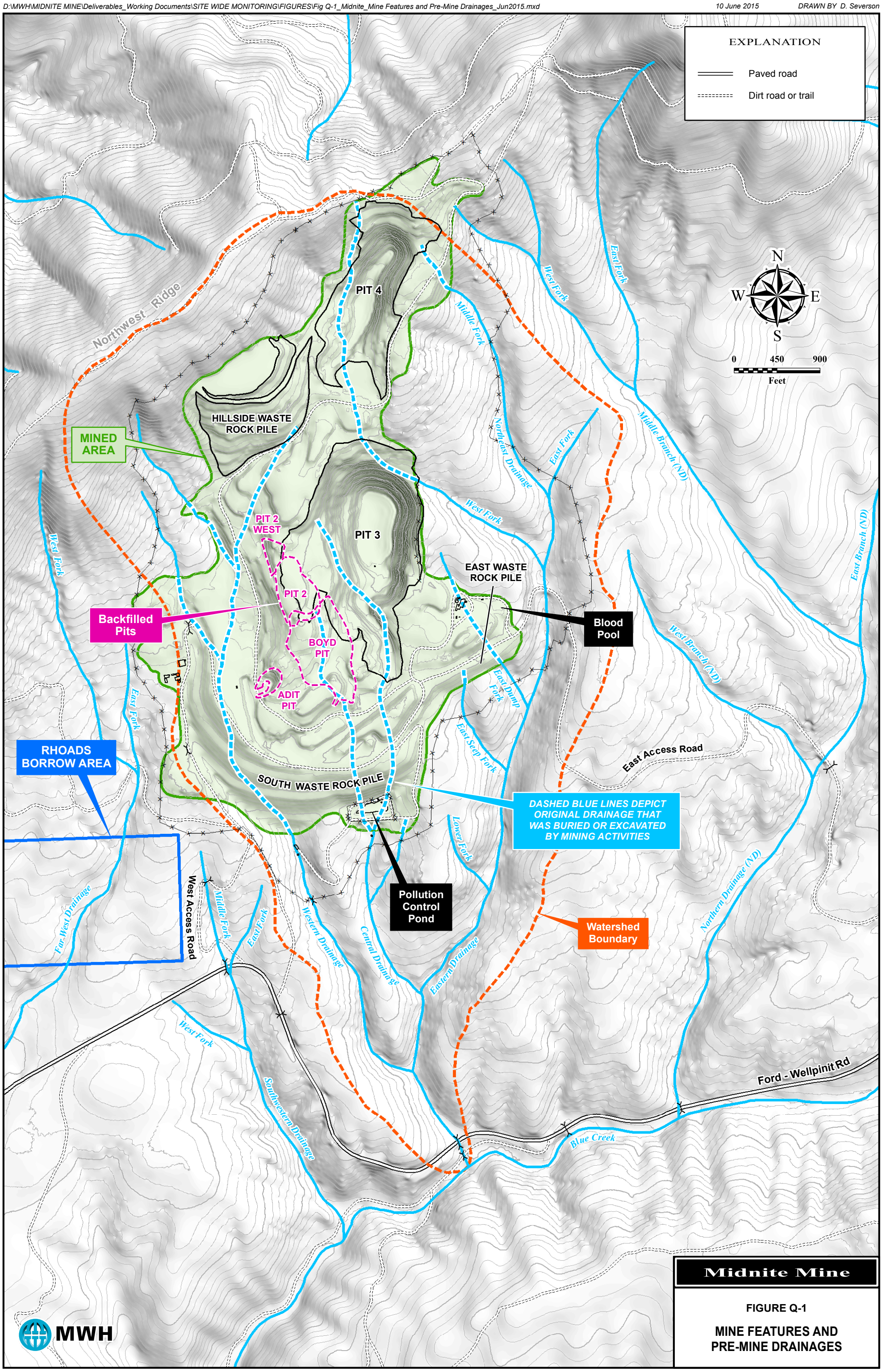
U. S. Environmental Protection Agency (EPA), 2005. Midnite Mine Remedial Investigation Report. Prepared for the U.S. EPA by URS Corporation. September.

U.S. Environmental Protection Agency (EPA), 2006. Midnite Mine Superfund Site, Spokane Indian Reservation, Washington, Record of Decision. Office of Environmental Cleanup. EPA Region 10. September.

U.S. Environmental Protection Agency (EPA), 2011. Statement of Work for the Remedial Design and Remedial Action for the Midnite Mine Superfund Site, Spokane Indian Reservation, Washington. August.

FIGURES

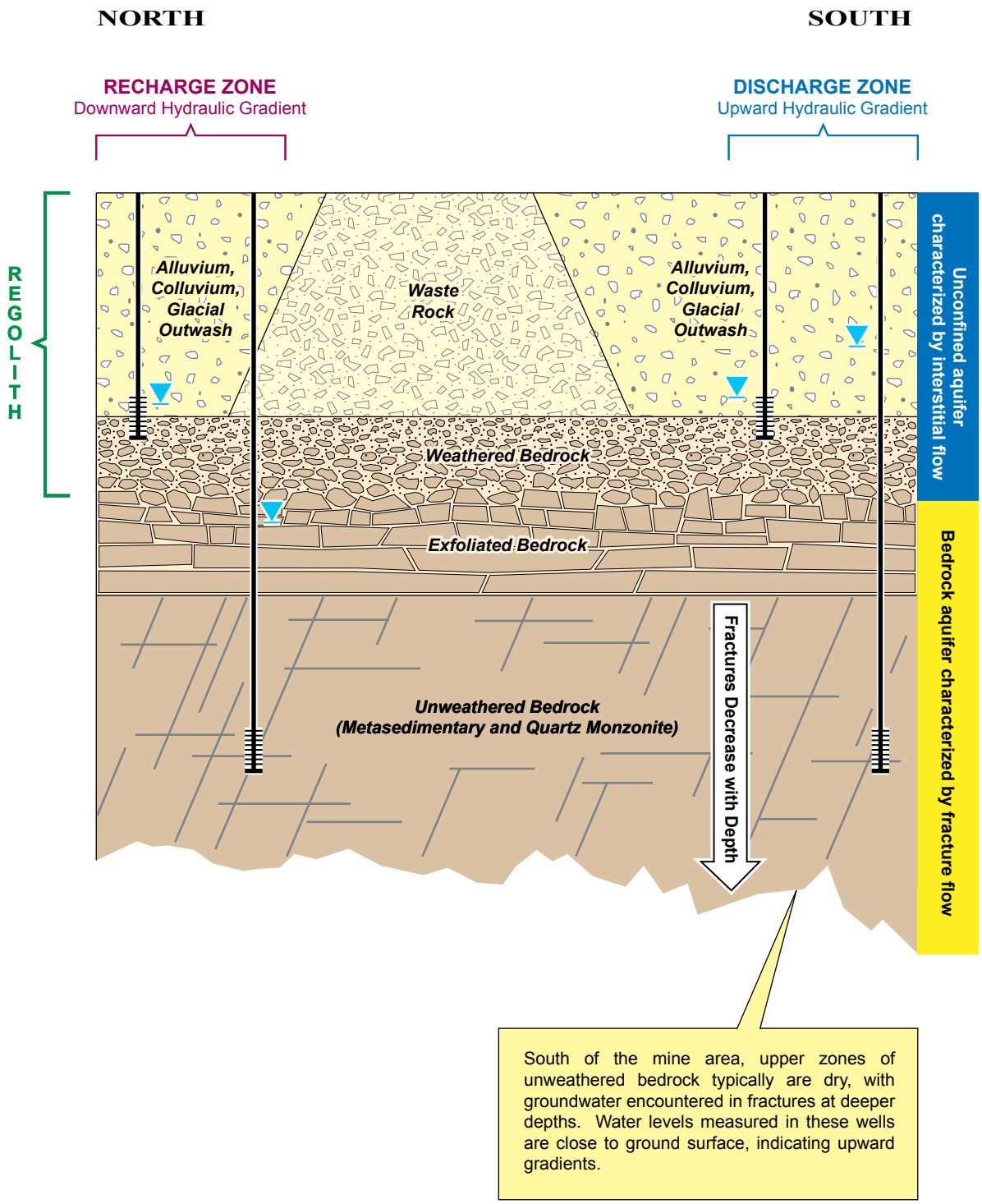
D:\MWH\MIDNITE MINE\Deliverables_Working Documents\SITE WIDE MONITORING\FIGURES\Fig Q-1_Midnite_Mine Features and Pre-Mine Drainages_Jun2015.mxd 10 June 2015 DRAWN BY D. Severson



Midnite Mine

FIGURE Q-1

MINE FEATURES AND PRE-MINE DRAINAGES



South of the mine area, upper zones of unweathered bedrock typically are dry, with groundwater encountered in fractures at deeper depths. Water levels measured in these wells are close to ground surface, indicating upward gradients.

Midnite Mine

FIGURE Q-2

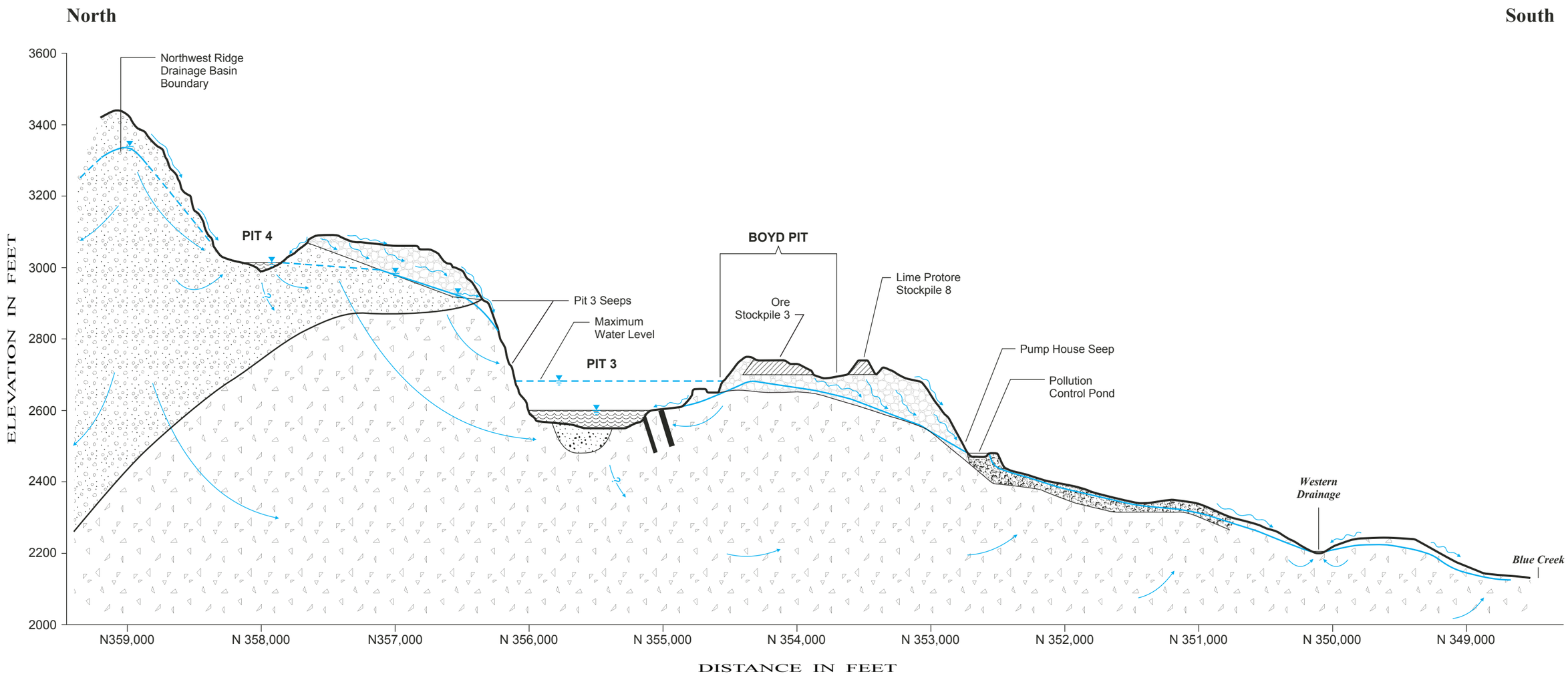
CONCEPTUAL ILLUSTRATION OF PRINCIPAL HYDROGEOLOGIC UNITS

MWH

DRAWN BY D. Severson

8 Jul 2014

Fig Q-2_Midnite Mine_Conceptual Illustration of Principal Hydro Units_MOD4.ai



Note: Subsurface contacts are inferred.

EXPLANATION

- Surface water
- Waste rock
- Stockpile material
- Surficial materials
- Aplite and pegmatite dikes
- Quartz Monzonite
- Togo Formation Calc-silicate
- Togo Formation Phyllite/schist
- Schematic groundwater flow lines
- Schematic interflow and runoff paths
- Groundwater table, dashed where inferred

MWH

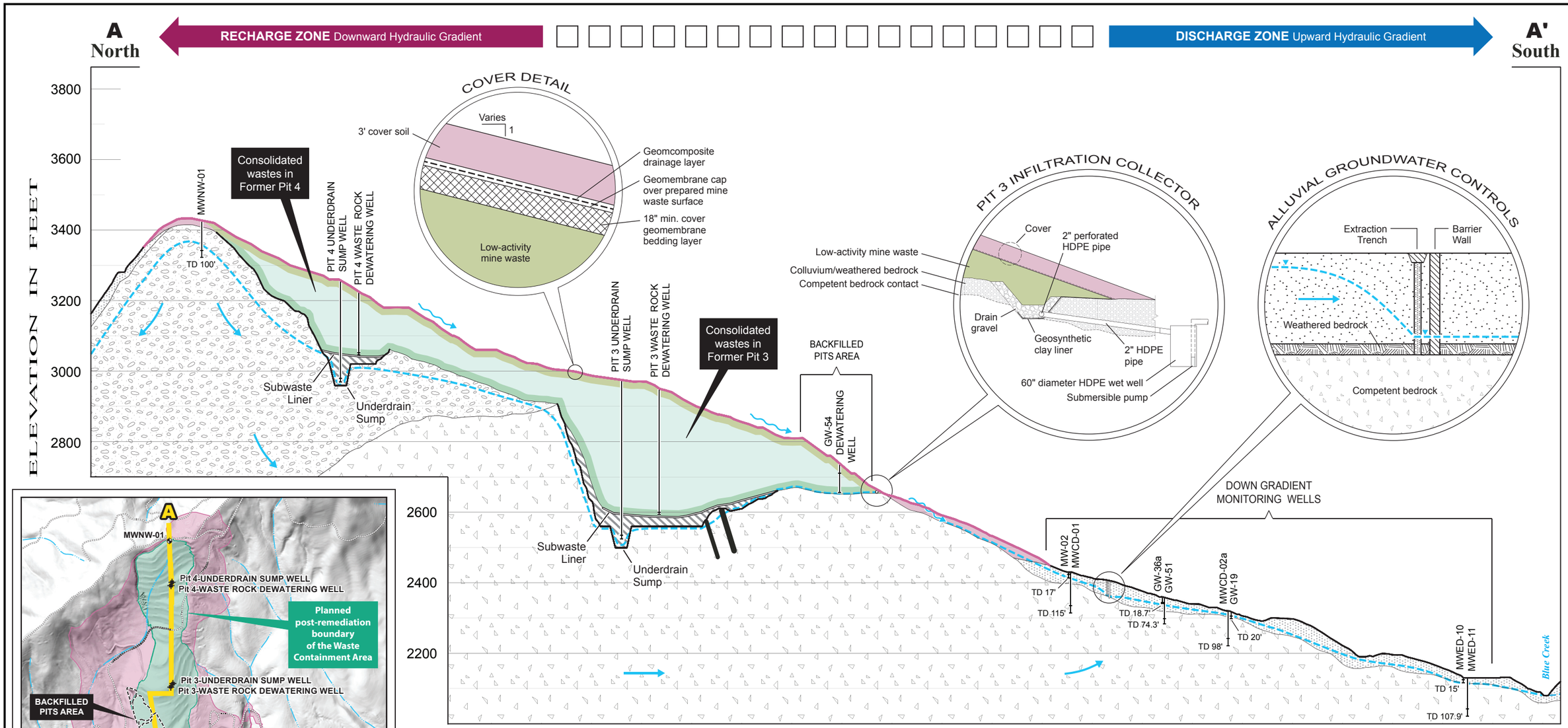
SOURCE: Adapted from Midnite Mine Remedial Investigation Report (EPA, 2005)

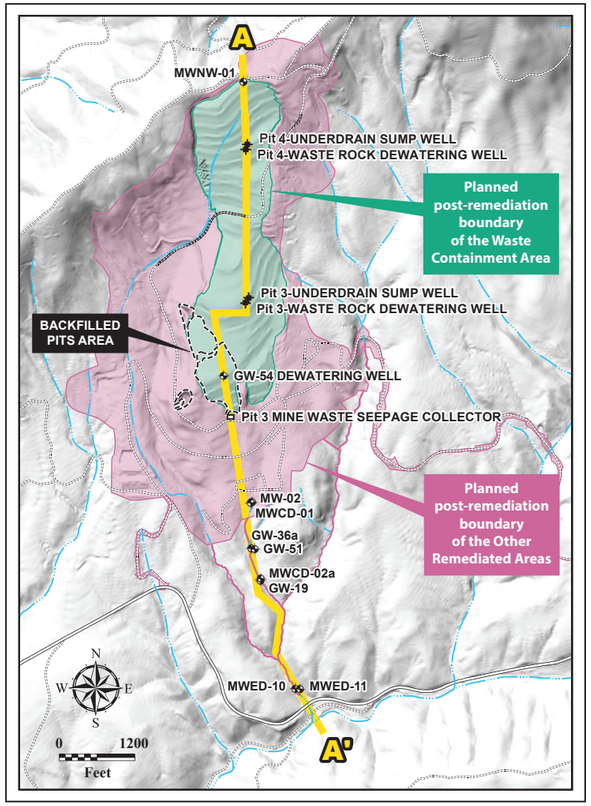
Midnite Mine

FIGURE Q-3

PRE-REMEDY HYDROLOGIC SYSTEM CONCEPTUAL FLOW MODEL

J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\Basis of Design Rpt\FIGURES_100 Percent\FIGURES\Fig Q-3_Pre-Remedy Hydrologic System Conceptual Flow Model_Dec2014.ai 29 Dec 2014 DRAWN BY D. Severnson





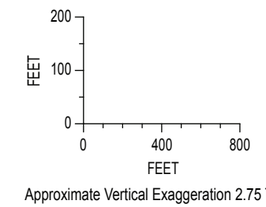
EXPLANATION

- Clean cover soil
- Low-activity mine waste[a]
- Unclassified mine waste
- Low-reactivity mine waste[b]
- Drain rock
- Surficial materials
- Aplite and pegmatite dikes
- Quartz Monzonite
- Togo Formation Calc-silicate
- Togo Formation Phyllite/schist

- Schematic groundwater flow lines
- Schematic interflow and runoff paths
- Approximate potentiometric surface
- Monitoring or dewatering well (hash marks depict screened interval)
- TD Total depth of well

(a) *Low-activity mine waste has lower potential to generate radon.*

(b) *Low-reactivity mine waste has lower potential to generate acid rock drainage (ARD).*



Approximate Vertical Exaggeration 2.75 Times

MWH

Midnite Mine

FIGURE Q-4

POST-REMEDY HYDROLOGIC SYSTEM CONCEPTUAL FLOW MODEL

DRAWN BY D. Severson

5 June 2015

J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\SITE WIDE MONITORING\FIGURES\Fig Q-4_Post-Remedy Hydrologic System Conceptual Flow Model_5Jun2015.ai

Midnite Mine Superfund Site
100 Percent Design

Appendix Q1 – Site-Wide Monitoring Field Sampling Plan

June 2015

Prepared for:

Dawn Mining Company
PO Box 250
Ford, Washington 990413

and

Newmont USA Limited
6363 South Fiddler's Green Circle
Greenwood Village, Colorado 80111

Prepared By:

MWH Americas, Inc.
2890 East Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

TABLE OF CONTENTS

Q1-1.0 INTRODUCTION 1

Q1-2.0 FIELD PROGRAM DURING RA CONSTRUCTION 1

Q1-2.1 MONITORING LOCATIONS, FREQUENCY, AND RATIONALE 2

Q1-2.1.1 Surface Water Monitoring 2

Q1-2.1.2 Sediment Monitoring 3

Q1-2.1.3 Groundwater Monitoring 4

Q1-2.1.4 Continuous Surface Water Flow and Quality Measurements 6

Q1-2.1.5 Surface Water Level and Flow Monitoring of Water Management System 6

Q1-2.1.6 Precipitation and Evaporation Data 6

Q1-2.1.7 Inspections to Identify New Monitoring Locations 7

Q1-2.1.8 Inspections of the Water Management System 7

Q1-2.2 WATER AND SEDIMENT SAMPLING PROCEDURES 7

Q1-2.2.1 Standard Operating Procedures 7

Q1-2.2.2 Sample Handling and Analysis 8

Q1-2.2.3 Sample Collection and Documentation 8

Q1-2.2.4 Quality Assurance/Quality Control Samples 9

Q1-2.3 FLOW AND WATER LEVEL MEASUREMENTS 9

Q1-2.3.1 Continuous Stream Flow and Field Parameter Measurement 9

Q1-2.3.2 Flow Monitoring of Water Management System 10

Q1-2.3.3 Water Level Measurements 11

Q1-2.3.4 Precipitation and Evaporation Data 11

Q1-3.0 ANTICIPATED POST-REMEDY MONITORING NETWORK 12

Q1-4.0 QUALITY ASSURANCE PROJECT PLAN (QAPP) 12

Q1-5.0 HEALTH AND SAFETY 13

Q1-6.0 REFERENCES 13

LIST OF TABLES

Table Q1-1 Surface Water Monitoring Schedule During Remedial Action

Table Q1-2 Sediment Monitoring Schedule During Remedial Action

Table Q1-3 Groundwater Monitoring Schedule During Remedial Action

Table Q1-4 Monitoring Well Summary

LIST OF FIGURES

Figure Q1-1 Surface Water and Sediment Monitoring Network during RA Construction

Figure Q1-2 Pre-RA Well Locations and Planned Remediated Areas

Figure Q1-3 Groundwater Monitoring Network during RA Construction and Extent of Mine Affected Regolith Groundwater

Figure Q1-4 Groundwater Monitoring Network during RA Construction and Extent of Mine Affected Bedrock Groundwater

Figure Q1-5 Dewatering and Observation Well Monitoring Network in the Remediated Mine Area

Figure Q1-6 Anticipated Post-Remedy Monitoring Network

LIST OF ATTACHMENTS

Attachment Q1-A Well Completion Diagrams and Lithology Logs

Attachment Q1-B Job Safety Analyses

LIST OF ACRONYMS

AQMP	Air Quality Monitoring Plan
BLM	U.S. Department of the Interior, Bureau of Land Management
BODR	Basis of Design Report
BPA	Backfilled Pit Area
COC	Contaminant of Concern
DMC	Dawn Mining Company, LLC
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
EWRP	East Waste Rock Pile
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
JSA	Job Safety Analysis
MA	Mined Area
mHz	megahertz
Newmont	Newmont USA Limited
NELAP	National Environmental Laboratory Accreditation Program
OM&M	Operations, Maintenance and Monitoring
PCP	Pollution Control Pond
PMP	Performance Monitoring Plan
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAWS	Remote Access Weather Station
RF	radio frequency
RI	Remedial Investigation
ROD	Record of Decision
Site	Midnite Mine Superfund Site
SMP	Site-wide Monitoring Plan
SOP	Standard Operating Procedure
SWRP	South Waste Rock Pile
Tribe	Spokane Tribe of Indians

WCA	Waste Containment Area
WTP	Water Treatment Plant

Q1-1.0 INTRODUCTION

This Field Sampling Plan (FSP) presents the field-specific procedures for monitoring surface water, sediment, and groundwater during and following the remedial action (RA) at the Midnite Mine Superfund Site (Site) located in Wellpinit, Washington. This FSP is a supporting document to the *Midnite Mine Remedial Action Site-Wide Monitoring Plan* (SMP), which presents the overall goals and procedures for site-wide monitoring. In addition to this FSP, the SMP also includes a Quality Assurance Project plan (QAPP) that provides the protocols to be followed during implementation of the SMP to assure that the resulting data are of sufficient quality to support the data end uses. The SMP, QAPP, and this FSP are components of the *Midnite Mine Superfund Site Basis of Design Report* (BODR), which presents the background and supporting information relevant to the Site and the planned RAs. The BODR also contains the engineering drawings, plans, and specifications for the RA.

As described in SMP Section Q1.4, this FSP will be revised or amended as necessary during and after the RA to meet the site-wide monitoring Data Quality Objectives (DQOs). This is necessary because monitoring locations will be added and deleted as the configuration of the Site changes during the phased RA construction activities. Anticipated revisions or amendments include updating the monitoring locations and frequencies, and adding or refining monitoring procedures as necessary. Discussion of site-wide monitoring objectives is included in Section Q1.0 of the SMP (overall objectives) and in Section Q2-3.0 of the QAPP (detailed DQOs). This plan does not include monitoring or sampling information for the Water Treatment Plant (WTP) influent and effluent. That information is included in the Operation, Maintenance, and Monitoring (OM&M) Plan (located in Appendix P of the BODR).

Air Monitoring. Details of the environmental air monitoring plan are being developed, and an Air Quality Monitoring Plan (AQMP) has been submitted for Tribe and EPA review. When finalized, the AQMP will be included as an attachment to the SMP.

Q1-2.0 FIELD PROGRAM DURING RA CONSTRUCTION

This section describes the surface water, sediment, and groundwater monitoring programs that will be initiated at the start of the RA construction activities. These monitoring programs will be updated as necessary throughout the phased RA as described in SMP Section Q1.3 to accommodate the changing site configurations and evolving DQOs as the construction project

progresses. The anticipated post-remedy monitoring network is described below in Section Q1-3.0.

Q1-2.1 MONITORING LOCATIONS, FREQUENCY, AND RATIONALE

The following monitoring locations, frequency and rationale were developed to satisfy the DQOs summarized in the tables contained in QAPP Attachment Q2-A.

Q1-2.1.1 Surface Water Monitoring

Surface water monitoring will be performed at the locations listed in Table Q1-1 and as shown on Figure Q1-1. Figure Q1-1 also shows the areas of mine affected surface water as identified during the Remedial Investigation (RI) in order to show where the sampling locations in the monitoring network are located in relation to the known areas of mine affected surface water at the start of the RA.

The site-wide surface water monitoring network was established by including the locations monitored prior to initiating the RA as part of the *Performance Monitoring Plan for the Phase I RD/RA: Interim Water Management for the Midnite Mine* (PMP; AES, 2011). The PMP surface water sampling locations were retained for data comparability and because many are located in the primary drainages down gradient of the MA where the RA construction activities will occur (i.e., the Western, Central, and Eastern drainages). These are the drainages most likely to see potential impacts from the RA construction activities. The PMP sampling locations in Blue Creek were retained both up- and down-gradient of where the main mine drainage enters Blue Creek. A new surface water monitoring location (BC-OY) was added below the confluence of Blue and Oyachen creeks to evaluate potential contaminant contributions to Blue Creek from Oyachen Creek. Data from this new sampling location will support evaluation of groundwater data collected from the new monitoring wells installed in the glacial deposits in this area (discussed below in Section Q1-2.1.3).

Other surface water monitoring locations consist of seep locations, the Pollution Control Pond (PCP), and Pits 3 and 4. These locations will be sampled until they are removed or altered by the RAs. For example, surface water sampling in Pits 3 and 4 will continue until the pits are dewatered and backfilling activities begin. Likewise, removal of above-ground mining wastes will likely eliminate several of the seeps at the toe of the waste rock piles. New seep sampling locations will be established if seeps develop after the wastes are removed, and new surface

water sampling locations will be added as new surface water impoundments are built and become operational.

Surface water sampling will be conducted quarterly during the months of January, April, July, and October to evaluate potential seasonal variation which might affect constituent concentrations. To the extent possible, the April sampling event (second quarter) will be scheduled to coincide with peak runoff, and the October sampling event (fourth quarter) will be scheduled to coincide with the first major stormwater runoff event of the fall season. In addition to the quarterly sampling, continuous measurement of indicator water-quality parameters (pH, conductivity, and temperature) will be performed at the four surface water monitoring locations in the Western, Central, Eastern, and Mine drainages (WDAC, SW 12, SW-11, and SW-6).

Throughout the RA construction activities, visual inspections will be made to evaluate the appropriateness of the surface water monitoring program as described below in Section Q1-2.1.7. The objectives of the visual inspections are to identify locations that potentially should be added to the sampling schedule, or to identify unexpected flows that occur between the quarterly sampling events that potentially should be sampled to meet the DQOs. The surface water sampling component of this FSP will remain flexible so that sample locations can be added and/or sampling frequency can be adjusted (increased/decreased) to evaluate if COCs are being released as a result of the RA.

Q1-2.1.2 Sediment Monitoring

Annual sediment sampling will be performed at the locations listed in Table Q1-2 and as shown on Figure Q1-1. Figure Q1-1 also shows the areas of mine affected sediment as identified during the RI in order to show where the sampling locations in the monitoring network are located in relation to the known areas of mine affected sediment at the start of the RA.

The site-wide sediment monitoring network was established by including the locations monitored as part of the PMP prior to initiating the RA. The PMP sediment sampling locations were retained for data comparability and because they are located in the primary drainages down gradient of the MA where the RA construction activities will occur (i.e., the Western, Central, and Eastern drainages). These are the drainages most likely to see potential impacts from the RA construction activities.

Q1-2.1.3 Groundwater Monitoring

Groundwater monitoring will be performed at the locations listed in Table Q1-3 and as shown on the following figures:

- **Figure Q1-2** shows the locations of all existing monitoring wells at the Site prior to the start of the RA. The wells depicted with orange symbols on this and all figures in this FSP are screened in the shallower regolith, and the wells with black symbols are screened in the deeper unweathered bedrock (see SMP Section Q2.1.2 for a discussion of the hydrogeologic units). The figure also shows the planned boundaries of the Waste Containment Area (WCA; which is the area of the engineered cover that will be constructed over the consolidated wastes), and the Other Remediated Areas (which are the areas where mine wastes or mine-affected sediments will be removed). The purpose of this figure is to show how existing Site monitoring wells were selected for inclusion in the site-wide monitoring network based on their location and completed depths (additional discussion is presented below). The wells shown on Figure Q1-2 with yellow halos will be retained in the site-wide monitoring network and the remaining wells will be properly abandoned during the RA.
- **Figures Q1-3 and Q1-4** show the wells that are included in the groundwater monitoring network at the start of the RA (note that the same monitoring network is depicted on both figures). The difference between the two figures is that Figure Q1-3 shows the groundwater monitoring network in relation to the known extent of shallow (regolith) mine-affected groundwater and Figure Q1-4 shows the groundwater monitoring network in relation to the known extent of deep (bedrock) mine-affected groundwater.
- **Figure Q1-5** shows the wells that will be used to provide data to evaluate the dewatering activities performed within the former MA as part of the Selected Remedy in Pits 3 and 4 and in the Backfilled Pits Area (BPA). The figure shows a combination of wells that currently exist (e.g., wells in the BPA and surrounding Pit 3 and Pit 4) and the planned dewatering wells that will be installed as Pit 3 and Pit 4 are backfilled. Figure Q1-5 also shows the anticipated extent and topography of the WCA and the Other Remediated Areas.

The site-wide groundwater monitoring network was established by reviewing the locations and screened intervals of all site monitoring wells that existed at the start of the RA (see Figure Q1-

2), and including in the network the wells that satisfy the site-wide monitoring objectives (see SMP Section Q1.1). The anticipated extents of the WCA and the Other Remediated Areas shown on Figure Q1-2 were used to identify wells that need to be removed to accommodate excavation and consolidation of the mine wastes, and therefore are not suitable for inclusion in the monitoring network. Additional considerations for developing the groundwater monitoring network included the following:

- Wells screened in regolith and wells screened in bedrock are included in the network in order to monitor the two principal hydrogeologic units at the Site (see SMP Section Q2.1.2 for a discussion of the hydrogeologic units). As depicted on Figures Q1-3 and Q1-4, the known extent of mine-affected groundwater in the regolith (referred to as alluvium in the RI report maps) differs from the known extent of mine-affected groundwater in the bedrock. Wells included in the monitoring network are located inside and outside the known extents of mine affected groundwater. Co-located well pairs are included in order to monitor hydraulic gradients between the regolith and bedrock.
- Wells located within the RA earthworks footprint generally were not included because the majority of these wells need to be decommissioned to allow removal of the mine wastes (see Figure Q1-2). Wells generally will not be retained within the WCA to protect the integrity of the waste containment liner and cover systems. However, some wells within the WCA and Other Remediated Areas footprint will be retained to provide data to evaluate the effectiveness of the dewatering activities in Pits 3 and 4 and in the BPA. Figure Q1-5 depicts the wells that will be used to provide data to evaluate the dewatering activities.
- Wells will be included (or new wells installed) to evaluate the effectiveness of the Alluvial Groundwater Controls installed in the Western, Central, and Far East Seep drainages down gradient of the MA (see Figures Q1-3 and Q1-4).
- Wells that that were monitored as part of the PMP prior to initiating the RA were included 1) for data comparability, 2) because previously established sampling locations are representative of potential releases that could occur as a result of RA activities, and 3) because previously established sampling locations are suitable for monitoring the effectiveness of the Selected Remedy following implementation. These wells are located in the Western, Central, and Eastern drainages where groundwater discharging from the MA converges. As a result, these wells are most likely to detect potential

impacts resulting from the RA construction activities, and are most likely to be the key post-remedy monitoring locations for evaluating cleanup levels in groundwater.

- The new wells installed during 2014 in the glacial deposits down gradient of the confluence of Oyachen and Blue creeks are included to evaluate groundwater conditions where Blue Creek becomes a losing stream (see Figure Q1-3).

Because a smaller degree of seasonal variation is expected in groundwater (as compared with surface water), groundwater sampling will be performed semi-annually during the spring and fall, with continuous, monthly, or semi-annual water-level monitoring depending on the DQOs for each well. Wells located near the Alluvial Groundwater Controls will be sampled quarterly to evaluate the performance of the groundwater controls. These wells may be sampled at a reduced frequency (e.g., semi-annually) after it is determined that the Alluvial Groundwater Controls are functioning as designed. The groundwater monitoring locations, frequencies, and rationale are summarized in Table Q1-3.

Q1-2.1.4 Continuous Surface Water Flow and Quality Measurements

Continuous measurement of the flow rate and field water quality parameters (pH, conductivity, and temperature) will be performed at the four surface water monitoring locations (WDAC, SW-12, SW-11, and SW-6) in the Western, Central, Eastern, and Mine drainages. This will allow for continuation of the existing data for evaluating the impacts of the RA.

Q1-2.1.5 Surface Water Level and Flow Monitoring of Water Management System

Flow monitoring of the operating water management system (e.g., PCP pond water) will be performed as summarized in Table Q1-1 support operation and maintenance of the WTP. These activities will be altered (and this FSP updated) as the RA progresses and impoundments/pits are taken off line and new impoundments are built.

Q1-2.1.6 Precipitation and Evaporation Data

Precipitation and other meteorological data are recorded by the BLM Remote Access Weather Station (RAWS) at the Midnite Mine. Daily precipitation data will be obtained from the RAWS. Daily evaporation data will be recorded during non-freezing conditions using a Class A evaporation pan installed at the site. The precipitation and evaporation data will be used to support water balance calculations.

Q1-2.1.7 Inspections to Identify New Monitoring Locations

Visual inspections will be performed weekly in remediated areas to identify new seeps that may have formed in areas that were reworked by earthmoving activities. The seep inspections will be performed by walking along the topographic contour of the downhill slopes near the contact of the remediated area with the adjacent undisturbed area. Wet areas or areas of flowing water will be documented on field forms, surveyed using a Global Positioning System (GPS) instrument, and photographed. The person performing the inspection will notify the Construction Manager immediately of wet areas or flowing water so that provisions can be made to capture and treat the water until contaminant concentrations are verified by sampling. Areas that have measureable flow will be added to the overall monitoring program as new seep locations. Areas that do not have flowing water, but are persistently wet (i.e., continuously wet for two weeks) will be added to the monitoring program at the discretion of the Supervising Contractor.

Q1-2.1.8 Inspections of the Water Management System

Visual inspections of the active seep and surface water collection systems, pump-back stations, and transfer pipelines will be conducted daily during RA construction when conditions allow safe access. The visual inspections will confirm the normal operation of collection and pumping systems, and identify any maintenance required to ensure the existing water management system is effectively intercepting and containing mine-affected surface water as designed.

Q1-2.2 WATER AND SEDIMENT SAMPLING PROCEDURES

Q1-2.2.1 Standard Operating Procedures

Field sampling methods, equipment utilized, and decontamination procedures are documented in the Site-Wide Monitoring Standard Operating Procedures (SMP-SOPs) included in the QAPP. The following SMP-SOPs apply:

- SMP-SOP1 – Groundwater Sampling
- SMP-SOP2 – Surface Water Sampling
- SMP-SOP3 – Sediment Sampling
- SMP-SOP4 – Groundwater Level Measurement
- SMP-SOP5 – Decontamination of Environmental Sampling Equipment

The sampling procedures provided in these documents are designed to provide the type and quality of data consistent with the objectives of this project.

Q1-2.2.2 Sample Handling and Analysis

The sediment and water samples will be analyzed for the parameters listed in QAPP Tables Q2-4 and Q2-5, respectively. Laboratory test methods and detection limits are provided in the QAPP. The laboratory designated for the project analytical chemistry is to be determined, and will be accredited under the National Environmental Laboratory Accreditation Program (NELAP).

QAPP Tables Q2-2 and Q2-3 provide volume, container-type, preservation and holding time requirements for each sample type and analytical method. Additional information on sample containers, preservation and holding times is provided in the QAPP.

The samples will be hand-delivered or shipped to the analytical laboratory under chain-of-custody procedures as outlined in the QAPP.

Quality assurance/quality control procedures will be consistent with generally accepted practices as presented in the QAPP.

Q1-2.2.3 Sample Collection and Documentation

Samples will be collected according to the SMP-SOPs listed above in Section Q1-2.2.1. Photographs will be taken if the sampling location changes significantly from the previous location or sampling issues occur that cannot be adequately described in writing in the sample collection notes.

Sample labels are completed with an indelible, waterproof marker. The sample numbering and nomenclature system is based on the sample location, media type, and sample type (primary, duplicate or blank). Details on sample labeling are provided in the QAPP. After the label is completed and attached to the sample container, clear plastic tape is placed over the label to protect and secure it to the container. Labels are attached and taped before filling the sample bottles, if possible. The above information may be written directly on the bottle if labels are not available.

Rinse water from decontamination will be discharged to the ground surface. Purge water from wells will also be discharged to the ground surface. Other waste resulting from non-dedicated sampling equipment (i.e. used filters, latex or nitrile gloves, tubing, bailers, etc.) will be disposed of as non-hazardous waste after sampling.

Q1-2.2.4 Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be collected during sampling as described in the QAPP.

Q1-2.3 FLOW AND WATER LEVEL MEASUREMENTS

Q1-2.3.1 Continuous Stream Flow and Field Parameter Measurement

Continuous measurement of the flow rate and field water quality parameters (pH, conductivity, and temperature) is performed at the following four surface water monitoring locations: WDAC, SW-12, SW-11, and SW-6. The following instrumentation is installed at these locations:

- SW-12 – 90-deg. V-notch weir plate, pressure transducer; conductivity/temperature and pH probes; recording data logger; 900 MHz RF telemetry; sealed battery and solar panel.
- SW-11 – 6-inch Parshall flume; transducer; conductivity/temperature and pH probes; recording data logger; 900 MHz RF telemetry; sealed battery and solar panel.
- WDAC – 90-deg. V-notch weir plate; pressure transducer; conductivity/temperature and pH probes; recording data logger; 900 MHz RF telemetry; sealed battery and solar panel.
- SW-6 - 9-inch Parshall flume; transducer; conductivity/temperature and pH probes; recording data logger; 900 MHz RF telemetry; sealed battery and solar panel.

The flow rate will be determined from the stage recorded by the pressure transducer and the defined stage-discharge relationship for the flow measurement device. The flow measurement devices were sized based on historic flow measurements. In addition to the SW-6 continuous flow measurement and field data equipment installations, SW-6 is configured with cellular reporting capability which data can be accessed and downloaded from a remote webpage application.

Manufacturer's recommendations and instructions will be followed for instrument testing and calibration of the electronic pH, conductivity, and temperature sensors. Conductivity data will be automatically corrected to 25-degrees Celsius and recorded by the data logger. The pH and conductivity probes will be calibrated prior to installation and on a regular calibration schedule using standard buffer solutions to determine accuracy. The flow monitoring stations will be audited quarterly during surface sampling events for maintenance, testing, and calibration of the sensors. Probe accuracy will be compared against portable field instruments that are also calibrated using standard buffer solutions. If the remote sensors are out of calibration, the

probes will be cleaned and recalibrated against standard buffer solutions. Probe scaling factors will be adjusted as necessary to maintain calibration. All calibration readings will be recorded on field forms. The operation of the instrumentation will be verified and maintenance will be routinely performed (e.g., cleaning of the pH and conductivity probes), and the continuously recorded data will be downloaded quarterly. Probes and meters will be serviced as needed following manufacturers' recommendations and instrument replacement will be performed as necessary. The pH, conductivity, and temperature probes will be removed from the stations during prolonged periods of no flow or freezing conditions that will damage the probes or result in erroneous measurements.

Q1-2.3.2 Flow Monitoring of Water Management System

Flow monitoring of the active seeps and pump-back systems will be performed. Flow measurements will be performed daily during the work week during the high flow period and weekly during the low flow period when conditions allow safe and accurate measurements at the seep locations identified in Table Q1-1. These locations and frequencies will be updated as seeps are removed and impoundments/pits are added or taken off line during the RA.

Totalizing flow meters currently exist on the following water transfer pipelines:

- Three transfer pipelines from the Western Drainage Pump-back Station to the PCP
- Transfer pipeline from the Blood Pool Pump-back Station to Pit 3
- Two transfer pipelines from the PCP to Pit 3
- Transfer pipelines from the Western Drainage, Blood Pool, and PCP pump-back stations.

Flow meters are not installed on the pipelines from the East Seep and the Restroom (Dam Toe Seep) pump-back stations, since the flows from the East and Dam Toe seeps are negligible compared to the other seeps and do not vary appreciably in response to spring runoff and precipitation events. In addition, flow meters are not installed on the pipelines from the Far East Seep Pump-back Station, since the collected water is pumped to the Blood Pool Pump-back Station during high seep flow and the duration of flow at the Far East Seep is minimal.

The components of the existing pump-back stations, including the transfer pipelines are described in the OM&M Plan. Each meter will be calibrated according to manufacturer's specifications and compared with calculated pumping rates on a quarterly basis to verify meter

calibration. The meters will be recorded weekly during pumping to provide the cumulative water volumes pumped.

During operation of the WTP, the daily water volume pumped from Pit 3 and Pit 4 to the WTP and the daily effluent volume from the WTP will be recorded using existing flow meters, when the WTP is operational. The meters will be calibrated according to manufacturer's specifications and compared with calculated pumping rates on a quarterly basis to verify meter calibration.

Q1-2.3.3 Water Level Measurements

The pit-lake water-level measurement discussion below will be updated as necessary during the RA to keep current with the active water management system during the RA. For example, water level monitoring in Pits 3 and 4 will cease once backfilling in these pit begin; water level monitoring will begin in new surface water impoundments that discharge to the WTP once they are built and operational.

Water levels in Pit 3, Pit 4, the PCP, and the pumping wells in the BPA will be recorded daily during WTP operation and weekly thereafter during non-freezing conditions and when conditions allow safe access and accurate measurements. The water levels in Pit 3 and Pit 4 will be recorded from a staff gauge installed in each pit. The staff gauges will be re-established, as necessary, as the pit water level changes and will be surveyed to a local datum to provide continuity in the pit water elevations consistent with current DMC/Newmont practices. Water levels in the pumping wells in Pit 3 and Pit 4 will be recorded daily once these wells are installed and become operational. The water level in the PCP will be measured relative to the pumphouse steps according to current DMC/Newmont practices.

Water levels will be measured at the frequencies summarized in Table Q1-3. Water-level measurement methods, equipment utilized, and decontamination procedures are documented in SMP-SOP4 and SMP-SOP5, respectively.

Q1-2.3.4 Precipitation and Evaporation Data

Precipitation data will be obtained from the existing RAWS. In the event that precipitation monitoring at the RAWS is discontinued, a tipping bucket rain gauge and a data logger will be installed to record 15-minute precipitation values at an accuracy of 0.01-inch depth. Daily precipitation will be logged and calculated. Evaporation data will be recorded during non-

freezing conditions using a Class A evaporation pan installed at the site consisting of the following:

- Evap-1 – Class A evaporation pan; water level gauge; 250-gallon water supply tank with automated refill valve; recording data logger; 900 MHz RF telemetry and cellular modem; sealed battery and solar panel.

Daily measurements of the pan water depth and minimum and maximum water temperature will be recorded daily. Water will be added or removed from the pan as necessary. Precipitation will be subtracted from the pan measurements to determine net evaporation.

Q1-3.0 ANTICIPATED POST-REMEDY MONITORING NETWORK

The anticipated post-remedy monitoring network is shown on Figure Q1-6. This post-remedy monitoring network is based on the planned final configurations of the waste containment areas and other remediated areas included in the BODR, the conceptual site model (e.g., groundwater converges on the primary drainages in the watershed that contains the mined area), and the anticipated impacts that the RA will have on the nature and extent and fate and transport of the Site COCs (see SMP Section Q2.0). The actual post-remedy monitoring network is likely to change based on the results of the site-wide monitoring that is conducted over the scheduled 10-year duration of the RA. For example, the post-remedy groundwater monitoring network may need to be revised (expanded or reduced) to sufficiently monitor the actual extent of groundwater that exceeds the cleanup levels established in the ROD. Another example is that as the primary mine drainages are remediated, surface water flow and sediment accumulation patterns may be different, and therefore, post-remediation surface water and/or sediment sampling locations may need to be modified. These changes will be presented in subsequent revisions to this SMP/FSP/QAPP as the RA progresses, and all changes to the monitoring network both during and following implementation of the Selected Remedy will require approval by EPA.

Q1-4.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

The QAPP is required reading for all staff participating in the FSP-related tasks. The QAPP will be in the possession of the field team during sample collection and in possession of the laboratory providing analytical services. All field, office, and analytical laboratory personnel working on this project will be required to comply with the procedures documented in the QAPP to maintain comparability and representativeness of the resulting data.

The QAPP includes the following information:

- Project organization and responsibilities
- Data quality objectives and criteria
- Sampling process design, documents and records
- Calibration procedures
- Analytical procedures
- Quality control
- Data reduction, validation, and reporting
- Performance systems and audits
- Preventative maintenance of field equipment
- Specific routine procedures to assess data
- Corrective actions
- Quality assurance reporting

Q1-5.0 HEALTH AND SAFETY

All site-wide monitoring activities will be performed in accordance with the Midnite Mine Superfund Site Remedial Action Health and Safety Plan (HASP) included in Appendix L of the BODR. The Job Safety Analyses (JSAs) specific to the site-wide monitoring activities are included in Attachment Q1-B.

Q1-6.0 REFERENCES

Advanced Environmental Sciences, Inc. (AES), 2011. Performance Monitoring Plan for the Phase I RD/RA: Interim Water Management for the Midnite Mine, Revision 3. Prepared for Dawn Mining Company and Newmont USA Limited. July 20.

TABLES

Table Q1-1 –Surface Water Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency[1]	Flow Rate or Level			Location and Rationale
		Continuous	Quarterly	Daily or Weekly	
SW-2[2]	Quarterly		X		Located in Eastern Drainage and within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-4	Quarterly		X		Located in Blue Creek just upstream of where the mine drainage discharges to Blue Creek, and is outside the area of mine affected surface water as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program. Location will be monitored during the RA construction to provide up gradient data in Blue Creek, and is a candidate location for long-term post remedy monitoring.
SW-4U	Quarterly		X		Located in Blue Creek upstream of where the mine drainage discharges to Blue Creek, and is outside the area of mine affected surface water as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program. Location will be monitored during the RA construction to provide up gradient data in Blue Creek, and is a candidate location for long-term post remedy monitoring.
SW-5[2]	Quarterly		X		Located in Blue Creek approximately ¼ mile downstream of where the mine drainage discharges to Blue Creek, and is within the area of mine affected surface water as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-6[2]	Quarterly	X[3]			Located in the Mine Drainage just above where it discharges to Blue Creek, and is within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-7[2]	Quarterly		X		Located in Blue Creek approximately 1 mile downstream of where the mine drainage discharges to Blue Creek, and is within the area of mine affected surface water as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.

Table Q1-1 –Surface Water Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency[1]	Flow Rate or Level			Location and Rationale
		Continuous	Quarterly	Daily or Weekly	
SW-10	Quarterly			X[4]	Western Drainage Seep located where the buried Western Drainage emerges at the toe of the South Waste Rock Pile (SWRP). This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the water treatment plant (WTP). Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.
SW-11[2]	Quarterly	X[3]			Located in the Eastern Drainage at its confluence with the Central Drainage, and within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-12[2]	Quarterly	X[3]			Seep located in lower reach of the Central Drainage and within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-15	Quarterly		X		PCP Dam Toe Seep (also known as the Central Drainage Seep) located at the toe of the Pollution Control Pond (PCP) dam. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the PCP is removed.
SW-20	Quarterly			X[4]	Pollution Control Pond water. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Location will continue to be monitored during the RA construction until the PCP is removed.
SW-39	Quarterly			X[4]	Pit 3 water. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Location will continue to be monitored during the RA construction until the Pit 3 is no longer used to store water.

Table Q1-1 –Surface Water Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency[1]	Flow Rate or Level			Location and Rationale
		Continuous	Quarterly	Daily or Weekly	
SW-40	Quarterly			X[4]	Pit 4 water. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Location will continue to be monitored during the RA construction until the Pit 4 is no longer used to store water.
WDAC[2]	Quarterly	X[3]			Located in the Western Drainage and within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
WDJ	Quarterly			X[4]	Western Drainage Junior Seep located where the buried Western Drainage emerges at the toe of the South Waste Rock Pile (SWRP). This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.
ES	Quarterly			X[4]	East Seep (also known as the Boyd Seep) located where the buried East Seep Fork of the Eastern Drainage emerges at the toe of the East Waste Rock Pile (EWRP). This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.
PHS	Quarterly		X		Pumphouse Seep located at the toe of the SWRP near the PCP. This location was previously sampled as part of the interim water management performance monitoring program. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.
FES	Quarterly			X[4]	Far East Seep located where the buried East Dump Fork of the Eastern Drainage emerges at the toe of the East Waste Rock Pile (EWRP). This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.

Table Q1-1 –Surface Water Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency[1]	Flow Rate or Level			Location and Rationale
		Continuous	Quarterly	Daily or Weekly	
BP	Quarterly			X[4]	Blood Pool Seep located near the existing WTP. This location was previously sampled as part of the interim water management performance monitoring program to characterize water captured by the water management system prior to treatment at the WTP. Discharge from this seep will continue to be captured and treated at the operating WTP during the RA, and will continue to be monitored during the RA construction until the waste rock that sources the seep water is removed.
BC-01	Quarterly		X		Seep along Blue Creek above its delta and is within the area of mine affected surface water as identified during RI. This location was previously sampled as part of the interim water management performance monitoring program, but does not have pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
BC-OY	Quarterly		X		New surface water sampling location to be established just below the confluence of Blue and Oyachen creeks. Location will be monitored to 1) evaluate potential contaminant contrubutions to Blue Creek from Oyachen Creek (by comparing data from SW-7), and 2) provide analytical data immediately upstream of where Blue Creek loses flow to glacial deposits. This information also will be used to support evaluation of groundwater data collected from the new monitoring wells installed in the glacial deposits in this area.

Notes:
1) Surface water sampling will be conducted quarterly during the months of January, April, July, and October. To the extent possible, the January monitoring event (first quarter) will be scheduled to coincide with peak runoff, and the October sampling event (fourth quarter) will be scheduled to coincide with the first major stormwater runoff event of the fall season.
2) Sampling location has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1).
3) Continuous flow and field parameter monitoring will be conducted if water present and during non-freezing conditions.
4) Water levels will be measured daily during water treatment plant operation and weekly during non-freezing conditions when conditions permit safe and accurate measurements.

EWRP = East Waste Rock Pile
PCP = Pollution Control Pond
QAPP = Quality Assurance Project Plan
RA = Remedial Action
RI = Remedial Investigation
SWRP = South Waste Rock Pile
WTP = water treatment plant

Table Q1-2 –Sediment Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency	Location and Rationale
SW-2	Annual (Fall)	Located in Eastern Drainage and within the area of mine affected sediment as identified during RI. This location was not previously sampled as part of the interim measures performance monitoring program. Location will be monitored during the RA construction to evaluate potential impacts to sediment, and is a candidate location for long-term post remedy monitoring.
SW-4	Annual (Fall)	Located in Blue Creek just upstream of where the mine drainage discharges to Blue Creek, and is outside the area of mine affected sediment as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program. Location will be monitored during the RA construction to provide up gradient data in Blue Creek, and is a candidate location for long-term post remedy monitoring.
SW-4U	Annual (Fall)	Located in Blue Creek upstream of where the mine drainage discharges to Blue Creek, and is outside the area of mine affected sediment as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program. Location will be monitored during the RA construction to provide up gradient data in Blue Creek, and is a candidate location for long-term post remedy monitoring.
SW-5[1]	Annual (Fall)	Located in Blue Creek approximately ¼ mile downstream of where the mine drainage discharges to Blue Creek, and is within the area of mine affected sediment as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
SW-6	Annual (Fall)	Located in the Mine Drainage just above where it discharges to Blue Creek, and is within the area of mine affected sediment as identified during RI. This location was previously sampled as part of the interim measures performance monitoring program. Location will be monitored during the RA construction to evaluate potential impacts to sediment, and is a candidate location for long-term post remedy monitoring.
SW-7[1]	Annual (Fall)	Located in Blue Creek approximately 1 mile downstream of where the mine drainage discharges to Blue Creek, and is within the area of mine affected sediment as identified during the RI. This location was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to surface water, and is a candidate location for long-term post remedy monitoring.
BC-OY	Annual (Fall)	New sediment sampling location to be established just below the confluence of Blue and Oyachen creeks. Location will be monitored to evaluate potential contaminant contrubutions to Blue Creek from Oyachen Creek (by comparing data from SW-7).

Table Q1-2 –Sediment Monitoring Schedule During Remedial Action

Site ID	Sampling Frequency	Location and Rationale
SW-11[1]	Annual (Fall)	Located in the Eastern Drainage at its confluence with the Central Drainage, and within the area of mine affected sediment as identified during RI. This location was previously sampled as part of the interim measures performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to sediment, and is a candidate location for long-term post remedy monitoring.
SW-12[1]	Annual (Fall)	Located in lower reach of the Central Drainage and within the area of mine affected sediment as identified during RI. This location was previously sampled as part of the interim measures performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to sediment, and is a candidate location for long-term post remedy monitoring.
WDAC[1]	Annual (Fall)	Located in the Western Drainage and within the area of mine affected sediment as identified during RI. This location was previously sampled as part of the interim measures performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction. Location will be monitored during the RA construction to evaluate potential impacts to sediment, and is a candidate location for long-term post remedy monitoring.

1) Sampling location has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1).

DQO = Data Quality Objective, QAPP = Quality Assurance Project Plan, RA = Remedial Action, RI = Remedial Investigation

Table Q1-3 — Groundwater Monitoring Schedule During Remedial Action

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Water Level Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
MWNW-01	Northwest Ridge Bedrock		X		X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 335 feet above the elevation of the Pit 4 waste rock dewatering sump and 790 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNW-02	Northwest Ridge Bedrock				X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 335 feet above the elevation of the Pit 4 waste rock dewatering sump and 790 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confirm flow directions.
MWNW-03	Northwest Ridge Bedrock				X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 451 feet above the elevation of the Pit 4 waste rock dewatering sump and 906 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following RA will be used to confirm flow directions.
MWNW-04	Northwest Ridge Bedrock				X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 313 feet above the elevation of the Pit 4 waste rock dewatering sump and 768 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confirm flow directions.
MWNW-07	Northwest Ridge Bedrock		X		X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 294 feet above the elevation of the Pit 4 waste rock dewatering sump and 750 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNE-01	Northeast Drainage Regolith		X		X		Up gradient well located outside area of mine-affected regolith groundwater as identified during the RI, and was not monitoried as part of the interim water management performance monitoring program. Well is screened approximately 50 feet above the elevation of the Pit 4 waste rock dewatering sump and 505 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNE-02	Northeast Drainage Bedrock		X		X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitoried as part of the interim water management performance monitoring program. Well is screened approximately 40 feet below the elevation of the Pit 4 waste rock dewatering sump and 415 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNE-03	Northeast Drainage Regolith		X		X		Up gradient well located outside area of mine-affected regolith groundwater as identified during the RI, and was not monitoried as part of the interim water management performance monitoring program. Well is screened approximately 7 feet below the elevation of the Pit 4 waste rock dewatering sump and 450 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNE-04	Northeast Drainage Bedrock		X		X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitoried as part of the interim water management performance monitoring program. Well is screened approximately 107 feet below the elevation of the Pit 4 waste rock dewatering sump and 350 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWNE-07	Northeast Drainage Bedrock		X		X		Up gradient well located outside area of mine-affected bedrock groundwater as identified during the RI, and was not monitoried as part of the interim water management performance monitoring program. Well is screened approximately 107 feet below the elevation of the Pit 4 waste rock dewatering sump and 230 feet above the elevation of the Pit 3 waste rock dewatering sump. Water level data collected during and following the RA will be used to confrim flow directions and to evaluate effects that dewatering Pit 3 and Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
BOM-89-10S	Buried Western Drainage Bedrock		X		X		Located within the mined are near the toe of the Hillside Waste Rock Pile. Well is located within the area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 53 feet below the elevation of the

Table Q1-3 — Groundwater Monitoring Schedule During Remedial Action

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Water Level Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
							Pit 4 underdrain sump and 387 feet above the elevation of the Pit 3 underdrain sump. Water level data collected throughout the RA will be used to confirm flow directions and to evaluate effects that dewatering Pit 3 and Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
BOM-89-10D	Buried Western Drainage Bedrock		X		X		Located within the mined are near the toe of the Hillside Waste Rock Pile. Well is located within the area of mine-affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. Well is screened approximately 113 feet below the elevation of the Pit 4 underdrain sump and 327 feet above the elevation of the Pit 3 underdrain sump. Water level data collected throughout the RA will be used to confirm flow directions and to evaluate effects that dewatering Pit 3 and Pit 4 has on nearby water levels. Well will be sampled semi-annualy to evaluate COC concetrations near the consolidated wastes and to support evaluation of data collected from down gradient locations.
MWFW-01	Far West Drainage Regolith		X			X	Well located outside area of mine affected regolith groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. This location is down gradient of where western portions of the MA straddle the main MA watershed boundary (see Figure Q1-2), and will be monitored during the RA construction to evaluate potential impacts to groundwater down gradient of the Construction Support Zone. Water level data from this well will be used to evaluate groundwater flow gradients (by comparing water levels with nearby MWFW-02).
MWFW-02	Far West Drainage Bedrock		X			X	Well located outside area of mine affected bedrock groundwater as identified during the RI, and was not monitored as part of the interim water management performance monitoring program. This location is down gradient of where western portions of the MA straddle the main MA watershed boundary (see Figure Q1-2), and will be monitored during the RA construction to evaluate potential impacts to groundwater down gradient of the Construction Support Zone. Water level data from this well will be used to evaluate groundwater flow gradients (by comparing water levels with nearby MWFW-01).
PBW-01	Western Drainage Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
PBW-02	Western Drainage Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
MWWD-02b	Western Drainage Regolith			X			Regolith well located near the Western Drainage Pumpback Station. Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBW-01 and PBW-02. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
MW-01	Western Drainage Regolith				X		Regolith well located near the Western Drainage Pumpback Station. Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBW-01 and PBW-02. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
MWWD-01	Western Drainage Bedrock			X			Bedrock well located near the Western Drainage Pumpback Station. Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBW-01 and PBW-02. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
GW-35a[2]	Western Drainage Regolith		X			X	Well located within the area of mine affected regolith groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent GW-50 screened in the bedrock) and flow direction.
GW-50[2]	Western Drainage Bedrock		X			X	Well located within the area of mine affected bedrock groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent GW-35a screened in the regolith) and flow direction.
PBC-01	Central Drainage Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
PBC-02	Central Drainage Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
PBC-03	Central Drainage Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Water Level Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
							line/decommissioned and replaced with the alluvial groundwater controls.
MWCD-02b	Central Drainage Regolith			X			Regolith well located near the Restroom Pumpback Station (Central Drainage). Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBC-01, PBC-02, and PBC-03. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
MW-02	Central Drainage Regolith			X			Regolith well located near the regolith well located near the Restroom Pumpback Station (Central Drainage). Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBC-01, PBC-02, and PBC-03. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
MWCD-01	Central Drainage Bedrock			X			Bedrock well located near the Restroom Pumpback Station (Central Drainage). Previously monitored for water levels as part of the interim water management performance monitoring program to evaluate effects of pumping nearby wells PBC-01, PBC-02, and PBC-03. Water level monitoring will continue during the RA construction these wells are taken off line/decommissioned and replaced with the alluvial groundwater controls.
GW-36a[2]	Central Drainage Regolith	X[6]			X		Well located within the area of mine affected regolith groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program and has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent GW-51 screened in the bedrock) and flow direction. This well also is located near the planned Alluvial Groundwater Controls in the Central Drainage, and will be sampled quarterly to evaluate the performance of the groundwater controls.
GW-51[2]	Central Drainage Bedrock		X		X		Well located within the area of mine affected bedrock groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent GW-36a screened in the regolith) and flow direction.
GW-19[2]	Central Drainage Regolith		X			X	Well located within the area of mine affected regolith groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, and has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MWCD-02a screened in the bedrock) and flow direction.
MWCD-02a	Central Drainage Bedrock		X			X	Well located within the area of mine affected bedrock groundwater as identified during the RI, and was not previously monitored as part of the interim water management performance monitoring program. Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent GW-19 screened in the regolith) and flow direction.
MWED-05	Far East Seep Regolith			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
MWED-06	Far East Seep Bedrock			X			Well was used to intermittently pump regolith groundwater during the interim water management, and was previously monitored for water levels as part of the interim water management performance monitoring program. Intermittent pumping and water-level monitoring will continue during the RA construction until the well is taken off line/decommissioned and replaced with the alluvial groundwater controls.
MW-05[2]	Eastern Drainage Regolith		X			X	Well located within the area of mine affected alluvial groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, but does not have pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MWED-03 screened in the bedrock) and flow direction.
MWED-03[2]	Eastern Drainage Bedrock		X			X	Well located within the area of mine affected bedrock groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, but does not have pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MW-05 screened in the regolith) and flow direction.
MW-04	Eastern Drainage Regolith		X			X	Well located within the area of mine affected regolith as identified during the RI. This well was not previously included in the interim water management performance monitoring program. Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-

Table Q1-3 — Groundwater Monitoring Schedule During Remedial Action

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Water Level Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
							term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MWED-04 screened in the bedrock) and flow direction.
MWED-04	Eastern Drainage Bedrock		X			X	Well located outside the area of mine affected bedrock groundwater as identified during the RI. This well was not previously included in the interim water management performance monitoring program. Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MW-04 screened in the regolith) and flow direction.
MWED-10[2]	Mine Drainage Regolith		X			X	Well located within the area of mine affected regolith groundwater as identified during the RI. This well was previously sampled as part of the interim water management performance monitoring program, but does not have pre-established indicator-parameter action levels for use during the RA construction. (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1). Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MWED-11 screened in the bedrock) and flow direction.
MWED-11	Mine Drainage Bedrock		X			X	Well located outside the area of mine affected bedrock groundwater as identified during the RI. This well was not previously included in the interim water management performance monitoring program. Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring. Water levels will be used to evaluate gradient (by comparing data with adjacent MWED-10 screened in the regolith) and flow direction.
MWBC-01	Middle Blue Creek Regolith		X			X	Well located in Blue Creek drainage just down gradient of the area of mine affected regolith groundwater as identified during the RI. This well was not included in the interim water management performance monitoring program. Well will be monitored during the RA construction to evaluate water levels and potential impacts to groundwater, and is a candidate well for long-term post remedy monitoring.
MWBC-02	Lower Blue Creek Regolith		X			X	New well located in the regolith near the confluence of Oyachen and Blue creeks. Will be monitored to evaluate the presence or absence of mine-related COCs in regolith groundwater and to monitor data trends during and following the RA.
MWBC-03	Lower Blue Creek Regolith		X			X	New well located in the regolith near the confluence of Oyachen and Blue creeks. Will be monitored to evaluate the presence or absence of mine-related COCs in regolith groundwater and to monitor data trends during and following the RA.
MWBC-04	Lower Blue Creek Regolith		X			X	New well located in the regolith near the confluence of Oyachen and Blue creeks. Will be monitored to evaluate the presence or absence of mine-related COCs in regolith groundwater and to monitor data trends during and following the RA.
MWBC-05	Lower Blue Creek Regolith		X			X	New well located in the regolith near the confluence of Oyachen and Blue creeks. Will be monitored to evaluate the presence or absence of mine-related COCs in regolith groundwater and to monitor data trends during and following the RA.
AMW-FES-EXT	*Far East Seep Drainage Regolith*				*X*		*New regolith monitoring well installed in the Far East Seep Drainage extraction trench to provide water-level data for evaluating the performance of the groundwater controls constructed in the Far East Seep Drainage*
AMW-FES-01	*Far East Seep Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Far East Seep Drainage*
AMW-FES-02	*Far East Seep Drainage Regolith*		*X*		*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Far East Seep Drainage. Well will be sampled during the RA to evaluate COC concentrations immediately down gradient of the groundwater controls.*
AMW-FES-03	*Far East Seep Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Far East Seep Drainage*
AMW-WD-EXT	*Western Drainage Regolith*				*X*		*New regolith monitoring well installed in the Western Drainage extraction trench to provide water-level data for evaluating the performance of the groundwater controls constructed in the Western Drainage*
AMW-WD-01	*Western Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Western Drainage*
AMW-WD-02	*Western Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Western Drainage*
AMW-WD-03	*Western Drainage Regolith*		*X*		*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Western Drainage. Well will be sampled during the RA to evaluate COC concentrations immediately down gradient of the groundwater controls.*
AMW-WD-04	*Western Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Western Drainage*
AMW-CD-	*Central Drainage*				*X*		*New regolith monitoring well installed in the Central Drainage extraction trench to provide water-level data for evaluating the performance of the groundwater controls*

Table Q1-3 — Groundwater Monitoring Schedule During Remedial Action

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Wat Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
EXT	*Regolith*						*constructed in the Central Drainage*
AMW-CD-01	*Central Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Central Drainage*
AMW-CD-02	*Central Drainage Regolith*		*X*		*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Central Drainage. Well will be sampled during the RA to evaluate COC concentrations immediately down gradient of the groundwater controls.*
AMW-CD-03	*Central Drainage Regolith*				*X*		*New regolith monitoring well to provide water-level data for evaluating the performance of the groundwater controls constructed in the Central Drainage*
GW-54	Backfilled Pits Area waste rock (dewatering well)	X		X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Well will be monitored during the RA to evaluate COC concentrations in BPA water and effectiveness of dewatering activities.
GW-54B	*Backfilled Pits Area waste rock (redundant dewatering well)*			*X*			*Redundant dewatering well to be installed during the RA - Water levels will be monitored to evaluate effectiveness of dewatering activities in the BPA.*
GW-56	Backfilled Pits Area waste rock (observation well)			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
GW-57	Backfilled Pits Area bedrock (observation well)			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
GW-58	Backfilled Pits Area			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
GW-53	Backfilled Pits Area waste rock (observation well)			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
BOM-89-2S	Backfilled Pits Area waste rock (observation well)			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
BOM-89-2D	Backfilled Pits Area bedrock (observation well)			X			Well located within the BPA, and was not included in the interim water management performance monitoring program. Water levels will be monitored during the RA to evaluate effectiveness of BPA dewatering activities.
Pit 4-UD-01	*Pit 4 Underdrain Sump Dewatering Well*	*X*		*X*			*Dewatering well to be installed during the RA and will be monitored to evaluate COC concentrations in Pit 4 underdrain sump water and effectiveness of dewatering activities.*
Pit 4-UD-02	*Pit 4 Underdrain Sump Redundant Dewatering Well*			*X*			*Redundant dewatering well to be installed during the RA - Water levels will be monitored to evaluate effectiveness of dewatering activities in the Pit 4 underdrain sump.*
Pit 4-WR-01	*Pit 4 Waste Rock Dewatering Well*	*X*		*X*			*Dewatering well to be installed during the RA and will be monitored to evaluate COC concentrations in Pit 4 waste rock sump water and effectiveness of dewatering activities.*
Pit 4-WR-02	*Pit 4 Waste Rock Redundant Dewatering Well*			*X*			*Redundant dewatering well to be installed during the RA - Water levels will be monitored to evaluate effectiveness of dewatering activities in the Pit 4 waste rock sump.*
Pit 3-UD-01	*Pit 3 Underdrain Sump Dewatering Well*	*X*		*X*			*Dewatering well to be installed during the RA and will be monitored to evaluate COC concentrations in Pit 3 underdrain sump water and effectiveness of dewatering activities.*

Table Q1-3 — Groundwater Monitoring Schedule During Remedial Action

Well ID	Well location and geology of screened Interval[1]	Sampling Frequency		Water Level Measurement Frequency			Rationale
		Quarterly	Semi-Annually	Continuous	Monthly	Semi-Annually	
Pit 3-UD-02	*Pit 3 Underdrain Sump Redundant Dewatering Well*			X			*Redundant dewatering well to be installed during the RA - Water levels will be monitored to evaluate effectiveness of dewatering activities in the Pit 3 underdrain sump.*
Pit 3-WR-01	*Pit 3 Waste Rock Dewatering Well*	X		X			*Dewatering well to be installed during the RA and will be monitored to evaluate COC concentrations in Pit 3 waste rock sump water and effectiveness of dewatering activities.*
Pit 3-WR-02	*Pit 3 Waste Rock Redundant Dewatering Well*			X			*Redundant dewatering well to be installed during the RA - Water levels will be monitored to evaluate effectiveness of dewatering activities in the Pit 3 waste rock sump.*

Sampling locations in *italics* are anticipated to be installed during the RA construction.

Shaded wells are located within the planned Waste Containment Area and are depicted on Figure Q1-4. All other wells are depicted on Figures Q1-2 and Q1-3.

1 Site wells generally are screened in either competent bedrock or regolith. Regolith is the unconsolidated material overlying competent bedrock, and depending on location includes waste rock, alluvium, colluvium, glacial outwash, and weathered bedrock.

2 Well has pre-established indicator-parameter action levels for use during the RA construction (See QAPP Attachment Q2-E and QAPP DQO Table Q2-A-1).

BPA = backfilled pits area

COC = constituent(s) of concern

DQO = Data Quality Objective

RA = Remedial Action

RI = Remedial Investigation

QAPP = Quality Assurance Project Plan

Table Q1-4 – Monitoring Well Summary

Well	Location	Screened Interval (ft bgs)	Well Total Depth (ft bgs)	Elevation[1] (ft)	Northing (ft)	Easting (ft)	Survey Datum (see note)	Well Casing Diameter (in)	Pump	Comments
MWNW-01	Northwest Ridge Bedrock	80-100	100	3424.7	358946.92	2311742.65	3	4	None	Sampling procedures TBD
MWNW-02	Northwest Ridge Bedrock	180-200	200	3527.09	358,673.92	2,310,680.65	3	4	Not Applicable	Not sampled – water levels only
MWNW-03	Northwest Ridge Bedrock	97-117	117	3560.71	357,905.92	2,309,918.65	3	4	Not Applicable	Not sampled – water levels only
MWNW-04	Northwest Ridge Bedrock	171-191	191	3496.9	356,987.92	2,308,748.65	3	4	Not Applicable	Not sampled – water levels only
MWNW-07	Northwest Ridge Bedrock	63.3-83.3	88.8	2851.02	355965.18	2312369.5	3	4	None	Sampling procedures TBD
MWFW-01	Far West Drainage Alluvium (paired w/ MWFW-02)	15-30.4	30.4	2530.1	352,989.92	2,309,379.65	3	4	None	Sampling procedures TBD
MWFW-02	Far West Drainage Bedrock (paired w/ MWFW-01)	101.9-121.9	122.3	2529.7	353,015.92	2,309,363.65	3	4	None	Sampling procedures TBD
MW-01	Western Drainage Regolith (paired w/ MWWD-01)	2-12	12	2408.36	352273.4	2670907.4	4	2	Not Applicable	Not sampled – water levels only
MWWD-01	Western Drainage Bedrock (paired w/ MW-01)	73.4-93.4	93.9	2406.49	352242	2670910	4	4	Not Applicable	Not sampled – water levels only
GW-35a	Western Drainage Regolith (paired w/ GW-50)	7.4-11.7	12.5	2366.75	351650.16	311220.53	3	4	Moyno Pump[5]	Pump 3 casing volumes[6]
GW-50	Western Drainage Bedrock (paired w/ GW-35a)	49.8-70.2	70.2	2366.91	351639.76	311200.66	3	4	Dedicated electric submersible	Pumps dry sampled next day
PBW-01	Western Drainage Regolith	4.8-14.9	14.9	2408.64	352231.21	311043.33	3	6	Not Applicable	Not sampled – water levels only
PBW-02	Western Drainage Regolith	8.7-18.8	18.8	2405.55	352197.84	311022.98	3	6	Not Applicable	Not sampled – water levels only
MWWD-02b	Western Drainage Regolith	6.3-16.3	16.6	2405.53	352180.4	311042.57	3	4	Not Applicable	Not sampled – water levels only
MW-02	Central Drainage Regolith (paired w/ MWCD-01)	7-17	17	2431.64	352346.7	2671737.1	4	2	Not Applicable	Not sampled – water levels only
MWCD-01	Central Drainage Bedrock (paired w/ MW-02)	95-115	115	2431.29	352337	2671713	4	4	Not Applicable	Not sampled – water levels only
GW-36a	Central Drainage Regolith (paired w/ GW-51)	14.4-18.7	19.5	2360.16 [2]	351566.94	311856.41	3	4	Moyno Pump[5]	Pump dry twice then sample
GW-51	Central Drainage Bedrock (paired w/ GW-36a)	59.9-74.3	74.3	2370.40	351553.26	311911.18	3	4	Dedicated electric submersible	Pumps dry then sample
GW-19	Central Drainage Regolith (paired w/ MWCD-02a)	12-20	20	2318.85 [2]	351055.51	312002.97	3	4	Moyno Pump[5]	Pump dry twice then sample
MWCD-02a	Central Drainage Bedrock (paired w/ GW-19)	78-98	98.5	2319.14	351084.67	2312008.15	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample.. Paired with GW-19
PBC-01	Central Drainage Regolith	8.7-33.1	33.1	2428.91	352268.71	311850.43	3	6	Not Applicable	Not sampled – water levels only
PBC-02	Central Drainage Regolith	5.5-18.9	18.9	2431.02	352262.45	311769.06	3	6	Not Applicable	Not sampled – water levels only
PBC-03	Central Drainage Regolith	6.4-30.9	30.9	2431.08	352293.88	311900.44	3	6	Not Applicable	Not sampled – water levels only
MWCD-02b	Central Drainage Regolith	8-33.4	33.4	2427.65	352249.78	311852.69	3	4	Not Applicable	Not sampled – water levels only

Table Q1-4 – Monitoring Well Summary

Well	Location	Screened Interval (ft bgs)	Well Total Depth (ft bgs)	Elevation[1] (ft)	Northing (ft)	Easting (ft)	Survey Datum (see note)	Well Casing Diameter (in)	Pump	Comments
MW-04	Eastern Drainage Regolith (paired w/ MWED-04)	10-20	20	2371.74	351964.06	2313100.85	4	2	Not Applicable	Not sampled – water levels only
MWED-04	Eastern Drainage Bedrock (paired w/ MW-04)	92.7-112.7	113.2	2371.74	351964.06	2313100.85	4	4	Not Applicable	Not sampled – water levels only
MW-05	Eastern Drainage Regolith (paired w/ MWED-03)	5-15	15	2462.74	353175.2	2673113.3	4	2	Moyno Pump[5]	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWED-03.
MWED-03	Eastern Drainage Bedrock (paired w/ MW-05)	29.2-49.2	49.7	2467.74	353160.6	2673201.7	4	4	Moyno Pump[5]	Pump 3 casing volumes[6] or pump dry then sample. Paired with MW-5.
MWED-10	Mine Drainage Regolith (paired w/ MWED-11)	5-15	15	2133.44	349345.55	312553.62	3	4	Moyno Pump[5]	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWED-11.
MWED-11	Mine Drainage Bedrock (paired w/ MWED-10)	87.9-107.9	108.4	2128.23	349336.92	2312627.65	3	4	Moyno Pump[5]	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWED-10.
MWED-05	Far East Seep Regolith (paired w/ MWED-06)	9.6-24.6	25.1	2590.70	354067.94	313290.52	3	4	Not Applicable	Not sampled – water levels only
MWED-06	Far East Seep Bedrock (paired w/ MWED-05)	31-51	51.5	2590.60	354072.25	313302.2	3	4	Not Applicable	Not sampled – water levels only
BOM-89-10S	Buried Western Drainage Bedrock (paired w/BOM-89-10D	55-65	75	2957	356377.20	2310850.15	7	2	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with BOM-89-10D.
BOM-89-10D	Buried Western Drainage Bedrock (paired w/BOM-89-10S	115-125	260	2957	356,377.20	2310850.15	7	2	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with BOM-89-10S.
MWNE-01	Northeast Drainage Regolith (paired with MWNE-02)	39-59	59	3099.13	358056.9	2312721.52	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWNE-02.
MWNE-02	Northeast Drainage Bedrock (paired with MWNE-01)	130.2-150.2	150.2	3099.63	358074.89	2312742.96	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWNE-01.
MWNE-03	Northeast Drainage Regolith (paired with MWNE-04)	116.5-136.5	136.5	3119.34	357026.4	2312207.59	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWNE-04.
MWNE-04	Northeast Drainage Bedrock (paired with MWNE-03)	217.5-237.5	237.5	3120.3	357037.64	2312203.52	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample. Paired with MWNE-03.
MWNE-07	Northeast Drainage Regolith	63.3-83.3	88.8	2851.02	355965.18	2312369.5	4	4	TBD	Pump 3 casing volumes[6] or pump dry then sample.
MWBC-01	Middle Blue Creek Regolith	7.1-27.1	27.6	?	348538.91	2311855.75	3	4	Moyno Pump[5]	Pump 3 casing volumes[6] or pump dry then sample
MWBC-02	Lower Blue Creek Regolith	9.7-40	40	1527.80	340287.74	306750.29	3	2	TBD	New well installed during 2014
MWBC-03	Lower Blue Creek Regolith	15-45.3	45.3	1524.69	340389.02	306645.67	3	2	TBD	New well installed during 2014
MWBC-04	Lower Blue Creek Regolith	39.6-119.9	120	1336.04	338219.78	301681.63	3	2	TBD	New well installed during 2014
MWBC-05	Lower Blue Creek Regolith	32-115.3	117	1339.86	338304.69	301643.19	3	2	TBD	New well installed during 2014
AMW-FES-EXT	*Far East Seep Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-FES-01	*Far East Seep Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*

Table Q1-4 – Monitoring Well Summary

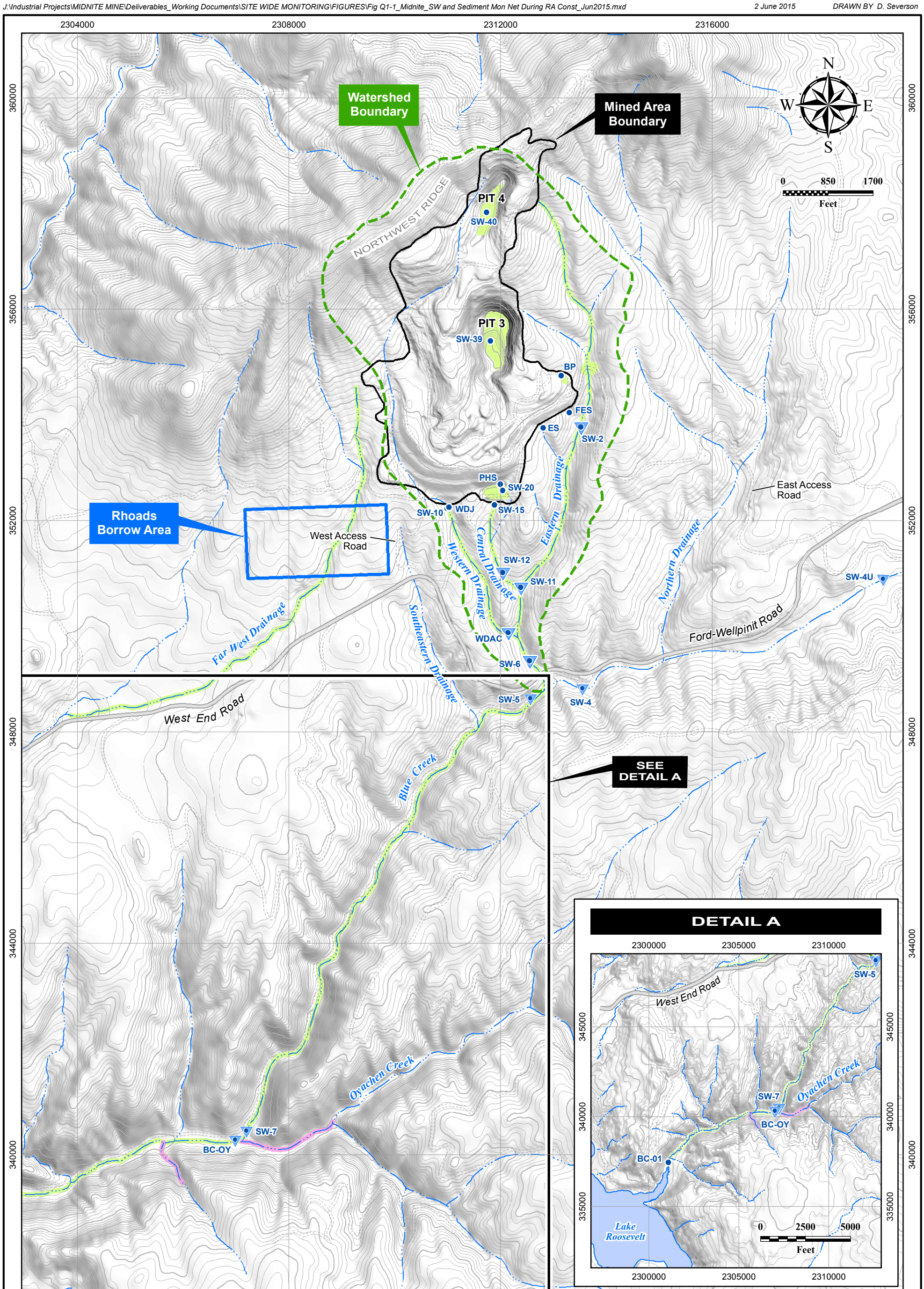
Well	Location	Screened Interval (ft bgs)	Well Total Depth (ft bgs)	Elevation[1] (ft)	Northing (ft)	Easting (ft)	Survey Datum (see note)	Well Casing Diameter (in)	Pump	Comments
AMW-FES-02	*Far East Seep Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-FES-03	*Far East Seep Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-WD-EXT	*Western Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-WD-01	*Western Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-WD-02	*Western Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-WD-03	*Western Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-WD-04	*Western Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-CD-EXT	*Central Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-CD-01	*Central Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-CD-02	*Central Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
AMW-CD-03	*Central Drainage Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
GW-53	Backfilled Pits Area Regolith	133-173.9	173.9	2907.6	354799.57	2311078.61	?	6	Not Applicable	Not sampled – water levels only
GW-54	Backfilled Pits Area Regolith	88.9-129.8	129.8	2785.4	354292.09	2311426.56	?	6	Dewatering pump	Sample discharge
GW-54B	*Backfilled Pits Area Regolith*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*New well anticiptaed to be installed during RA construction*
GW-56	Backfilled Pits Area Regolith	64-94 (?)	94.5	2762.51	354053.72	2311458.95	?	?	Not Applicable	Not sampled – water levels only Well log not available
GW-57	Backfilled Pits Area Bedrock	183.68-194.14	194.14	2783.72	354364.82	2311449.45	?	6	Not Applicable	Not sampled – water levels only Well log not available
GW-58	Backfilled Pits Area Regolith	145-173	173	2906.1	351605.34		?	6	Not Applicable	Not sampled – water levels only
BOM-89-2S	Backfilled Pits Area Regolith	95-100	110	2876	354,792.16	2311201.96	?	2	Not Applicable	Not sampled – water levels only
BOM-89-2D	Backfilled Pits Area Bedrock	130-135	145	2876	354,792.16	2311201.96	?	2	Not Applicable	Not sampled – water levels only

Notes:
1) Measuring point elevation unless noted
2) Elevation is top of protective casing lid
3) NAD 83 (CORS 96) Ground Coordinates; NAVD 88 Elevations
4) NAD 27 Ground Coordinates; NAVD 88 Elevations
5) Moyno Pump (Model #33201) is a progressing cavity pump (positive displacement). Tubing is dedicated.
6) Purge Volumes: (based on Schedule 40 PVC) 2" PVC= 0.17 gal/ft.; 4" PVC = 0.65 gal/ft; 6" PVC = 1.48 gal/ft
7) Source of coordinates is the well log.

Well locations in italics are anticipated to be installed during RA construction.

bgs = below ground surface, RA = Remedial Action, TBD = to be determined

FIGURES



* Approximate extent of mine-affected surface water and sediment as defined in the RI Report

* Tributary with indicator parameters that exceed surface water background limits as defined in the RI Report

Surface water sampling location included in the site-wide monitoring program

Surface water and sediment sampling location included in the site-wide monitoring program

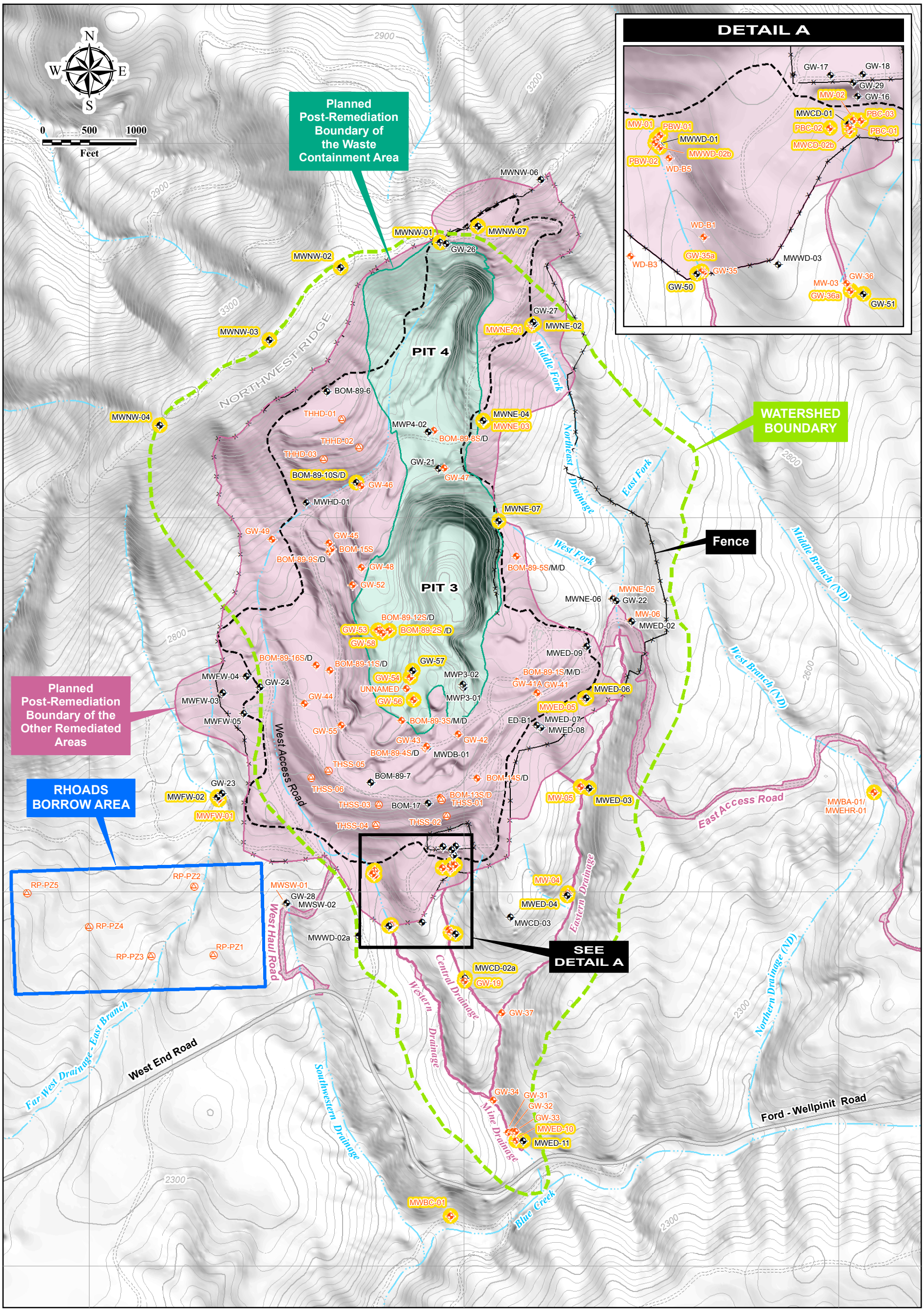
MWH

* SOURCE: Contaminated surface water and sediment extent from *Midnite Mine Remedial Investigation Report (EPA, 2005)*

Midnite Mine

FIGURE Q1-1

SURFACE WATER AND SEDIMENT MONITORING NETWORK DURING RA CONSTRUCTION



NOTE:

Regolith is the unconsolidated material overlying competent bedrock, and depending on location includes waste rock, alluvium, colluvium, glacial outwash, and weathered bedrock.

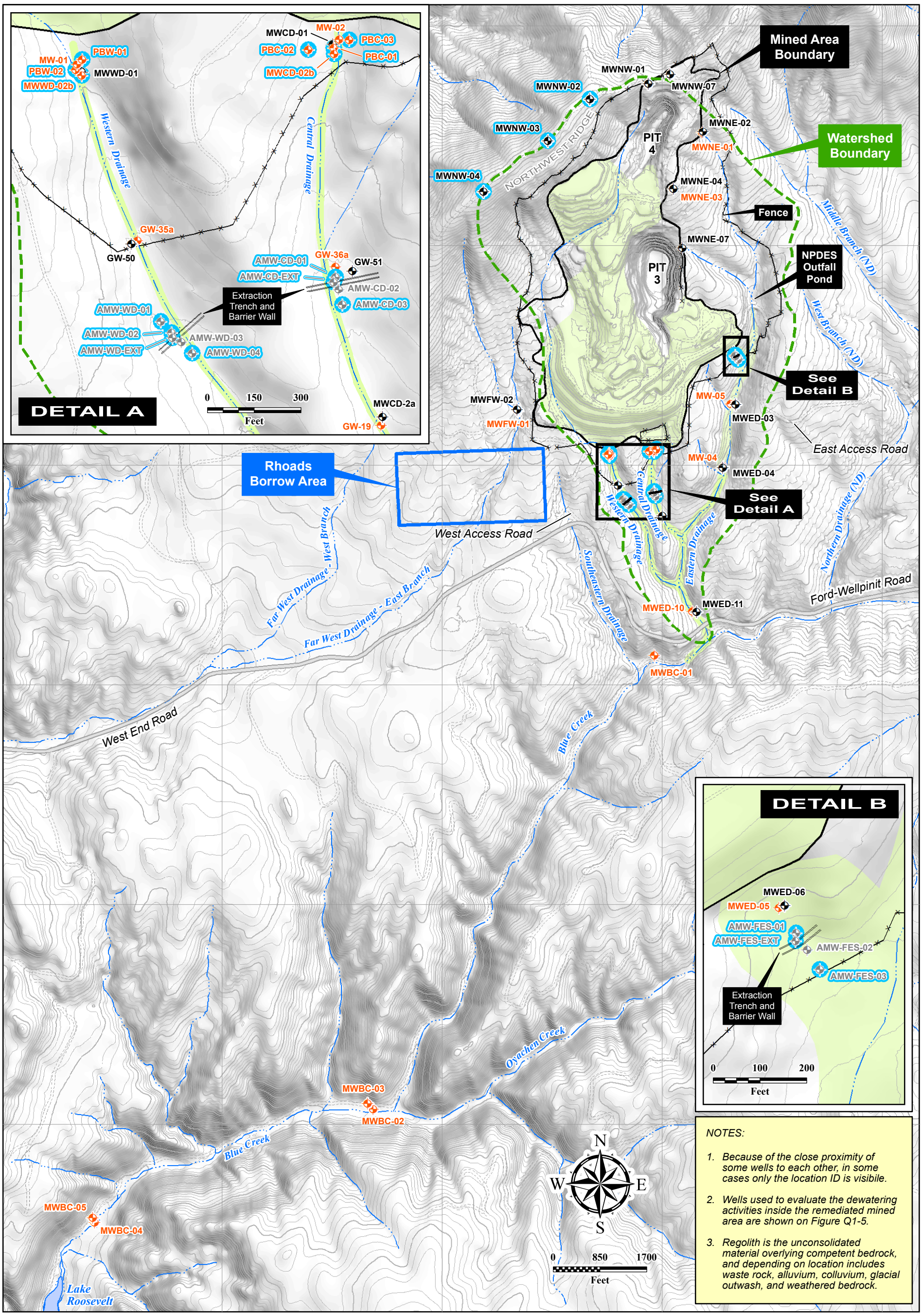
- Bedrock monitoring well
- Regolith monitoring well
- Regolith piezometer
- Yellow halos denote wells included in the site-wide groundwater monitoring network (see Figures Q1-3, Q1-4, and Q1-5)
- Boundary of disturbed area
- Waste Containment Area (planned)
- Other Remediated Areas (planned)
- Existing drainage
- Existing topography Contour interval 50 feet
- Existing road

MWH

Midnite Mine

FIGURE Q1-2

PRE-RA WELL LOCATIONS AND PLANNED REMEDIATED AREAS



NOTES:

1. Because of the close proximity of some wells to each other, in some cases only the location ID is visibile.
2. Wells used to evaluate the dewatering activities inside the remediated mined area are shown on Figure Q1-5.
3. Regolith is the unconsolidated material overlying competent bedrock, and depending on location includes waste rock, alluvium, colluvium, glacial outwash, and weathered bedrock.

* Approximate extent of mine-affected regolith groundwater as defined in the RI Report

Regolith monitoring well included in site-wide monitoring program

Planned regolith monitoring well included in site-wide monitoring program

Bedrock monitoring well included in site-wide monitoring program

Blue halos denote wells generally monitored for water levels only (see Table Q1-3)

Alluvial groundwater controls

MWH

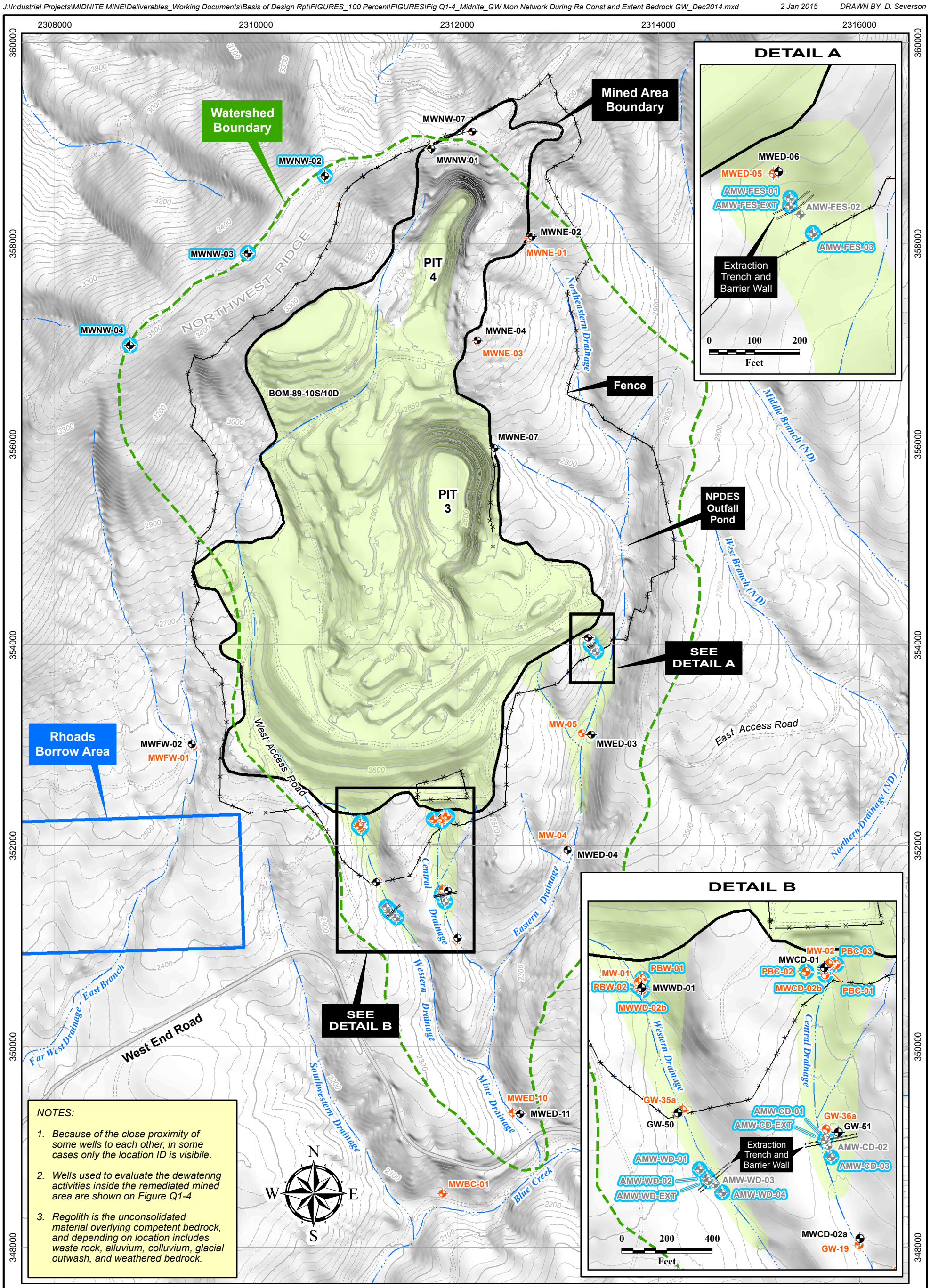
* SOURCE: Mine-affected regolith groundwater extent from *Midnite Mine Remedial Investigation Report (EPA, 2005)*

Midnite Mine

FIGURE Q1-3

GROUNDWATER MONITORING NETWORK DURING RA CONSTRUCTION AND EXTENT OF MINE AFFECTED REGOLITH GROUNDWATER

J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\Basis of Design Rpt\FIGURES_100 Percent\FIGURES\Fig Q1-4_Midnite_GW Mon Network During Ra Const and Extent Bedrock GW_Dec2014.mxd 2 Jan 2015 DRAWN BY D. Severson



0 450 900
Feet

* Approximate extent of mine-affected bedrock groundwater as defined in the RI Report

Bedrock monitoring well included in site-wide monitoring program

Regolith monitoring well included in site-wide monitoring program
(Regolith wells below the confluence of Oyachen and Blue Creeks are shown on Figure Q1-3).

Planned regolith monitoring well included in site-wide monitoring program

Blue halos denote wells monitored for water levels only (see Table Q1-3)

Alluvial groundwater controls

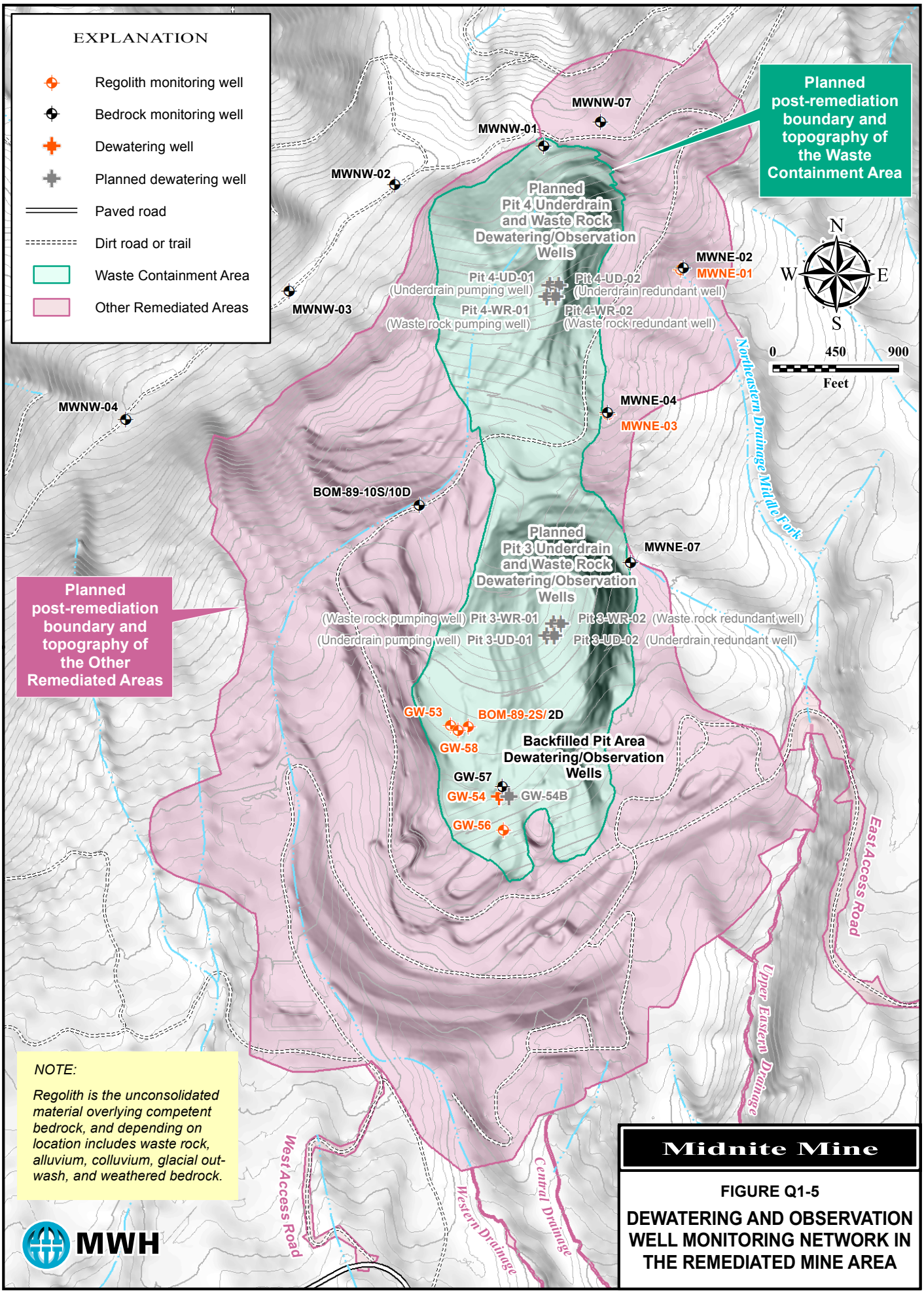
MWH

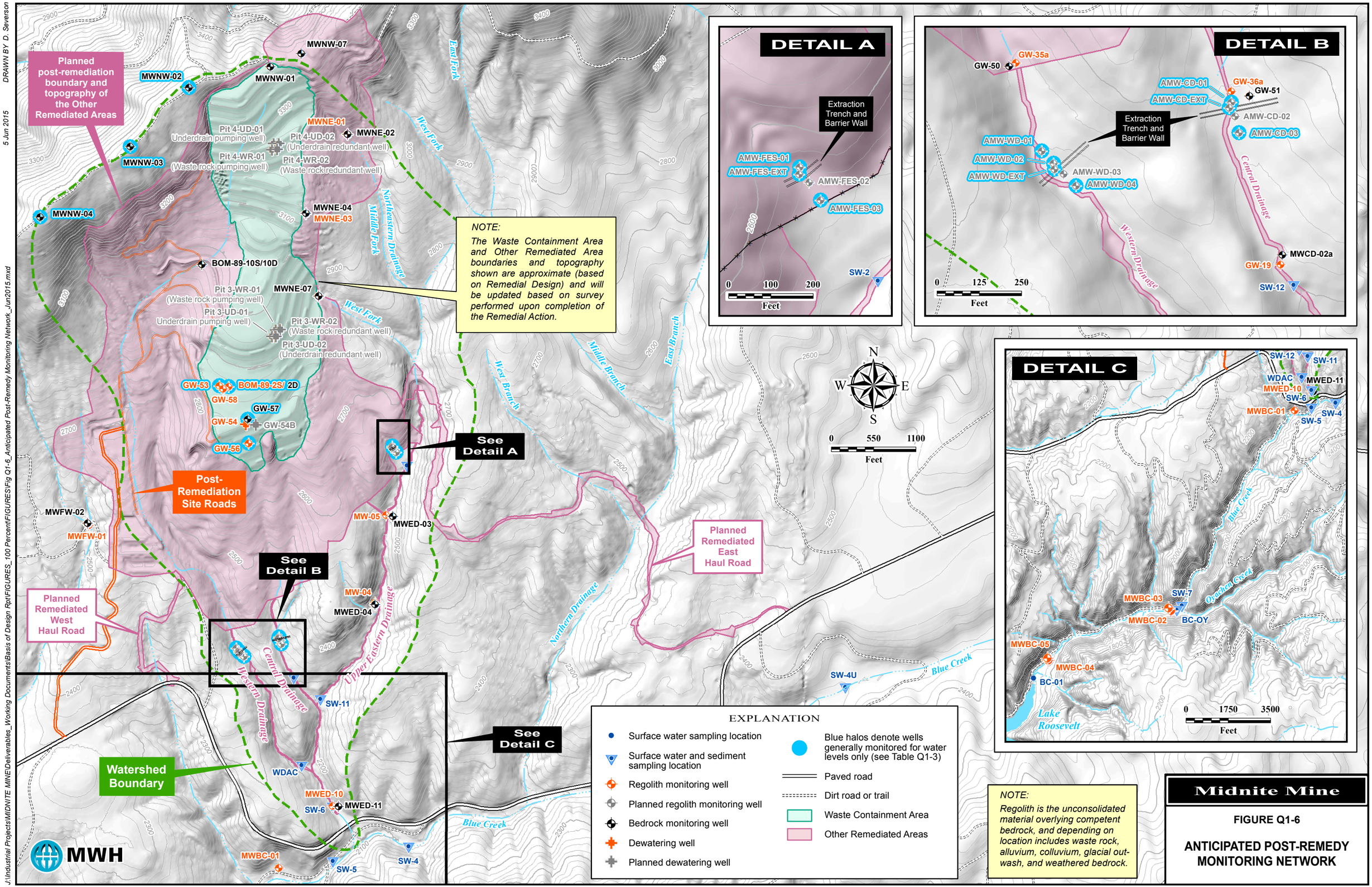
* SOURCE: Mine-affected bedrock groundwater extent from *Midnite Mine Remedial Investigation Report (EPA, 2005)*

Midnite Mine

FIGURE Q1-4

GROUNDWATER MONITORING NETWORK DURING RA CONSTRUCTION AND EXTENT OF MINE AFFECTED BEDROCK GROUNDWATER

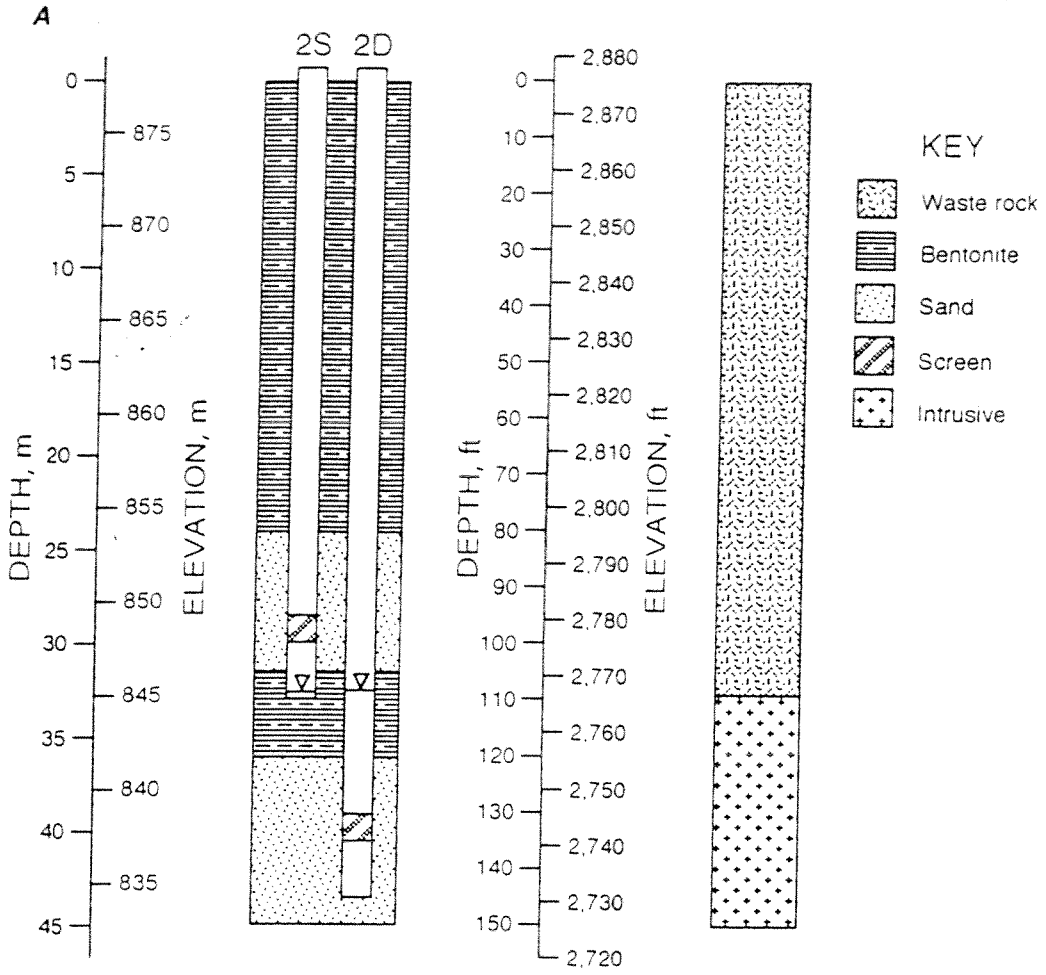

EXPLANATION
Regolith monitoring well
Bedrock monitoring well
Dewatering well
Planned dewatering well
Paved road
Dirt road or trail
Waste Containment Area
Other Remediated Areas
Planned post-remediation boundary and topography of the Waste Containment Area
Planned post-remediation boundary and topography of the Other Remediated Areas
MWNW-07
MWNW-01
MWNW-02
MWNW-03
MWNW-04
MWNE-02
MWNE-01
MWNE-04
MWNE-03
MWNE-07
BOM-89-10S/10D
BOM-89-2S/2D
GW-53
GW-58
GW-57
GW-54
GW-54B
GW-56
Planned Pit 4 Underdrain and Waste Rock Dewatering/Observation Wells
Pit 4-UD-01 (Underdrain pumping well)
Pit 4-UD-02 (Underdrain redundant well)
Pit 4-WR-01 (Waste rock pumping well)
Pit 4-WR-02 (Waste rock redundant well)
Planned Pit 3 Underdrain and Waste Rock Dewatering/Observation Wells
(Waste rock pumping well) Pit 3-WR-01
Pit 3-WR-02 (Waste rock redundant well)
(Underdrain pumping well) Pit 3-UD-01
Pit 3-UD-02 (Underdrain redundant well)
Backfilled Pit Area Dewatering/Observation Wells
N
W
E
S
0
450
900
Feet
Northeastern Drainage Middle Fork
East Access Road
Upper Eastern Drainage
Central Drainage
Western Drainage
West Access Road
NOTE:
Regolith is the unconsolidated material overlying competent bedrock, and depending on location includes waste rock, alluvium, colluvium, glacial out-wash, and weathered bedrock.
MWH
Midnite Mine
FIGURE Q1-5
DEWATERING AND OBSERVATION WELL MONITORING NETWORK IN THE REMEDIATED MINE AREA
DRAWN BY D. Severson
5 June 2015
J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\Basis of Design Rpt\FIGURES_100 Percent\FIGURES\Fig Q1-5_Dewatering and Observ Wells Mon Net in the Rem Mine Area_3Jun2015.mxd


Planned post-remediation boundary and topography of the Other Remediated Areas
MWNW-07
MWNW-02
MWNW-01
MWNW-03
MWNW-04
MWNE-01
MWNE-02
MWNE-04
MWNE-03
MWNE-07
Pit 4-UD-01
Underdrain pumping well)
Pit 4-UD-02
(Underdrain redundant well)
Pit 4-WR-01
(Waste rock pumping well)
Pit 4-WR-02
(Waste rock redundant well)
BOM-89-10S/10D
Pit 3-WR-01
(Waste rock pumping well)
Pit 3-UD-01
Underdrain pumping well)
Pit 3-WR-02
(Waste rock redundant well)
Pit 3-UD-02
(Underdrain redundant well)
GW-53
BOM-89-2S/ 2D
GW-58
GW-57
GW-54
GW-54B
GW-56
See Detail A
Post-Remediation Site Roads
MWFW-02
MWFW-01
MW-05
MWED-03
See Detail B
MW-04
MWED-04
Planned Remediated West Haul Road
Planned Remediated East Haul Road
See Detail C
Watershed Boundary
WDAC
MWED-10
SW-6
MWED-11
MWBC-01
SW-5
SW-4
SW-11
SW-4U
East Fork
West Fork
Middle Fork
Northeastern Drainage
Middle Branch
East Branch
West Branch
Northern Drainage
Upper Eastern Drainage
Central Drainage
Western Drainage
Blue Creek
NOTE:
The Waste Containment Area and Other Remediated Area boundaries and topography shown are approximate (based on Remedial Design) and will be updated based on survey performed upon completion of the Remedial Action.
N
S
E
W
0 550 1100
Feet
DETAIL A
Extraction Trench and Barrier Wall
AMW-FES-01
AMW-FES-EXT
AMW-FES-02
AMW-FES-03
SW-2
0 100 200
Feet
DETAIL B
GW-50
GW-35a
AMW-CD-01
AMW-CD-EXT
GW-36a
GW-51
AMW-CD-02
AMW-CD-03
Extraction Trench and Barrier Wall
AMW-WD-01
AMW-WD-02
AMW-WD-EXT
AMW-WD-03
AMW-WD-04
MWCD-02a
GW-19
SW-12
0 125 250
Feet
DETAIL C
SW-12
SW-11
WDAC
MWED-11
MWED-10
SW-6
MWBC-01
SW-4
SW-5
MWBC-03
SW-7
MWBC-02
BC-OY
MWBC-05
MWBC-04
BC-01
Lake Roosevelt
0 1750 3500
Feet
EXPLANATION
Surface water sampling location
Surface water and sediment sampling location
Regolith monitoring well
Planned regolith monitoring well
Bedrock monitoring well
Dewatering well
Planned dewatering well
Blue halos denote wells generally monitored for water levels only (see Table Q1-3)
Paved road
Dirt road or trail
Waste Containment Area
Other Remediated Areas
NOTE:
Regolith is the unconsolidated material overlying competent bedrock, and depending on location includes waste rock, alluvium, colluvium, glacial out-wash, and weathered bedrock.
MWH
Midnite Mine
FIGURE Q1-6
ANTICIPATED POST-REMEDY MONITORING NETWORK
DRAWN BY D. Severson
5 Jun 2015
J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\Basis of Design Rpt\FIGURES_100 Percent\FIGURES\Fig Q1-6_Anticipated Post-Remedy Monitoring Network_Jun2015.mxd

Attachment Q1-A

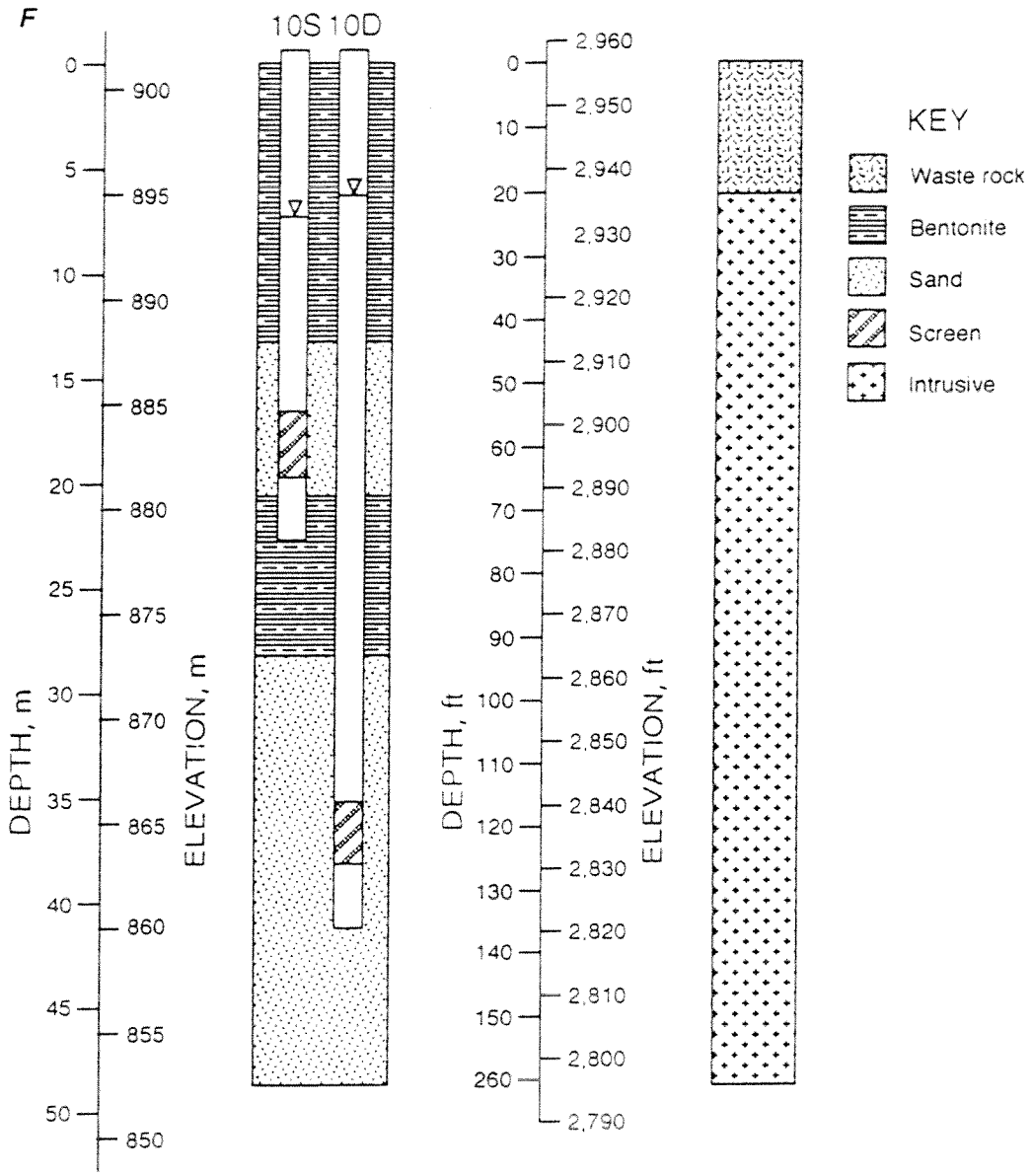
Well Completion Diagrams and Lithology Logs

Figure 4

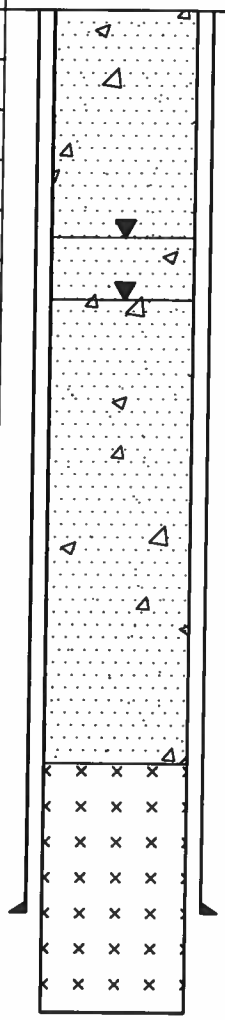


Well construction details and lithologic logs of drilling locations. A, Wells 2S and 2D.

Figure 4—Continued



F, wells 10S and 10D.

REMARKS	DEPTH (FT)	WELL LOG	GEOLOGY
COLLAR ELEVATION = 2328.11' N 6043.33 E 10844.65 TOTAL DEPTH = 20' WATER LEVEL 4/25/91 = 4.6' WATER LEVEL DURING 1979 DRILLING = 5.8'	2 4 6 8 10 12 14		OVERBURDEN
CASING SET AT 18'	16 18		PORPHYRITIC QUARTZ MONZONITE
CASING REPLACED WITH PVC AND 8' SCREEN – 6/10/80	20		

SMI
SHEPHERD MILLER, INC.

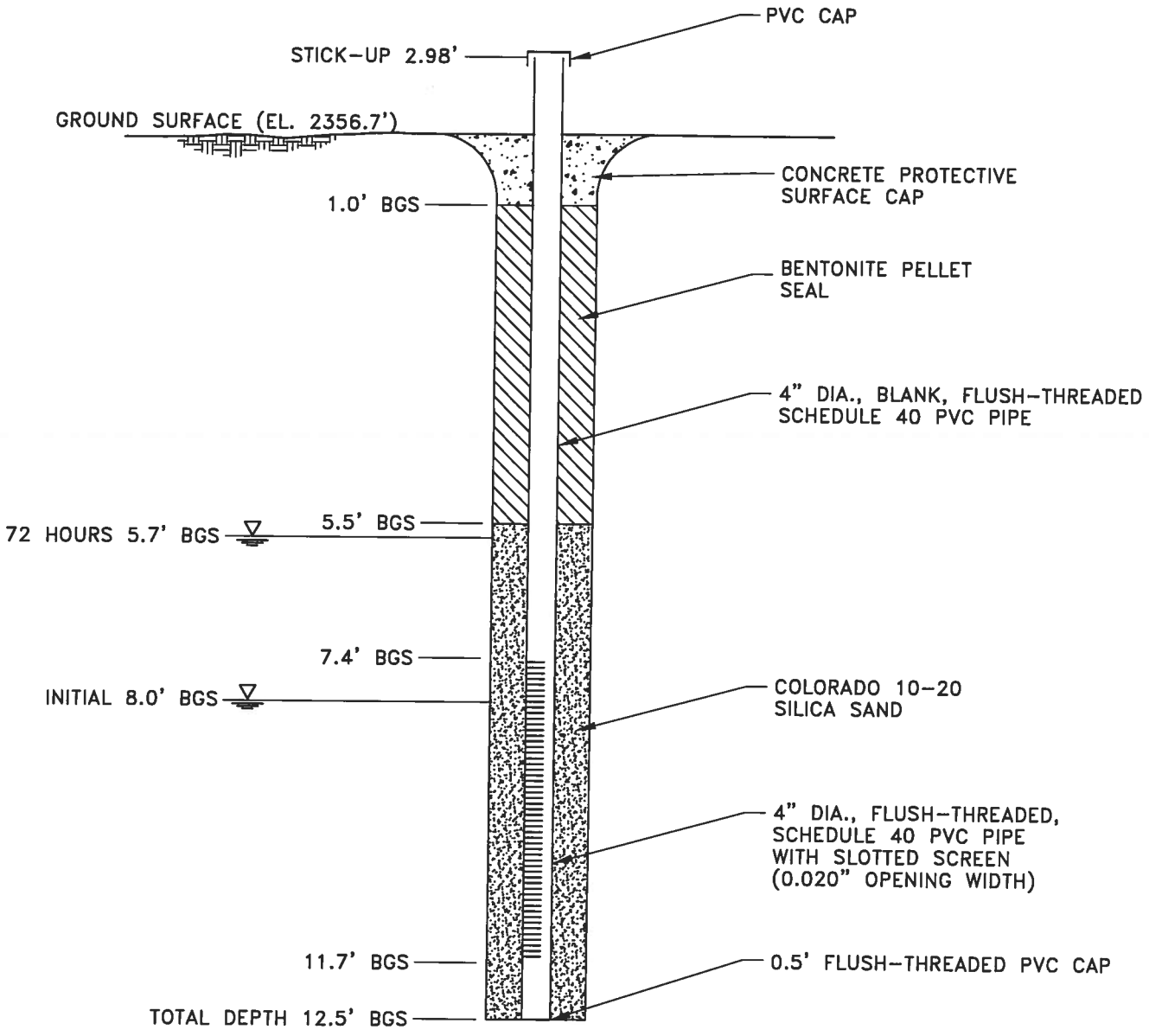
WELL LOG #19

Date: JULY, 1991

Project: 252

Assumed that well was renamed GW-19

GW-35A
LOCATION
N 351703.55'
E 2671089.95'

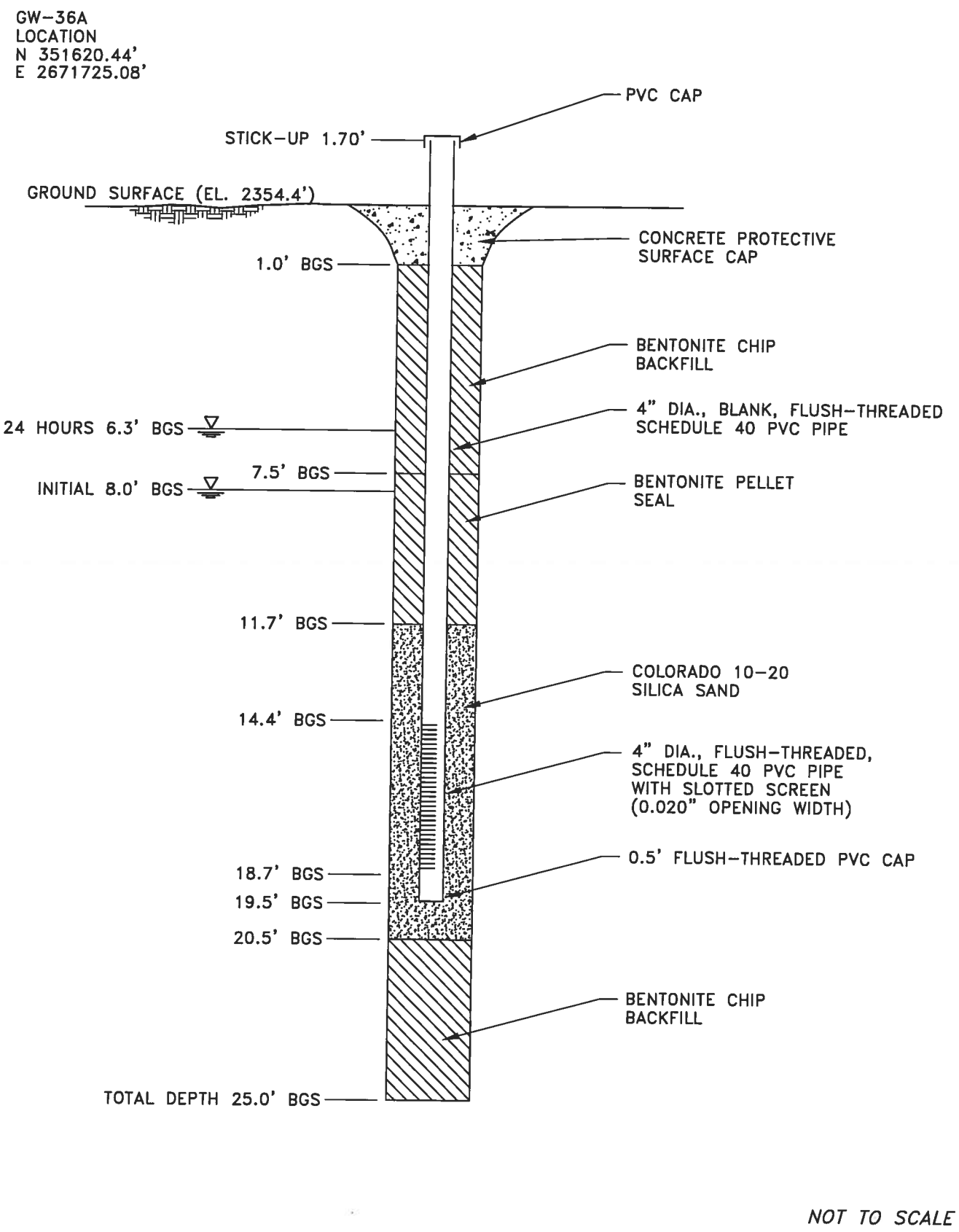


NOT TO SCALE

SHEPHERD MILLER
INCORPORATED

GW-35A MONITORING WELL
COMPLETION DETAILS

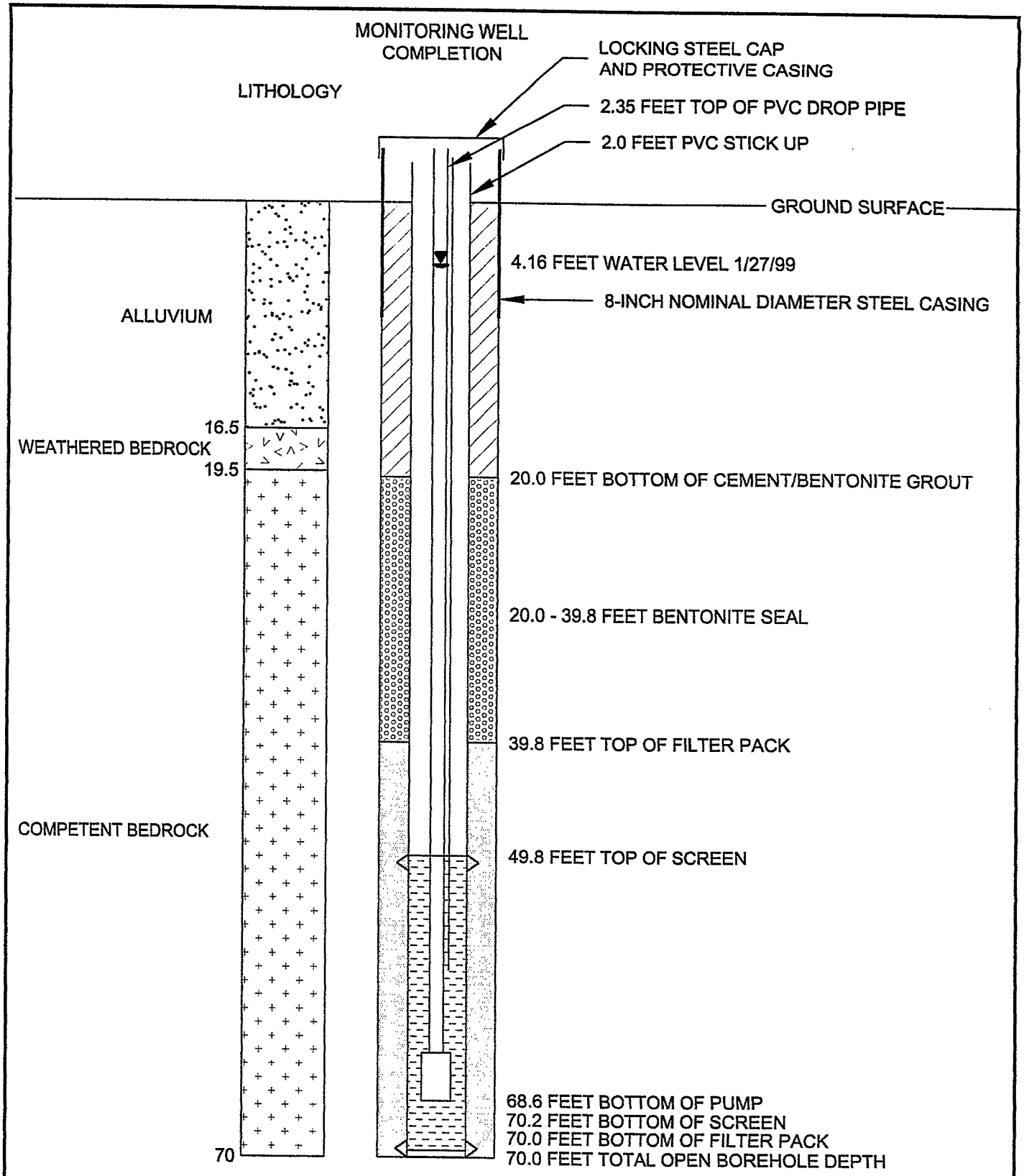
Date:	OCT. 1996
Project:	01-252
File:	WELL-2



SHEPHERD MILLER
INCORPORATED

GW-36A MONITORING WELL
COMPLETION DETAILS

Date:	OCT. 1996
Project:	01-252
File:	WELL-3

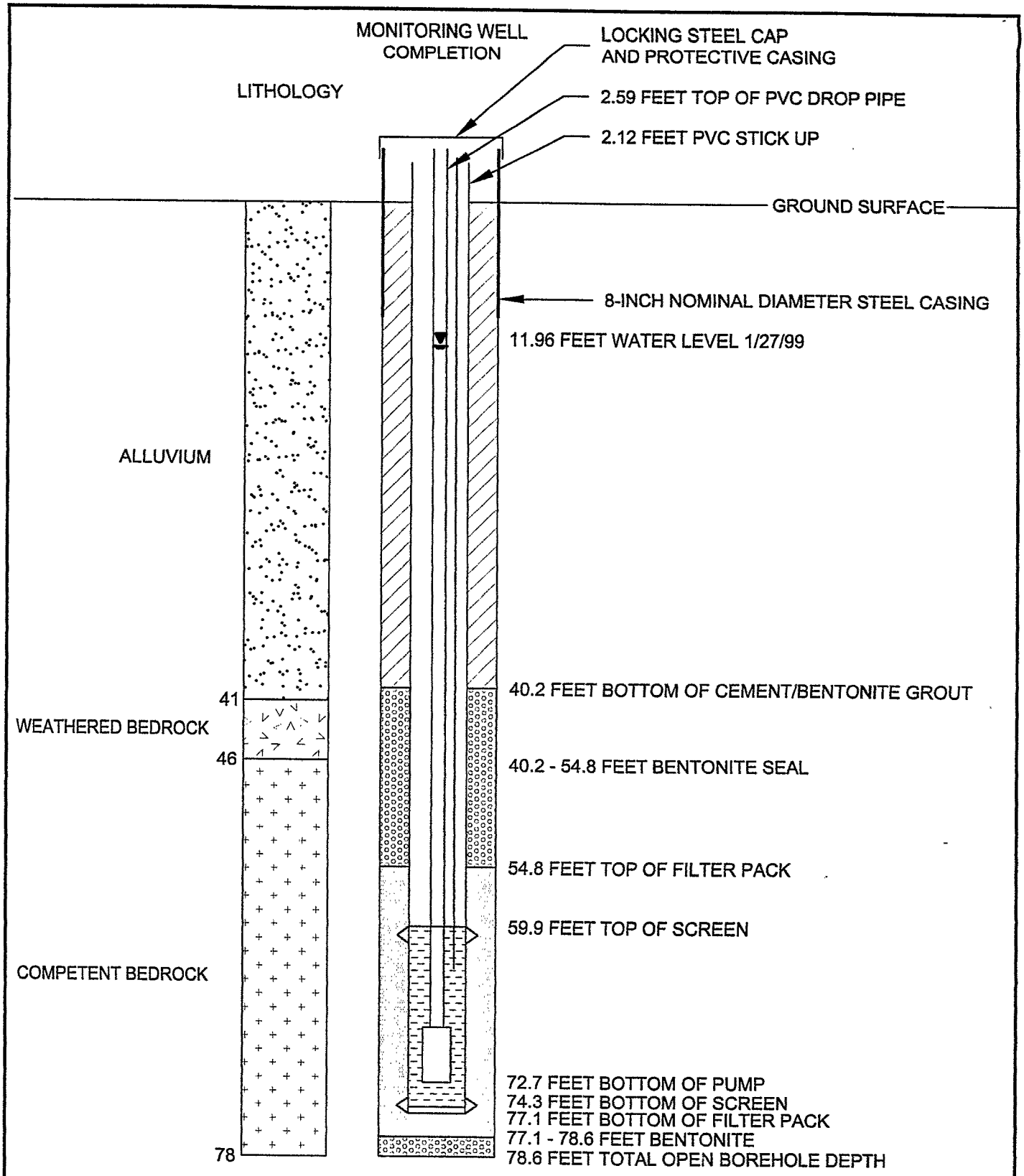


NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

GW-50

Date:	MARCH 1999
Project:	01-252\T7
File:	LI-GW50.dwg

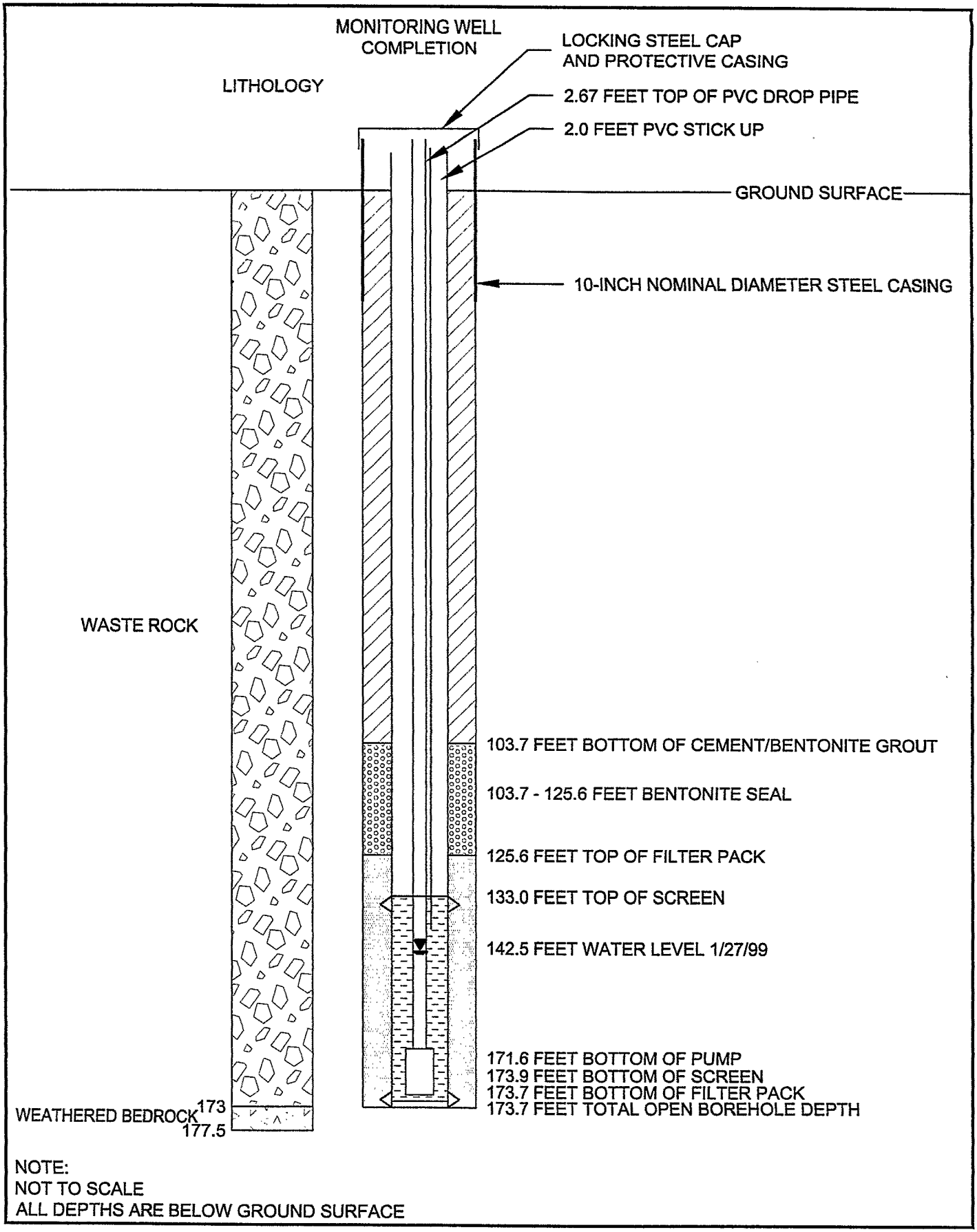


NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

GW-51

Date:	MARCH 1999
Project:	01-252\T7
File:	LI-GW51.dwg

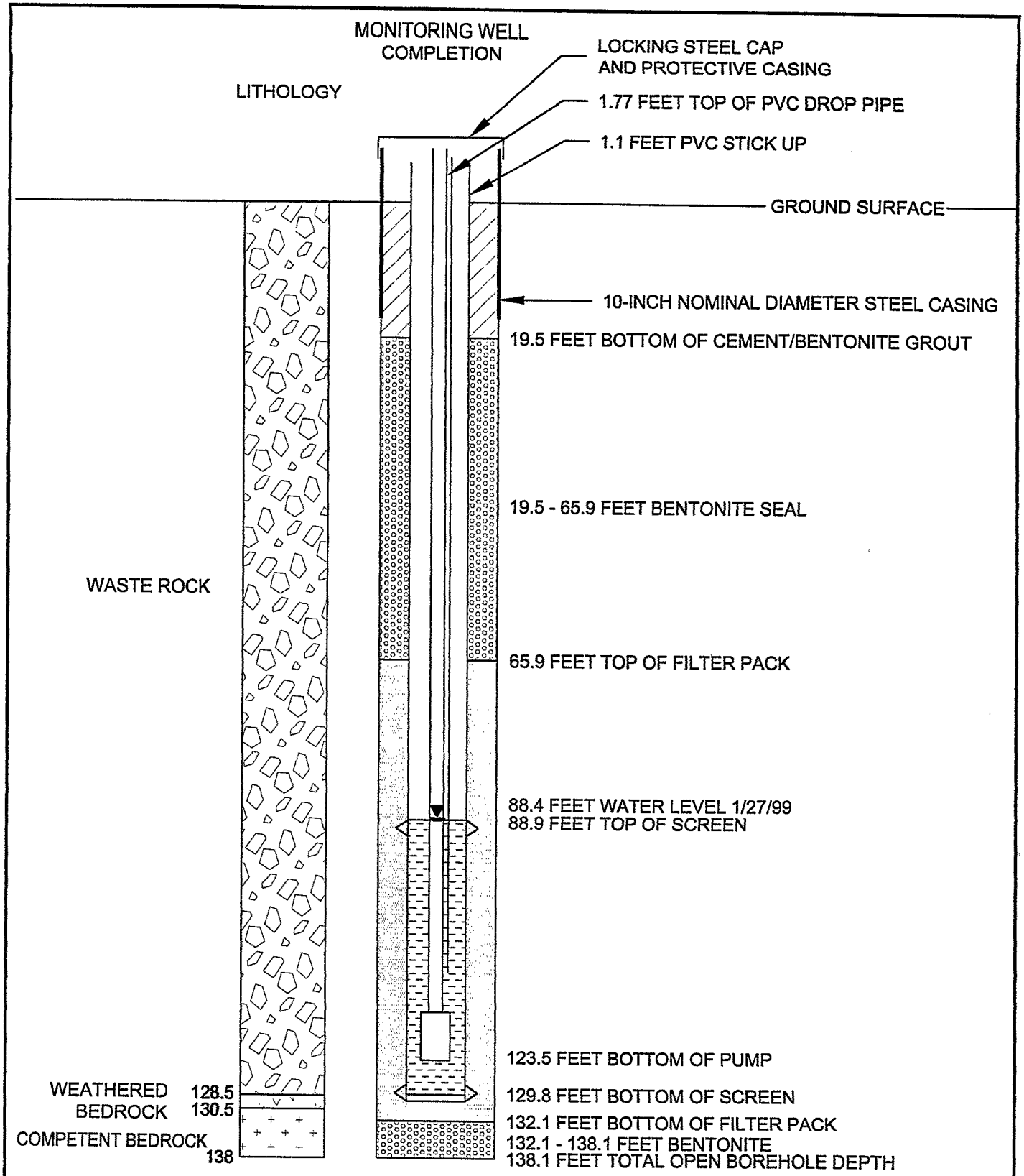


NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER INCORPORATED

GW-53

Date:	MARCH 1999
Project:	01-252\T7
File:	LI-GW53.dwg



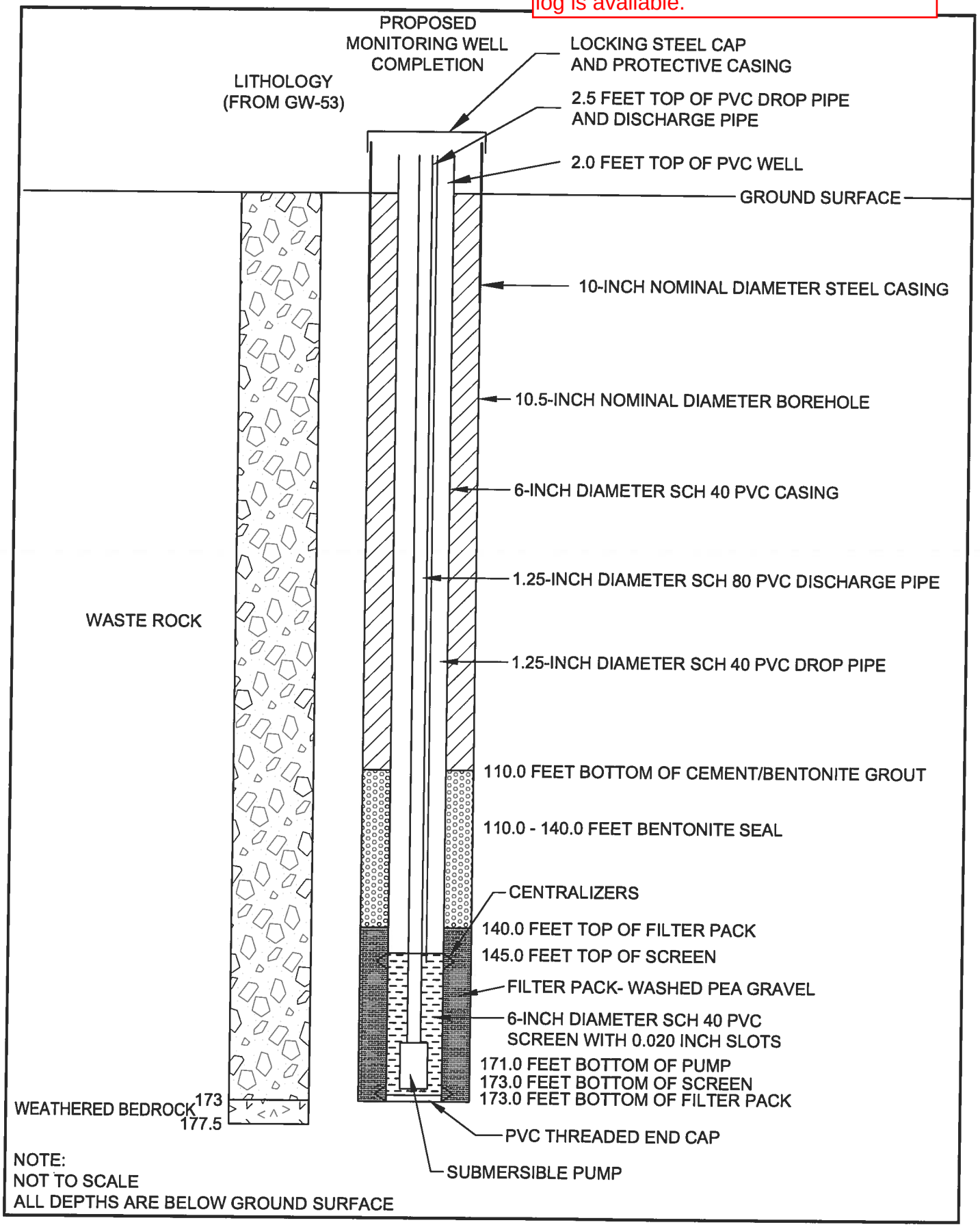
NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

GW-54

Date:	MARCH 1999
Project:	01-252\T7
File:	LI-GW54.dwg

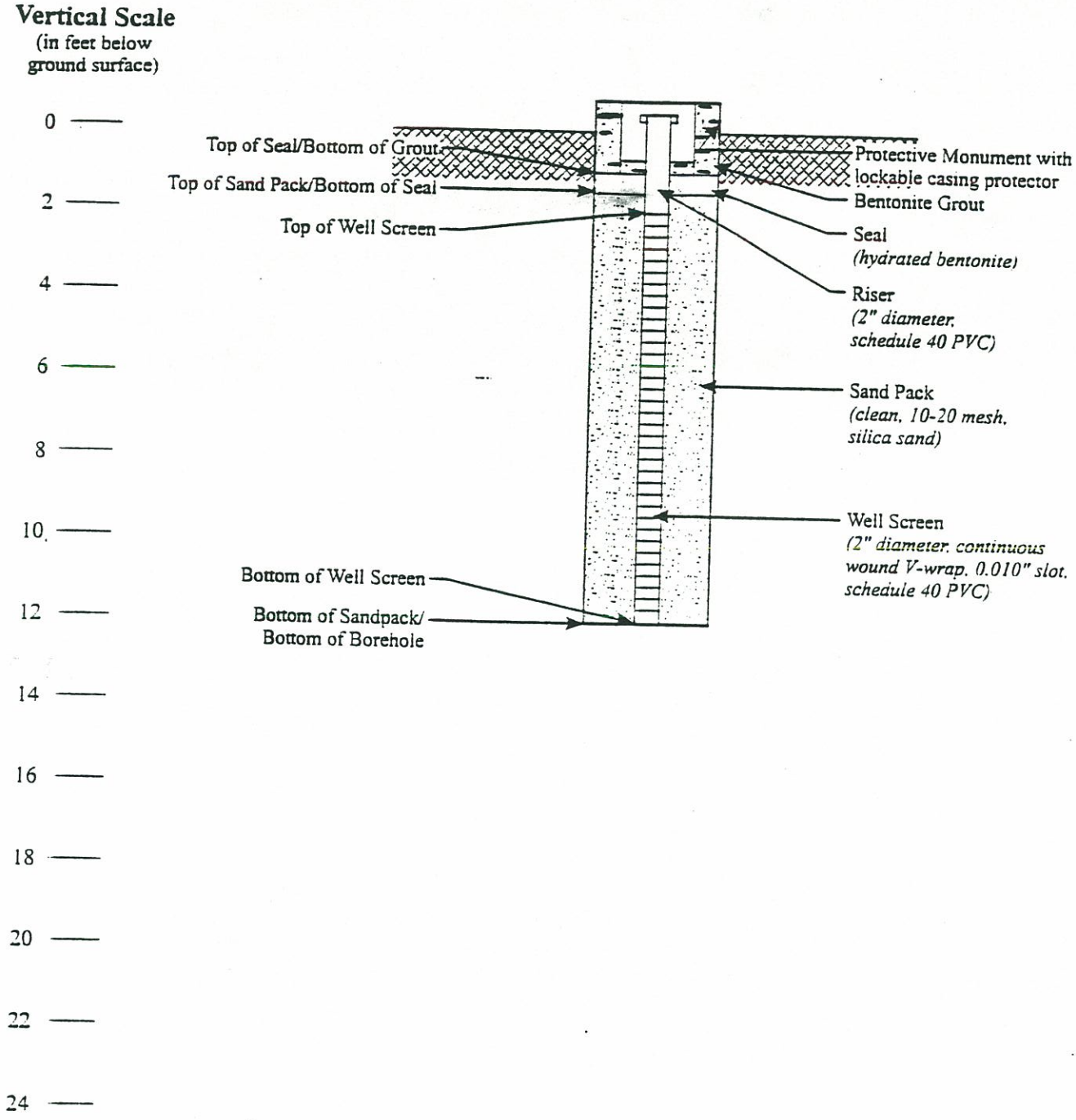
It is assumed that well was completed as proposed on this diagram. No other well log is available.



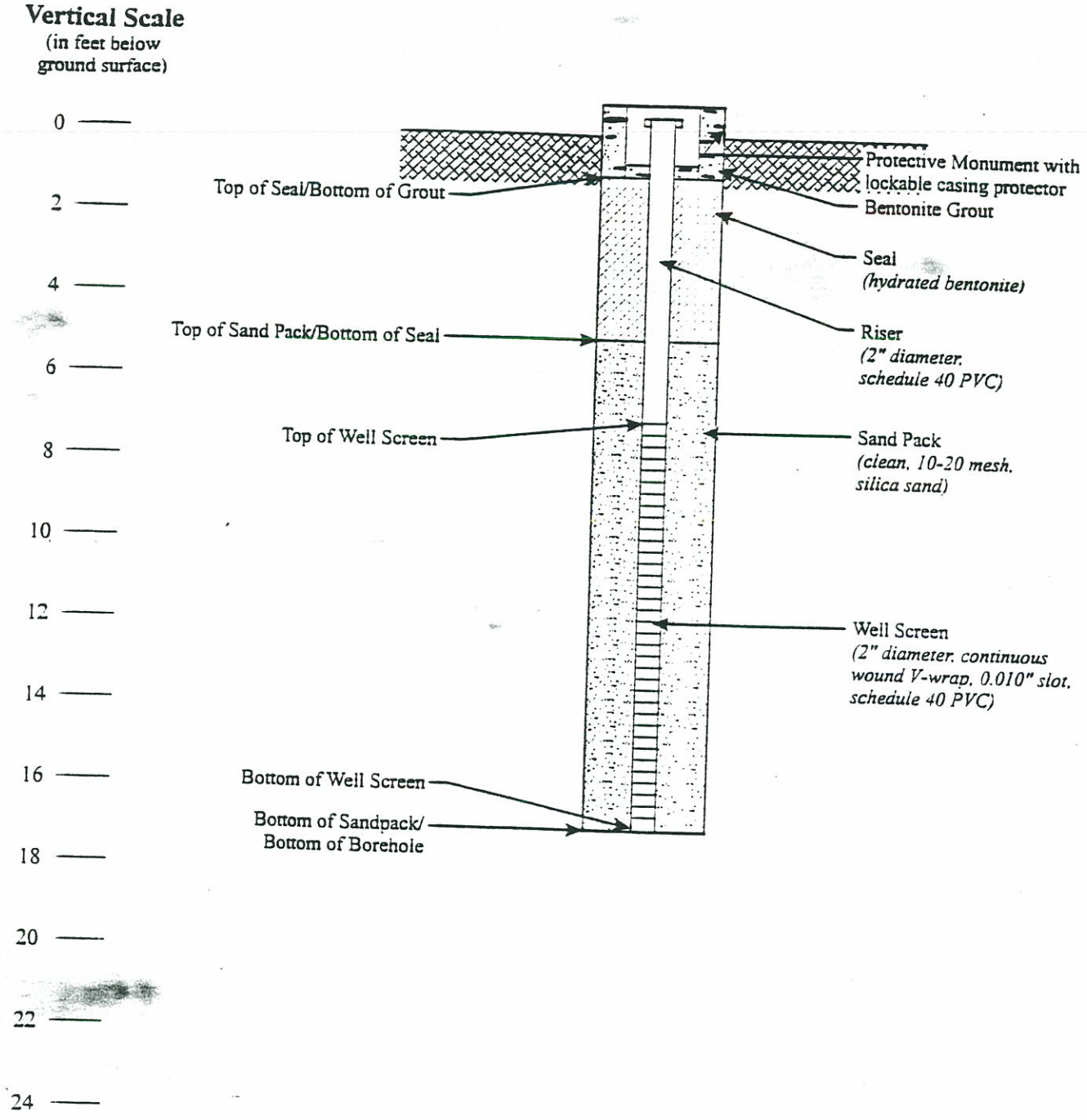
SHEPHERD MILLER
INCORPORATED

FIGURE 2
PROPOSED COMPLETION GW-58

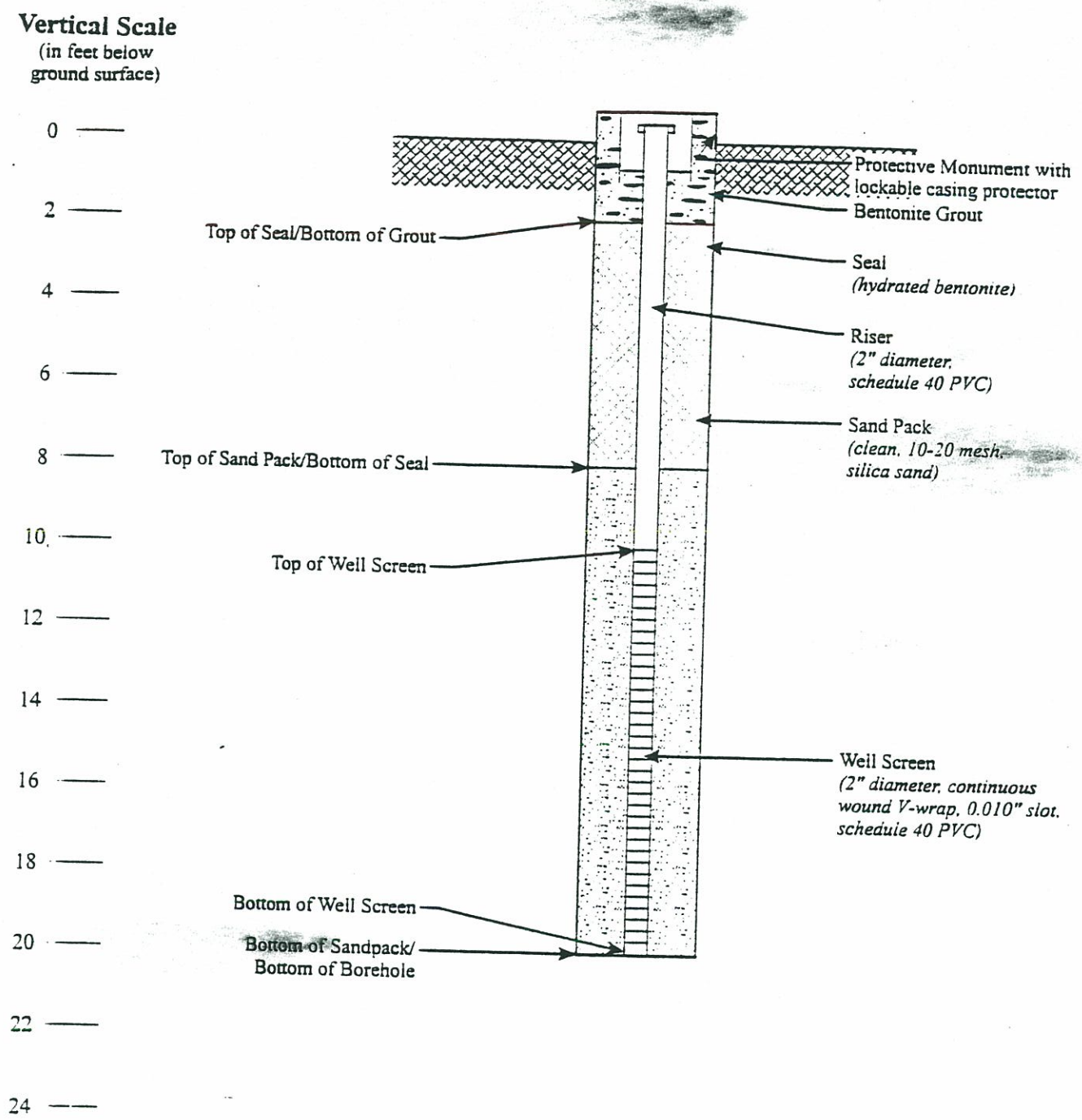
Date:	SEPTEMBER 2000
Project:	01-252\T7
File:	LI-GW58.dwg



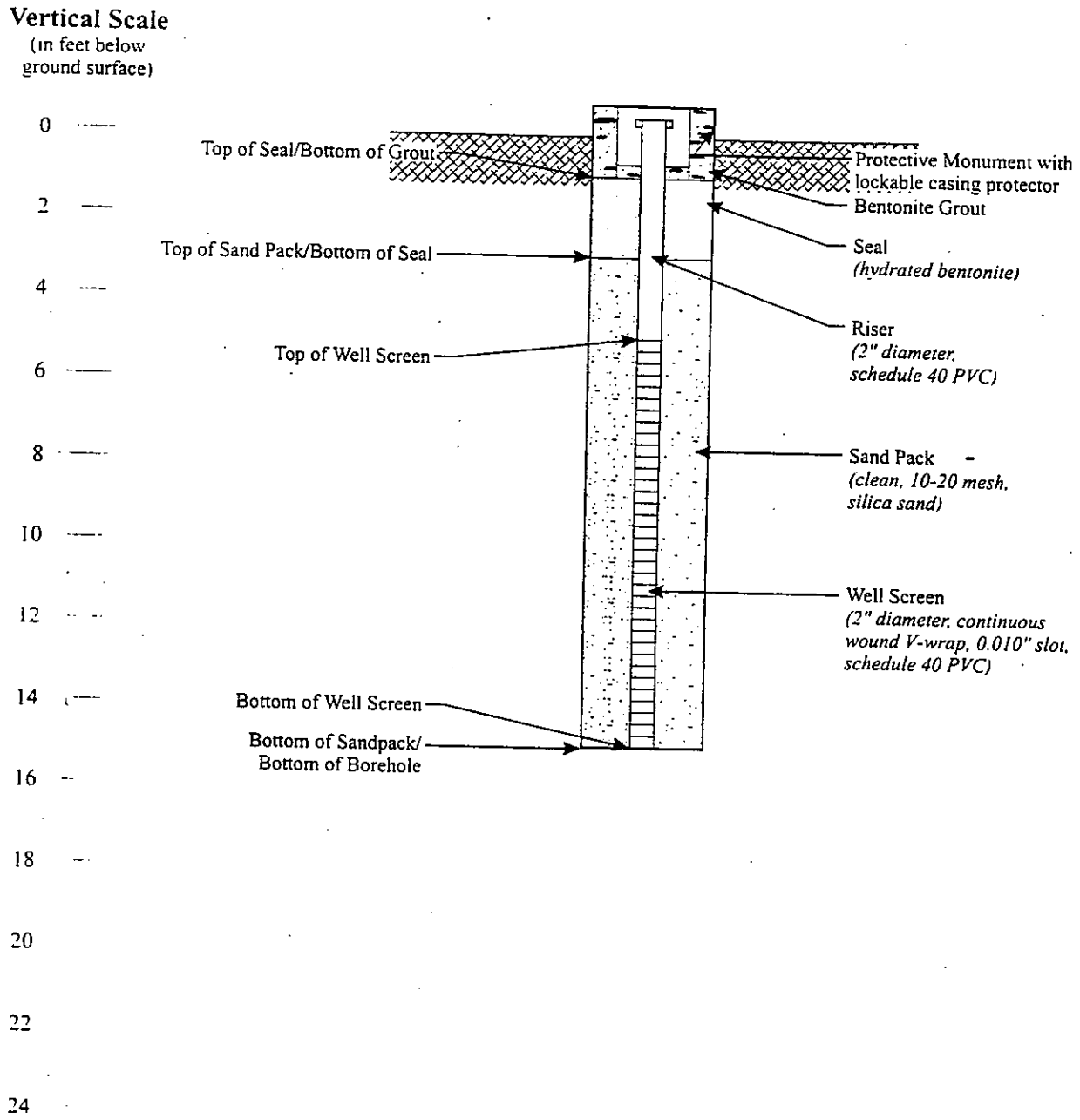
ecology and environment, inc. International Specialists in the Environment Anchorage, Alaska	MIDNITE MINE Wellpinit, Washington	MONITORING WELL MW-01			
	NOTE: Vertical Scale: 1/2" = 2' Horizontal Scale: None	Drawn: AES	DATE: 8/28/98	JOB NO. BG1001SRT0	Dwg.No. BG1001F16



ecology and environment, inc. International Specialists in the Environment Anchorage, Alaska	MIDNITE MINE Wellpinit, Washington	MONITORING WELL MW-02			
	NOTE: Vertical Scale: 1/2" = 2' Horizontal Scale: None	Drawn: AES	DATE: 8/28/98	JOB NO. BG1001SRT0	Dwg.No. BG1001F16



ecology and environment, inc. International Specialists in the Environment Anchorage, Alaska	MIDNITE MINE Wellpinit, Washington	MONITORING WELL MW-04			
	NOTE: Vertical Scale: 1/2" = 2' Horizontal Scale: None	Drawn: AES	DATE: 8/28/98	JOB NO. BG1001SRT0	Dwg.No. BG1001F16



ecology and environment, inc. International Specialists in the Environment Anchorage, Alaska	MIDNITE MINE Wellpinit, Washington	MONITORING WELL MW-05			
	NOTE: Vertical Scale: 1/2" = 2' Horizontal Scale: None	Drawn: AES	DATE: 8/28/98	JOB NO. BG1001SRT0	Dwg.No. BG1001F16

URS

Project Name:	Phase 2A/1B RI/FS
Project Location:	Midnite Mine
Project Number:	53F4001800.03

Log of Boring MWBC-01

Date(s) Drilled: 10-24-00 TO 10-26-00	Logged By: GARRETT BROWN/CH2M HILL	Total Depth of Borehole (ft): 31.4' bgs	
Drilling Method: AIR ROTARY WITH CASING ADVANCE	Diameter of Borehole (in): 9 3/4" TO 26' THEN 8 1/2" TO 31.4'	Ground Surface Elevation (ft-msl): TBD	
Drill Rig Type: SPEEDSTAR 30K	Drilling Company: CASCADE	Groundwater Elevation (ft-msl): TBD	
Driller's Name: R. LEININGER / Sampler Type: CYCLONE GRAB SAMPLE	Checked By: DK Nicholson	Measuring Point Elevation (ft-msl): TBD	
Locations / Comments: NE 1/4, SW 1/4, SEC. 13, T28N, R37E		Northing / Easting: TBD	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	GRAB				10YR 4/3	ML		Silt - brown, minor sand, moist, slightly cohesive, organic debris.	1640 - Started drilling. Driving casing to keep borehole open. RAD = 60 uR/h. Easy drilling.
					↓	GM		Silty-gravel at 3'.	
5	GRAB				10YR 4/4	SM-GM		Silt, sand and gravel - dark yellowish brown, moist, sub-angular to sub-rounded, slightly cohesive matrix, slightly iron stained. Parent material is quartz monzonite.	1644; R=51 uR/h. Rapid, easy drilling
10	GRAB				10YR 5/4	GM-GC		Silty to clayey gravel - damp, yellowish brown, angular to sub-rounded.	1652; R=34 uR/h. Rapid easy drilling
15	GRAB				10YR 6/2	BEDROCK OR BOULDER?		Hit resistant rock at 12', wet, but not producing water. Porphy. qtz monzonite - hard, light brownish gray (unweathered), slightly weathered, fairly competent, coarse-grained, pink K-feldspar, smoky qtz, plagioclase, biotite, all angular grains	Slower drill rate. Difficult driving casing. 1710 R=26 uR/h. Initially drilled open hole 16'-29', then had to case down to 26'; sloughing.
20	GRAB				↓	↓	↓	Porphy. qtz monzonite - as above, but dry, very hard, unweathered, competent, angular cuttings.	1808; R=26 uR/h. Slow drill rate. Wet again at 21'.
25	GRAB				10YR 6/2	RUBBLE		Rubble zone - qtz monzonite, saturated, weathered, soft, sloughing, some rounded cuttings; 0.5 GPM	1850 Soft; muddy. Very rapid drill rate. 1855 END OF DAY
30	GRAB				↓	BEDROCK		Porphy. qtz. monzonite - saturated, as above, soft, until 25 1/2'. Then hard. Hard, competent qtz monzonite at 27' sample; 0.5 gpm; iron stained weathered; angular cuttings. getting harder at 29 FEET	10-25-00: 0846, SWL at 11'; TD=18.9' Sloughed in. Drove casing to 26'. Bailed off slough zone 22-25. Hard slow drill rate

URS	Project Name:	Phase 2A/1B RI/FS	Log of Boring MWBC-01
	Project Location:	Midnite Mine	PAGE 2 OF 2
	Project Number:	53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				10YR 6/2	BED-ROCK		Porphy. qtz. monzonite - orientated, hard angular cuttings, 0.5 gpm, slightly weathered and iron stained, light brownish gray (unweathered) pink K-feldspar, smoky quartz, plagioclase, 5-10% biotite, chlorite alteration, coarse grained	1026: R=36uR/h Very hard drilling 1050 - Stopped drilling.
35									

Stopped drilling at 10:50; after cleaning out borehole and tripping the drillrods, the TD was at 31.4' bgs. Decided to complete the ~~well~~ G.B. well with 20 feet of 10-slot screen in order to screen the rubble zone at 22-25' and still have some of the screen above the water table. Set the screen from 7 to 27' bgs. A six-inch end cap is below the screen. Centralizers at top and bottom of screen. Combination of CSSI 10-20 and 20-40 sand between 5' and 31.4' bgs. Bentonite chips 2-5' bgs. SWL on 10-26-00 at 10.8' bgs

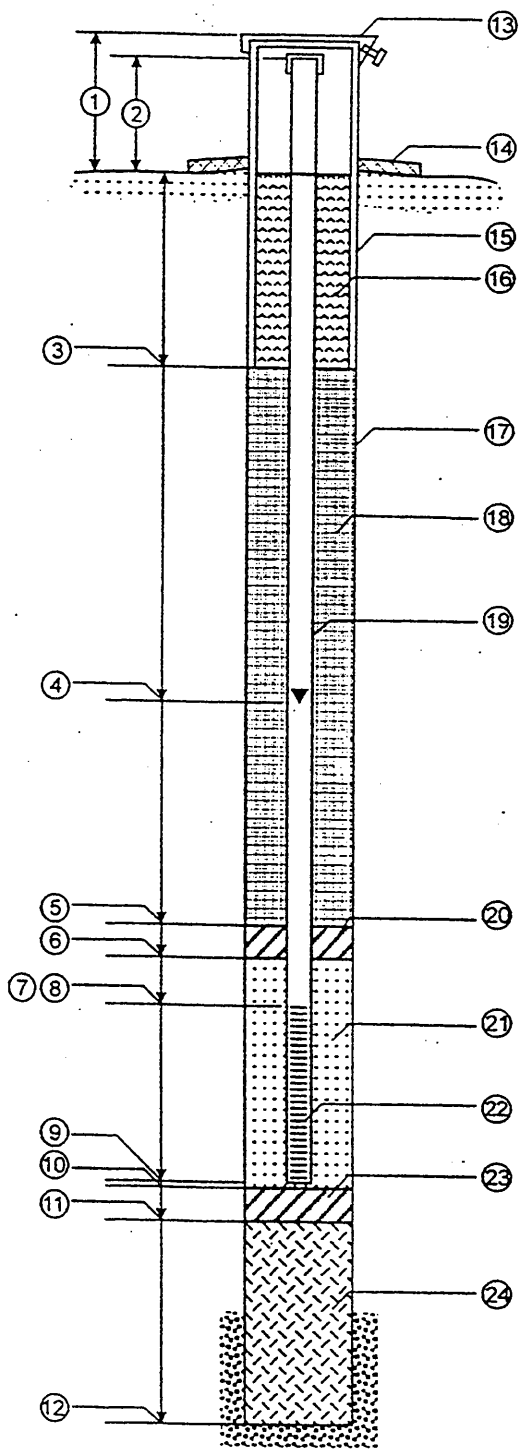
URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number	Project Name	Date/Time Started
53F4001800.03	MIDNITE MINE PHASE IIA/IB	10-24-00/16:40
Well/Borehole Number	**Well/Borehole Location**	**Date/Time Completed**
MWBC-01	BLUE CREEK	10-26-00/10:10

Installation Team	Type of Drilling	Ground Surface Elev.	Top of Well Casing Elev.
R.LEININGER/CASCADE G.BROWN/CH2MHILL	AIR ROTARY / CASING ADVANCE	TBD ft.msl	TBD ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: TBD ft.
2. Stick-Up Well Casing Above Ground: TBD ft.
3. Depth to Bottom of Upper Seal/Protective Casing: TBD ft.
4. Depth to Initial Ground Water Surface Elevation: 10.8' bgs ft.
5. Depth to Top of Top Seal: 2.0' bgs ft.
6. Depth to Bottom of Top Seal: 5.0' bgs ft.
7. Depth to Top of ~~Well Point or~~ Screen: 7.1' bgs ft.
8. Total Length of Blank Casing: FROM G.S.: 7.1' ft.
9. Bottom Depth of Well Screen: 27.1' bgs ft.
   WELL DEPTH w/ ENDCAP = 27.6' bgs
10. Depth to Top of Bottom Seal (If Installed): NA ft.
11. Depth to Bottom of Bottom Seal (If Installed): NA ft.
12. Depth of Borehole: 31.4' bgs ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: ~~TBD~~ steel Diameter: 8 in.
16. Type of Upper Seal: WILL BE CONCRETE
17. Borehole Diameter: 9 3/4" TO 26' THEN 8 1/2" TO T.D. in.
18. Type of Upper Backfill: NA
19. Type of Well Casing: SCH80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): MEDIUM BENTONITE CHIPS 2.0' TO 5.0' bgs
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 5.0 TO 31.4' bgs 10-20+ 20-40 SAND Diameter: 20-40 in.
22. Type of Screen Material: SCH.80 SLOTTED Slot Size: 0.010 in.
23. Type of Bottom Seal (If Installed): NA
24. Type of Lower Backfill: NA

Recorded By:	Date	Checked By:	Date
Garrett Brown	10-26-00	David K Nicholson	11/12/01

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWCD-01
	Project Location: Midnite Mine	1 OF 2
	Project Number: 53F4001800.03	

Date(s) Drilled	10/7/99-8/99	Logged By	ROBERT MARTIN	Total Depth of Borehole (ft)	117.5
Drilling Method	AIR ROTARY 8" NOM	Diameter of Borehole (in)	8"	Ground Surface Elevation (ft-msl)	2429.69
Drill Rig Type	STAR 30K	Drilling Company	CASCADE	Groundwater Elevation (ft-msl)	107' BGS
Driller's Name	TODD	Sampler Type	cyclone	Checked By	DK Nicholson	Measuring Point Elevation (ft-msl)	GROUND SURFACE
Locations / Comments	Central Drainage					Northing / Easting	352337 / 2671713

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer Saturation	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	1609		160			SC		CLAYEY SAND - MOIST, DARK BROWN, FINE SAND	
8	1618 1626		155			SC		CLAYEY SAND - DARK BROWN, FINE SAND.	8' - ADDING WATER ADD RODS AT 8' FOR DRILLING.
13	1630 1637		50			CL		CLAY WITH SAND - GRAY, FINE SAND.	
18	1641 1657		50			CL		CLAY WITH SAND - GRAY CLAY W/ LIGHT BROWN LUMPS OF CLAYEY SAND	
23	1700		60			CL		CLAY WITH SAND - GRAY W/ COARSE SAND	
28	1703 1740		65			CL		CLAY WITH SAND - SAME AS ABOVE	28 - @ BOTTOM SOME YELLOW-BROWN SAND POSSIBLE BEDROCK.
33	1752 1755		40					QUART MONZONITE, MEDIUM TO COARSE GRAINED	30 - HOLE MAKING 1-2 GPM 31 - IN BEDROCK, HARDER DRILLING.
38	1803 1857		35						10/8/99 - WATER IN HOLE AT START
43	800		53						
48	805 810		45						48 - CUTTINGS DRY
53	814		45						54 - A LITTLE HARDER NO WATER AT START
58	819 823		50						
63	831		50						62 - HAVING TROUBLE W/ CUTTINGS COMING OUT OF HOLE.
68	840 846		55						66' - ADDING MORE WATER TO CLEAR CUTTINGS.
73	854		45						

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWCD-01 2 OF 2
	Project Location: Midnite Mine	
	Project Number: 53F4001800.03	

Date(s) Drilled 10/7/99	Logged By ROBERT MARTIN	Total Depth of Borehole (ft) 117.5
Drilling Method AIR ROTARY 8" NOM	Diameter of Borehole (in) 8'	Ground Surface Elevation (ft-msl)
Drill Rig Type STAR 30K	Drilling Company CASCADE	Groundwater Elevation (ft-msl) 107' BGS
Driller's Name TODD / Sampler Type	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) GROUND SURFACE
Locations / Comments		Northing / Easting

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	RQD (%)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
78	90 / 91		50						78 - WET AT START BUT INJECTING WATER POSSIBLE H_2O AT 78-79 (AS PER TODD). 80' - STOPPED INJECTING H_2O, LOOKS WET. 83' - NOT INJECTED H_2O CUTTINGS WET IN CLUMPS 89' - INJECTING H_2O
83	91 / 6		40						
88	92 / 93		45						
93	93 / 9		40						
98	94 / 95		45						98-98 DRILLER SAYS HARD 99 - SOFTER DRILLING
103	100		30						107 - LARGE 1-2" ~~CHUNK~~ CHIPS OF ROCK IN CUTTINGS - FRESH NOT INJECTING H_2O WET AT 108'
108	100 / 101		50						
113	102 / 4		40						111' - HOLE PRODUCING A LITTLE WATER. < 1 GPM 114' - STARTED INJECTING WATER - TOO DRY TO GET CUTTING OUT.
118	103 / 5		30						
123								TOTAL DEPTH 117.5'	
12									
14									

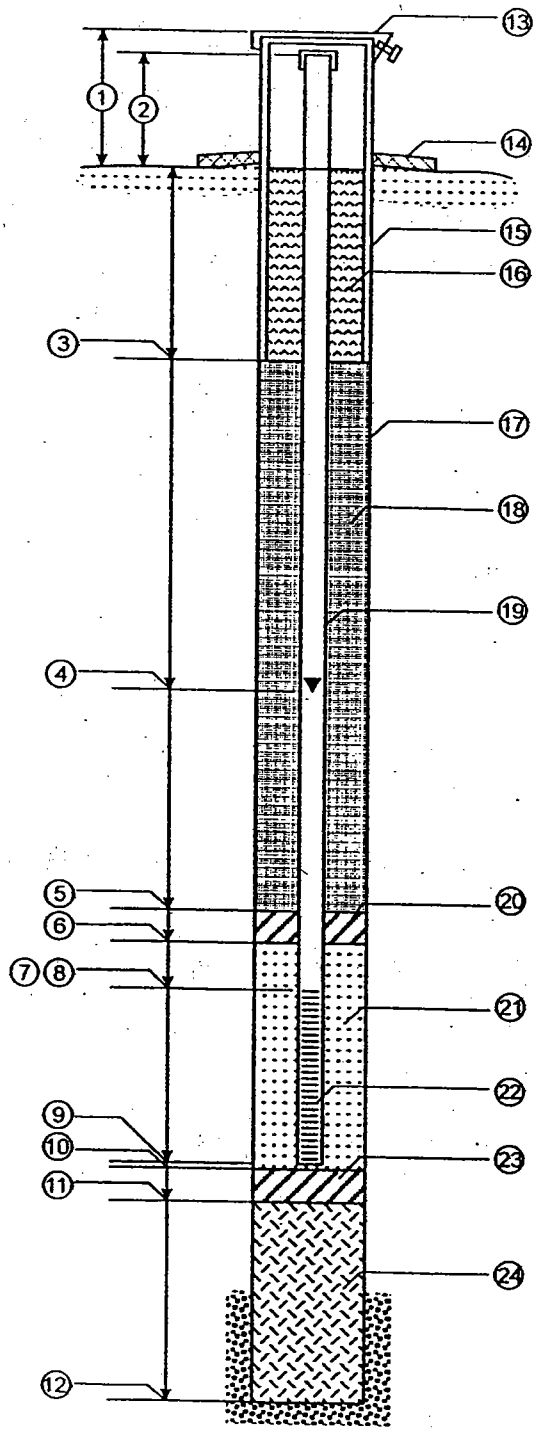
URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number	Project Name	Date/Time Started
53F4001800.03	MIONITE MINE	~~10/8/99~~ 10/7/99 16:00
Well/Borehole Number	**Well/Borehole Location**	**Date/Time Completed**
MWCD-01	Central Drainage	10/8/99 16:30

Installation Team	Type of Drilling	Ground Surface Elev.	Top of Well Casing Elev.
TEAM #3	AIR ROTARY	2429.69 ft.msl	2431.29 ft.msl



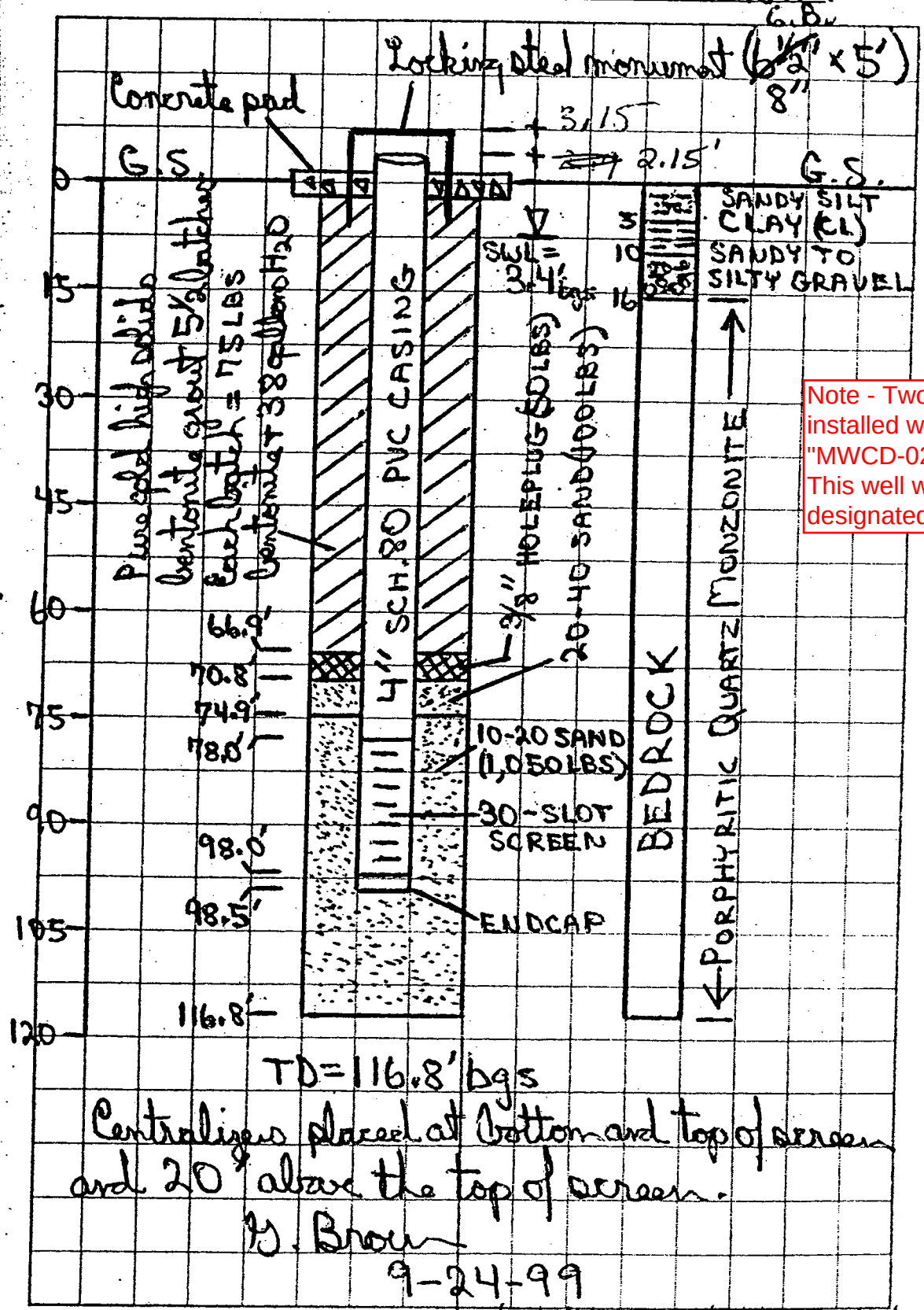
1. Stick-Up of Protective Casing (If Any) Above Ground: ~~2.45~~ 2.8 ft.
2. Stick-Up Well Casing Above Ground: 1.6' ~~2.7~~ ~~2.45~~ ft. DKN 10-12-99
3. Depth to Bottom of Upper Seal/Protective Casing: _____ ft.
4. Depth to Initial Ground Water Surface Elevation: _____ ft.
5. Depth to Top of Top Seal: 0 ft.
6. Depth to Bottom of Top Seal: 80 ft.
7. Depth to Top of Well Point or Screen: 95 ft.
8. Total Length of Blank Casing: 95 ft.
9. Bottom Depth of Well Screen: 115 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 117 ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: ~~Portland~~ Concrete DKN
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: cement/bentonite grout
19. Type of Well Casing: PVC SCH 80 Diameter: 4 in.
20. Type of Top Seal (IF Installed): PURE GOLD BENTONITE CHIPS
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10x20 Diameter: 8 in.
22. Type of Screen Material: PVC SCH 80 Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

Recorded By	Date	Checked By	Date
[signature]	10/7/99	DK Nicholson	4/26/00

Location MWCD-02 Date 9-24-99

Project / Client T28N-R37E-SEC.13-NE¼NW¼

WELL CD-02 COMPLETION DIAGRAM

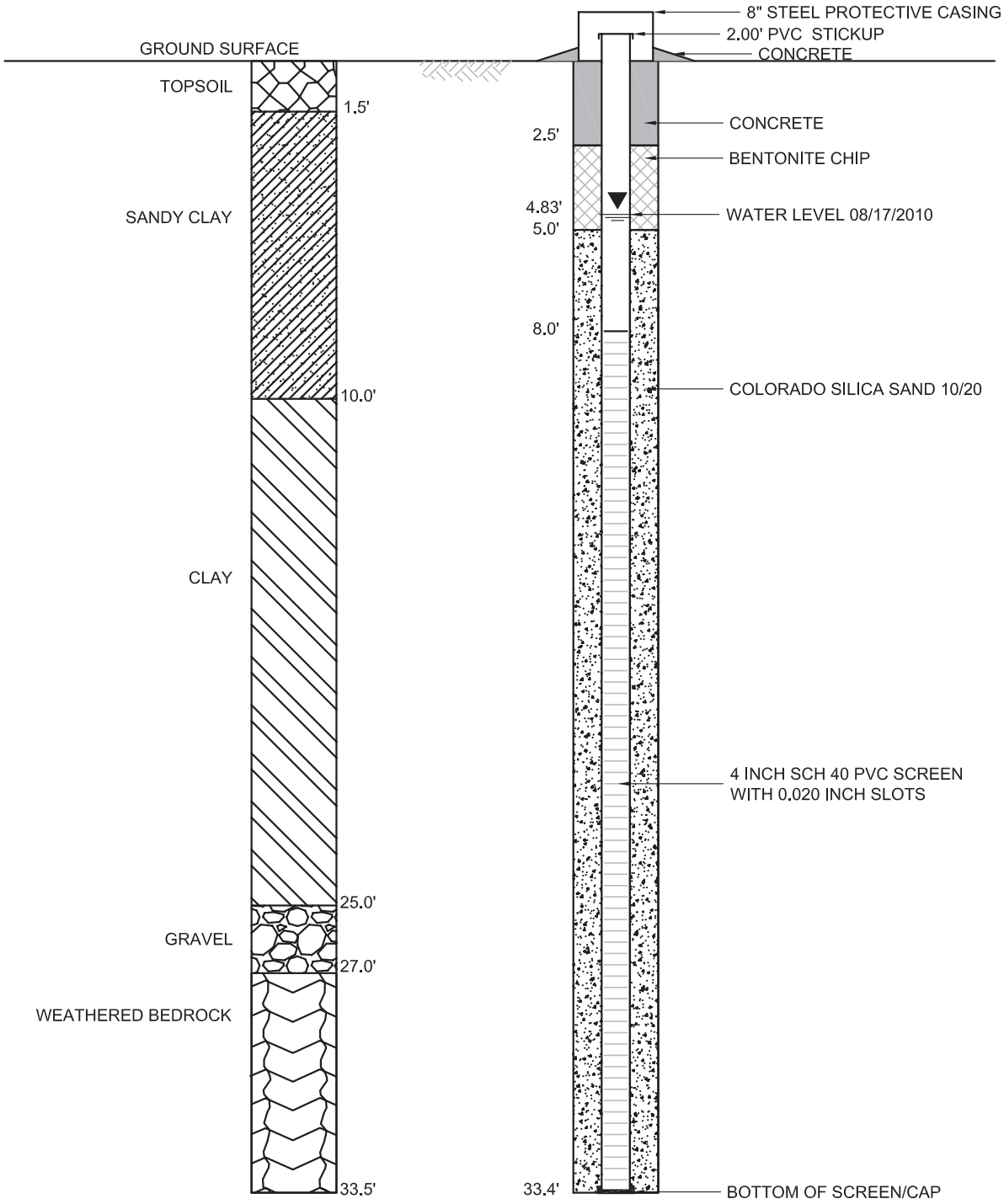


Note - Two wells were installed with the "MWCD-02" designation. This well was later designated "-02a"

Centralizers placed at bottom and top of screen and 20' above the top of screen.

D. Brown
9-24-99

checked by DK Nicholson 4/26/00



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED: 11/11/10 PRINTED: 12/20/10 BY: NEIL.BRENNAN

Project No. 181850

November 2010

Note - Two wells were installed with the "MWCD-02" designation. This well was later designated "-02b"

Figure 4
Well Completion Diagram MWCD-02

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW ED-03
	Project Location: Midnite Mine	PAGE 1 OF 4
	Project Number: 53F4001800.03	

Date(s) Drilled 9/25/99 - 9/26/99	Logged By GARRETT BROWN/CH2M HILL	Total Depth of Borehole (ft) 110.6' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 7 7/8" HAMMER BIT	Ground Surface Elevation (ft-msl) ~~TBD~~ 2467.74	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER / Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2469.76	
Locations / Comments 9 3/4" OD (8 1/2" ID) THREADED STEEL CASING		Northing ~~TBD~~ 353161 / Easting 2673202	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS (ED-03 is located 110' east of existing well MW-5)
	GRAB				10YR-5/8	ML		Surface material is silt, yellowish brown (10YR-5/8), dry, powdery non-cohesive.	9/25/99 10:30 Started drilling and driving casing. SWL=5.9' in nearby well MW-5
5	GRAB				10YR-3/6	GM-ML		Gravelly silt - dark yellowish brown, slightly moist, slightly cohesive w/ sub-rounded gravel (10%) up to 1 cm in diameter.	1038; RAD=58uR/h DUST=0.52mg/m³
10	GRAB				10YR-4/6	GM		Clayey gravel - dark yellowish brown clay and coarse sand (10-20%) matrix w/ sub-rounded gravel up to 2 cm, very moist to damp, cohesive, balling up	1052; RAD=91uR/h
15	GRAB				10YR-4/3	ML		Silt - brown, moist, slightly cohesive.	1056; RAD=68uR/h Checked for water at 18'. None present 1106-1120 - Rig down
20	GRAB				10YR-3/3	ML	23'	Silt - dark brown, moist, slightly cohesive, loose, easy drilling.	1122; RAD=44uR/h
25	GRAB					DECOMPOSED BEDROCK + SILT		Transition from silt to bedrock. Silt and highly decomposed bedrock. Difficult to discern mineral types in rock, yellowish brown, moist, moderately soft, easy drilling.	1125; RAD=67uR/h Water apparent at 28' Started drilling open hole at 28'.
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS Project Location: Midnite Mine Project Number: 53F4001800.03	Log of Boring ED-03 PAGE 2 OF 4

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				2.5Y-6/3	BEDROCK	x x x x x x x x x x x x x x x x x x x x x x x x	Calc-silicate hornfels - light yellow brown, slightly weathered, saturated moderately soft, composed mainly of quartzite and epidote. Minor calcite slight reaction w/ 10% HCl. fine-	1138; RAD=61uR/h
35	GRAB				10Y-7-1			Calc-silicate hornfels - as above, only more competent, moderately hard and color change to light greenish gray. Also trace of biotite present, and possible diopside. Slight reaction w/ HCL(10%) indicates calcite	1141; RAD=62uR/h
40	GRAB				10Y-7/1			Calc-silicate hornfels - as above Saturated but no H_2O production	1148; RAD=65uR/h
45	GRAB				10Y-7/1		+ +	Calc-silicate hornfels - as above and Marble - marble is massive, fine-grained, hard, light greenish gray, slightly moist, readily reacts w/ 10% HCl.	1158 RAD=58uR/h Injecting H_2O at 46' to lift cuttings. Shut off at 49; because borehole started producing 2-3gpm.
50	GRAB				10YR-6/1		+ +	Marble - saturated, producing 3-4gpm, greenish gray, massive very competent and hard, very pure consistent color, fine-grained, moderate reaction w/ 10% HCl	1218; RAD=57uR/h
55	GRAB				10YR-6/1			Marble - as above 3-4 gpm coming from borehole.	1240 RAD=48uR/h
60	GRAB				10YR 6/1			Marble - as above 3-4 gpm production from open borehole.	~~1286~~ C.B. 1258 RAD=36uR/h 1302 - Shut down to go empty dumpster cuttings. Resumed at 1358. Moderate water blown from hole.
65									

URS GREINER
Woodward Clyde

Project Name:	Phase 1A RI/FS
Project Location:	Midnite Mine
Project Number:	53F4001800.03

Log of Boring ED-03

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65	GRAB				7.5YR 4/1	BEDROCK		Marble, as above, plus minor amount of calc-silicate hornfels as earlier described. dark gray in color. mod. reaction w/ 10% HCl	1410- RAD=22uR/h
70	GRAB				10GY- 7/1			Marble - massive, pure, med-grained, very hard, light greenish gray; moderate reaction w/ 10% HCl; 3-4 gpm from borehole	1428 RAD=29uR/h
75	GRAB				2.5Y 5/1			Dolomitic marble - massive, very hard, fine-grained, gray 10% HCl reaction w/ powdered rock only. 3-4 gpm	1452 RAD=61uR/h
80	GRAB				10Y- 6/1			Marble - massive, pure, very hard, fine-grained, greenish gray	1510 RAD=26uR/h
85	GRAB				10Y- 6/1			Marble - as above Borehole still producing 3-4 gpm.	1524 RAD=34uR/h
90	GRAB				10GY 7/1			Dolomitic marble - massive, fine-grained, light greenish gray, very hard. 3-4 gpm; 10% HCl reaction w/ rock powder only	1603 RAD=47uR/h
95	GRAB				10GY 7/1			Dolomitic marble - as above	1635 RAD=59uR/h
100									

URS GREINER Woodward Clyde		
	Project Name:	Phase 1A RI/FS
	Project Location:	Midnite Mine
	Project Number:	53F4001800.03

Log of Boring ED-03

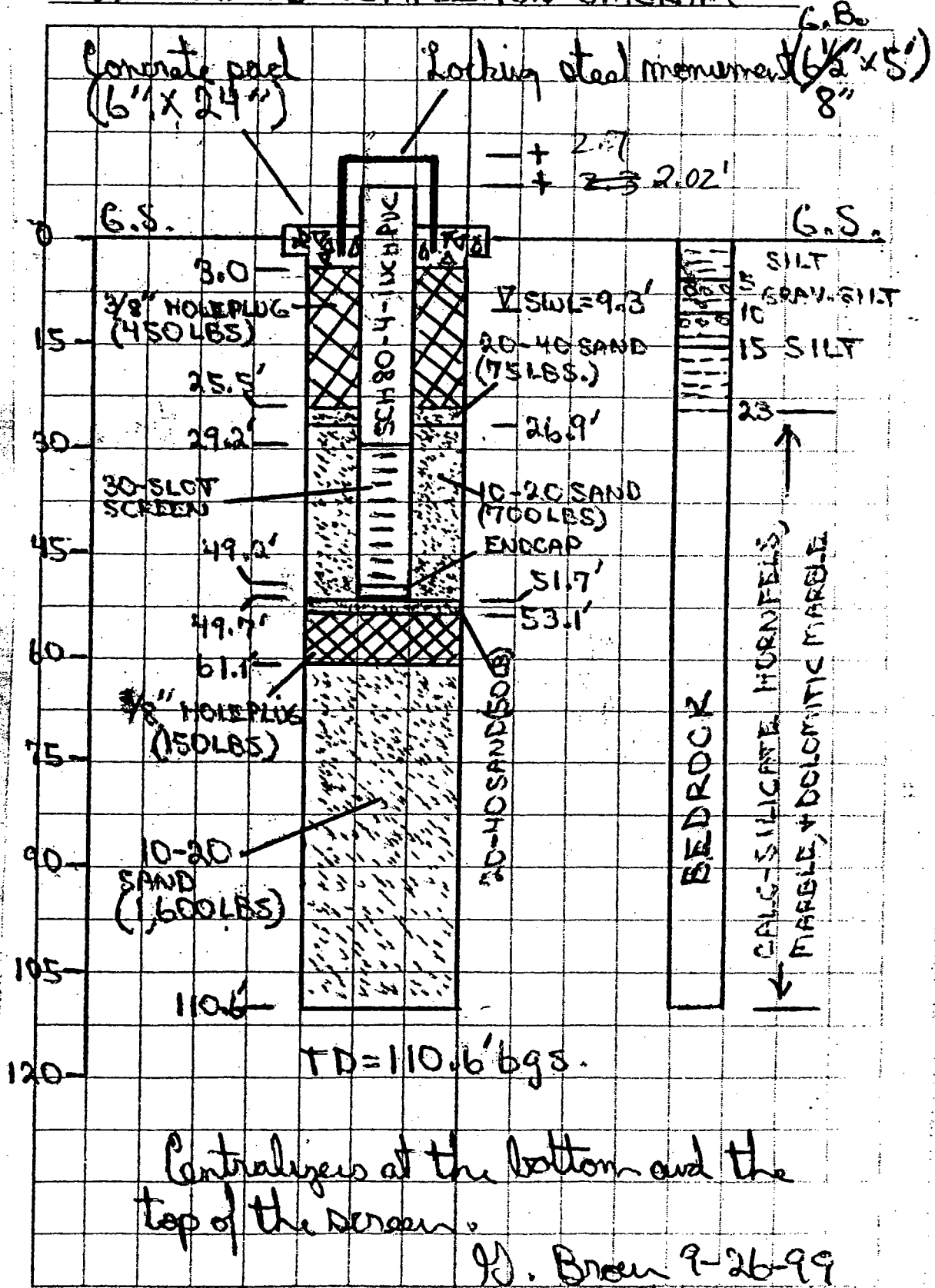
Depth (ft-bgs)	Samples: Blows/Foot	Samples: Recovery (ft)	Samples: PID (ppm)	Samples: Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'	GRAB				N-7/1	BEDROCK	x x x	Calc-silicate hornfels- moderately hard, fine-grained, mainly qtz. and epidote. Calcite coating present on some grains. light gray; 3-4 gpm	1658 RAD=21uR/h
105'	GRAB				10GY 6/1	(BEDROCK, continued ↓)	x x x	Calc-silicate hornfels- as above only color change to greenish gray. No calcite coating; minor 10% HCl reaction. Trace of pyrite.	1720 RAD=27uR/h
110'	GRAB						x x x	Calc silicate hornfels at 110'. TD=110.6' bgs.	1750 RAD=42uR/h. 1752-Circulated w/ water for 2 minutes to clean out. 1754-1810-Tripped hole of rods. 9/26/99- Re-tagged bottom of hole at 110.6'. No slough. SWL= 9.7' bgs 0830-1030- Ran geophysics 1100-1430 Completed well and packed out steel casing.
115'									
120'									
125'									
130'									
135'									

Notes: Ran caliper, temp, natural gamma, and S.P. logs. SP log not useful. Gamma log had slightly elevated counts at 66, 68, and 75' bgs. However, the caliper log showed no widening of fractures below 36'. Temp log decreased slowly to 36' then become stable. Existing well MW-5 is completed in alluvium (TD=16.9' bgs). ED-03 was fractured between 27.5' and 36' bgs, in bedrock. Although this zone is close to the alluvial contact it appears to be a different water-bearing zone. Decided to plug back the borehole to 50' and set 20' of 30-slot well screen across from the bedrock water-bearing zone. Screen is from 29.2 to 49.2' bgs. Sand pack is from 25.5 to 53.1' bgs. Hole plug below the sand pack for approx 10' (53.1 to 61.1') 10-20 sand from 61.1' to total depth drilled at 110.6' bgs.

Location MWED-03 Date 9-26-99

Project / Client T28N-R37E-SEC.12-SW1/4 SE 1/4

WELL ED-03 COMPLETION DIAGRAM



Centralizers at the bottom and the top of the screen.

D. Breen 9-26-99

checked by DK Nicholson 4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW ED-04
	Project Location: Midnite Mine	PAGE 1 OF 4
	Project Number: 53F4001800.03	

Date(s) Drilled 9/16/99 – 9/22/99	Logged By GARRETT BROWN/CH2M HILL	Total Depth of Borehole (ft) 119.7' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 17 7/8" HAMMER BIT	Ground Surface Elevation (ft-msl) ~~TBD~~ 2371.74	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER	Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2373.86
Locations / Comments 9 3/4" OD (8 1/2" ID) THREADED STEEL CASING			Northing 352015 Easting ~~TBD~~ 2472970

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS ED-04 is located 25' SOUTH OF MW-4
								Silt and organic debris on ground surface	9/16/99 Begun drilling at 10:00. Driving steel casing.
5	GRAB				10YR-5/4	ML		Sandy silt - yellowish brown, dry slightly cohesive, loose, silt w/ minor fine sand.	1004; RAD=14uR/h
10	GRAB				10YR-5/3	SW-GW		Sandy to silty gravel - brown, very moist, fine to coarse sand and 20% silt w/ angular to sub-rounded gravel up to 1 cm.	1024; RAD=14uR/h SWL ≅ 12' bgs
15	GRAB				10YR-5/4	BEDROCK		De-composed qtz. monzonite + clay, yellowish-brown, saturated, weathered iron-stained, de-composed, predom. K feldspar and qtz. w/ minor plag. and traces of clay, biotite + muscovite	1029;
20	GRAB				10YR-5/4			Porphyritic qtz. monzonite - weathered silty, yellowish-brown, saturated, de-composed, soft.	1040; RAD=19uR/h Set casing in weathered bedrock at 18.5' bgs.
25	GRAB				10YR-5/6			Weathered qtz. monzonite, as above saturated.	1052; RAD=32uR/h
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-04
	Project Location: Midnite Mine	PAGE 2 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				10YR-5/4	BEDROCK		Porphy. qtz. monzonite - yellowish brown, moist, slightly weathered	1056 - RAD=42uR/h
35	GRAB				10YR-5/2			Porphy. qtz monzonite - grayish brown, slightly moist, slightly weathered mod. hard, predominantly K feldspar (pink), smoky qtz, and unidentified greenish mineral. no dust.	1105; RAD=39uR/h
40	GRAB				2.5Y-7/1			Porphyritic qtz monzonite - as above, only hard and competent, and light gray (unweathered) in color, dry.	1114; RAD=24uR/h
45	GRAB				2.5Y-6/2			Porphy qtz. monzonite - as above, only color change to light brownish gray, dry.	1128; RAD=42uR/h
50	GRAB				2.5Y 7/1			Porphy. qtz. monzonite - dry, hard, light gray, mod. hard + competent.	1136; RAD=37uR/h.
55	GRAB				2.5Y-6/1			As above, only color change to gray	1158; RAD=32uR/h.
60	GRAB				2.5Y-7/1			As above, only color change to light gray.	1209; RAD=49uR/h
65									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS Project Location: Midnite Mine Project Number: 53F4001800.03	Log of Boring ED-04 PAGE 3 OF 4

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65	GRAB				2.5Y-7/1	BEDROCK		Porphyritic qtz monzonite - as above, dry, hard, competent, light gray (unweathered).	1221 - RAD=29 uR/h
70	GRAB				2.5Y-7/1			As above; hydraulically connected to nearby well MW-4. Blowing air and water from MW-4 while drilling 72-74' in well ED-04. Blowing air only after 74'.	1232; RAD=52 uR/h 1255 - At 73', air/water begin blowing out of nearby well MW-4, which is only 20' deep. High angle fracture connecting the two wells.
75	GRAB				2.5Y-7/1			Porphyritic qtz. monzonite, as above. wet.	At 75' time = 1303 RAD=41 uR/h.
80	GRAB				2.5Y-7/1			As above, only slightly softer and easier drilling. Air still venting from MW-4, but no water.	1312; RAD=49 uR/h 1315-1415 Shut down to empty cuttings dumpster. Considerable water in borehole after being down for 1 hour.
85	GRAB				10YR-5/2			Porphyritic qtz. monzonite - saturated but no production grayish-brown moderately hard, slightly weathered cuttings slightly rounded and stained fractured, rough, w/ drill chatter.	1418 - RAD=44 uR/h
90	GRAB				10YR-6/2			Porphy. qtz. monzonite - as above, wet, only ~~cost~~ G.B. color change to light brownish gray (unweathered). Muddy cuttings but no measurable water production.	1432; RAD=31 uR/h 1435 - Begin injecting water to lift cuttings. Blowing water from MW-4 again.
95	GRAB				10YR-6/4			Porphy. qtz monzonite - saturated from H_2O injection, light yellowish brown weathered and stained, soft, jointed and fractured. K feldspar, qtz, and plagioclase w/ minor biotite and traces of pyrite and muscovite.	1440-1508 - Bring hole to up to 20' rods 1514-95' sample RAD = 61 uR/h.
100									

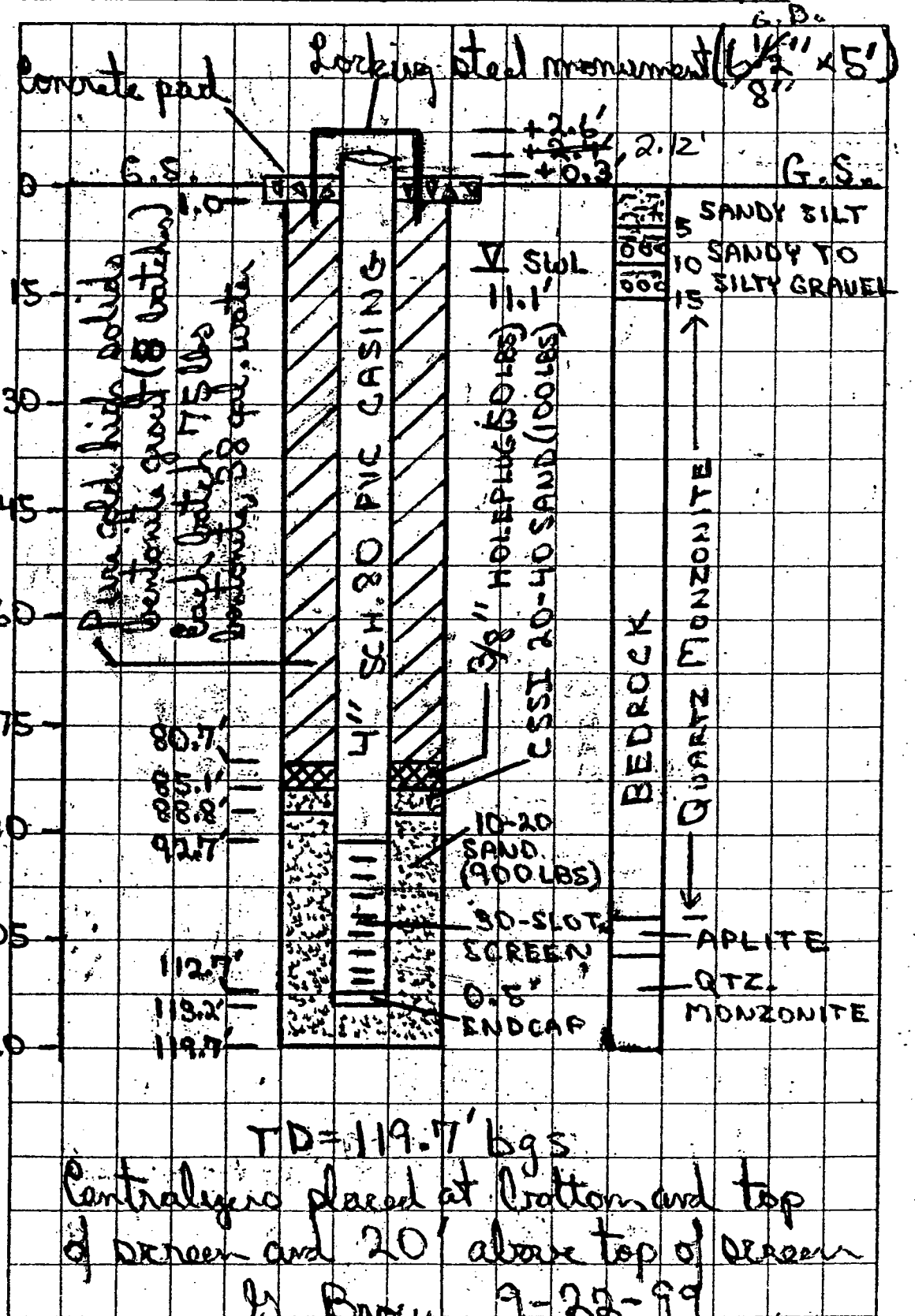
URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-04
	Project Location: Midnite Mine	PAGE 4 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'	6	GRAB			10YR-6/4	BEDROCK		Porphy. qtz. monzonite - saturated from H_2O injection, light yellowish brown, weathered, fractured. Air blowing from ground around the borehole.	1524 - RAD=41uR/h H_2O injection 1534 - Lost circulation at 102'
105					—			No return until 106'. Pulled flat rock from cyclone hose → 7 to 10 cm long, planar, hard, fine-grained, whitish gray, no fizz to 10% HCl. hard, looks like qtz or aplite dike rock.	1545-1645 → Had to clear cyclone hose. Dike rocks → 102'-108'
110'		GRAB			10YR-6/4		110'	Porphyritic qtz. monzonite - saturated, 2-3 gpm, light yellowish brown, weathered, fractured. Water prod. stops at 112'	1705 → at 110' RAD=51uR/h. Nearby well MW-4 venting air, no water
115'		GRAB			10YR-6/4			Porphy. qtz monzonite - light yellowish brown, saturated, hard, more competent than above. (<1gpm).	1800; RAD=39uR/h
120'		GRAB			10YR-6/4			Porphy. qtz. monzonite - as above. TD= 119.7' bgs. Completed borehole w/ sch. 80 PVC casing and screen (4-inch). Set screen across from aplite dike zone. Top of screen at 92.7' bgs. Bottom of screen at 112.7' bgs. Bottom of end cap at 113.2' bgs. SWL= 11.1' bgs.	1846; RAD=41uR/h Circulated hole w/ 150 gallons injected water. Still blowing cuttings. Trip hole of rods. Hanging up.
125'									9-17-99; 0850 Simultaneously tripping hole caved to 20' bgs. Rig down for repairs.
130'									9-22-99 - Returned from 4 days off. Re-drilled hole to 120'; set temp. casing at 37'. Tripped hole and set well.
135'									

Location ~~11~~W ED-04 Date 9-22-99

Project / Client T28N-R37E-SEC13-NW1/4 NE1/4

WELL ED-04 COMPLETION DIAGRAM



TD=119.7' bgs

Centralizers placed at bottom and top of screen and 20' above top of screen

J. Brown 9-22-99

checked by DK Nicholson

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW ED-05
	Project Location: Midnite Mine	PAGE 1 OF 1
	Project Number: 53F4001800.03	

Date(s) Drilled 10-9-99	Logged By GARRETT BROWN/CHAD HILL	Total Depth of Borehole (ft) 27.4' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 7 7/8" TRI-CONE BIT.	Ground Surface Elevation (ft-msl) ~~TBD~~ 2588.31	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER	Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2590.62
Locations / Comments 9 3/4" OD (8 1/2" ID) THREADED STEEL CASING			Northing ~~TBD~~ 354120 Easting 2673159

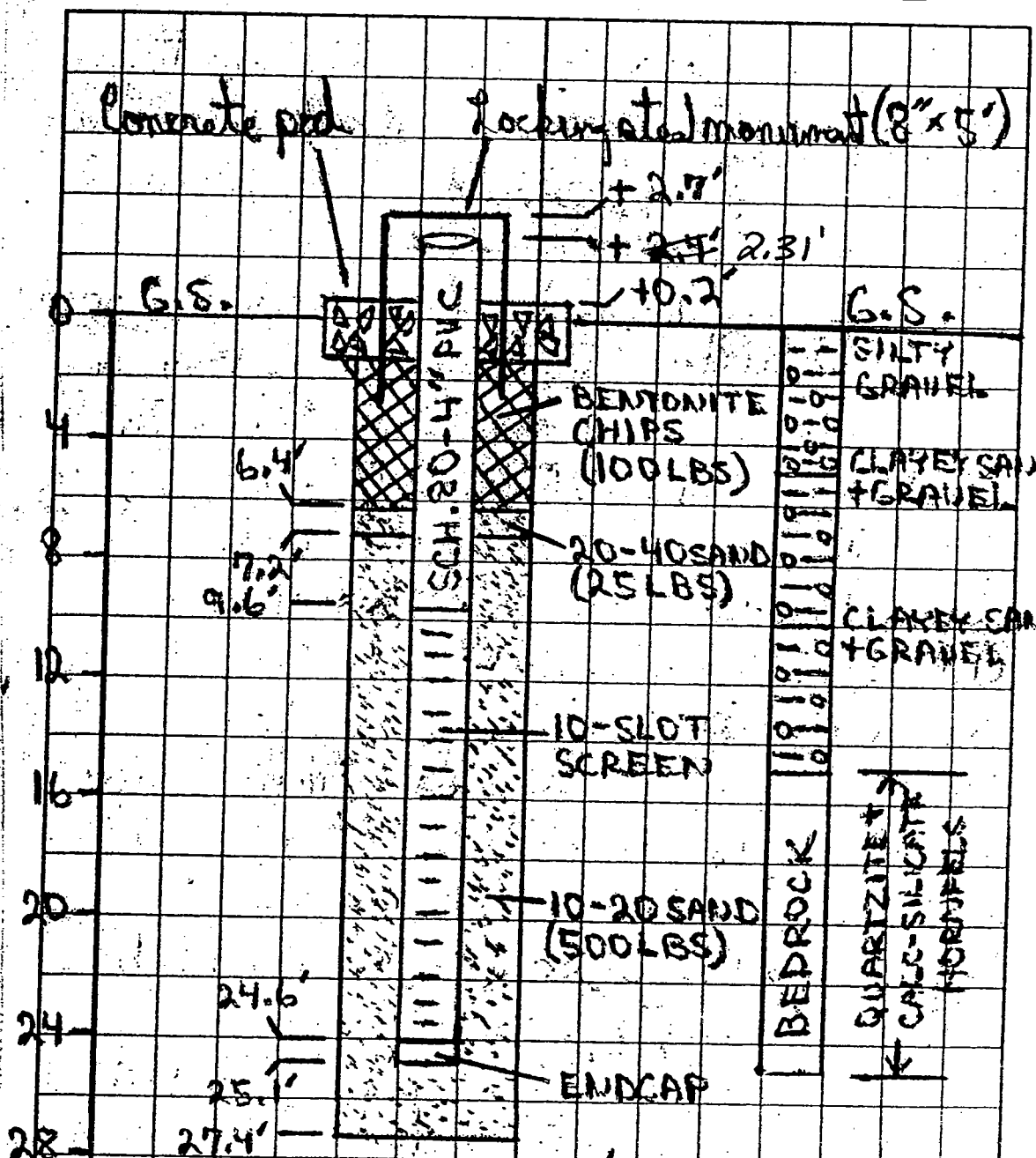
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	GRAB				10YR 4/3	GM		Surface soil is silty gravel (GM), brown, dry, loose to medium, non-cohesive w/ angular gravel and fill up to 2cm in diameter	1137 - Begin drilling and driving steel casing. Easy drilling
5	GRAB				10YR 3/3	SM-GM		Clayey sand and gravel - dark brown, slightly moist cohesive, medium to stiff, clay w/ fine to coarse sand (20-10%) and angular to sub-rounded gravel up to 2cm.	1140 RAD=53uR/h. Easy drilling. Set casing at 9.5' and begin open hole.
10	GRAB				10YR 3/2	SM-GM		Clayey sand and gravel, as above only moister and color change to very dark grayish brown.	1144 RAD=59uR/h Easy drilling
15	GRAB				5GY 6/1	BEDROCK		Diorite - slightly moist, weak fine-grained, fresh, greenish gray. Minor silt from overlying alluvium	1147 RAD=67uR/h Easy drilling
20	GRAB				5Y-6/2			Calc-silicate hornfels - moist, slightly weathered, weak, light olive gray, quartz, plagioclase, epidote, and biotite. No reaction w/ 10% HCl.	1152 RAD=52uR/h Easy drilling. 1155; RAD=55uR/h
25	GRAB				7.5YR 6/3			Calc-silicate hornfels - as above only color change to light brown	1210 - Stripped hole and tagged at 27.4'
	Set well to monitor for shallow water in the spring.							TD=27.4' bgs. Set well w/ 10-SLOT screen between 10-25' bgs. Well currently dry.	1225-1310 Well completion.
30									

Eastern Drainage

Location MWED-05 Date 10-9-99 113

Project / Client T28N-R37E-SEC12-NW¼, SE¼

WELL ED-05 COMPLETION DIAGRAM



TD=27.4' bgs

Centralizers at top of screen and bottom of screen. No water in well on 10-9-99
No water on 10-10-99 either (Post note)
D. Brown 10-9-99

checked by DK Nicholson 4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWED-06
	Project Location: Midnite Mine	PAGE 1 OF 5
	Project Number: 53F4001800.03	

Date(s) Drilled 10-7-99 TO 10-9-99	Logged By GARRETT BROWN/CH2M HILL	Total Depth of Borehole (ft) 131' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 8¼" HAMMER BIT	Ground Surface Elevation (ft-msl) ~~TBD~~ 2588.43	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER / Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2590.80	
Locations / Comments 9¾" OD (8½" ID) THREADED STEEL CASING		Northing ~~TBD~~ 354124 / Easting 2673171	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	GRAB				10YR-5/3	GM		Surface soil is silty gravel, brown, (10YR-5/3), dry, slightly cohesive, clumpy silt w/ angular gravel up to 2cm in diameter, medium consistency.	10-7-99 0925 Started drilling and driving steel casing RAD=34uR/h
5	GRAB				10YR 3/3	SM TO GM		Silty sand and gravel - dark brown, silt is slightly cohesive, slightly moist medium to stiff, w/ fine to coarse sand (≤ 20%) and angular to sub-rounded gravel up to 2cm in diameter	0932; RAD=69uR/h
10	GRAB				10YR 3/3	SM TO GM		Clayey sand and gravel - dark brown, medium to stiff clay w/ fine to coarse sand (10%) and angular to sub-rounded gravel up to 1cm, very moist	0945 RAD=50uR/h.
15	GRAB				10YR-6/4 TO 10YR 8/2	ML and BED-ROCK		Silt and bedrock interface - unwashed is light yellowish brown (10YR/6-4) to very pale brown (washed), moist, silt is medium consistency. Bedrock is weak, fine-grained, mostly quartzite.	0949 RAD=74uR/h Set casing at 17' bgs and started drilling open hole.
20	GRAB				5Y-6/4	BED-ROCK		Calc-silicate hornfels - fine grained weak, moist, pale olive, mostly quartz w/ minor ~~calcite~~ G.B., epidote plagioclase, K-feldspar, biotite. No reaction w/ 10% HCl.	0954 RAD=65uR/h Easy rapid drilling
25	GRAB				5Y-6/4			Calc-silicate hornfels - as above	0958 RAD=43uR/h Rapid drill speed.
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-06
	Project Location: Midnite Mine	PAGE 2 OF 5
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				10Y-7/1 TO 5Y-6/2	BEDROCK		Calc-silicate hornfels - very moist light greenish gray to light olive gray, weak, slightly weathered, mostly quartz w/ minor epidote, diopside, and biotite. No HCl reaction	1004 RAD=98uR/h. Rapid drilling
35	GRAB				10Y-7/1 TO 10GY 5/1			Calc-silicate hornfels - as above only medium grained and light greenish gray to greenish gray.	1007 RAD=63uR/h. Rapid drilling
40	GRAB				10Y 7/1 TO 5GY 6/1			Calc-silicate hornfels and dolomite moderately hard, wet, light greenish gray to greenish gray, competent, quartz, epidote, diopside, biotite, and dolomite (powder reacts w/ 10% HCl	1015 RAD=40uR/h. Rapid drilling
45	GRAB				5GY-6/1			Calc-silicate hornfels - dry to slightly moist, hard, competent, unweathered, greenish gray, quartz, calcite, biotite, epidote Moderate reaction w/ 10% HCl	1022 RAD=49uR/h Moderate to slow drill rate.
50	GRAB				5GY 6/1 TO 10Y 4/1			Calc-silicate hornfels - soft + moist 50-52', otherwise dry and hard. greenish gray to dark greenish gray, quartz, calcite, K-feldspar, epidote, diopside, and biotite.	1048 RAD=29uR/h. Slow drill speed
55	GRAB				10GY 7/1 TO N/5			Calc-silicate hornfels - as above hard, competent, dry, light greenish gray to gray. Slight reaction w/ 10% HCl.	1112 RAD=59uR/h Slow drill speed.
60	GRAB				10YR 5/3 TO 10GY 7/1			Calc-silicate hornfels - mostly quartz and calcite, readily reacts w/ 10% HCl. minor biotite, hard, competent, brown to light greenish gray, slightly moist.	1136 RAD=41uR/h. Slow drill speed
65									

URS GREINER
Woodward Clyde

Project Name:	Phase 1A RI/FS
Project Location:	Midnite Mine
Project Number:	53F4001800.03

Log of Boring ED-06

Depth (ft-bgs)	Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65	GRAB				5GY 8/1 TO 5GY 6/1	BEDROCK	x x x	Calc-silicate hornfels - mostly quartz and calcite, no biotite. Very hard, fine-grained, slightly moist, competent, light greenish gray to greenish gray.	1201 RAD=45uR/h Slow drill rate
70	GRAB				5GY 6/1 TO N/5			Calc-silicate hornfels - as above only color change to greenish gray and gray.	1228 RAD=36uR/h. Soft zone at 72'. Slow drill rate.
75	GRAB				5GY 7/1 TO 2.5Y 6/4			Calc-silicate hornfels - as above only color change to light greenish gray and light yellowish brown. Slightly moist and very hard.	1245; RAD=31uR/h Slow drill rate 1310-1324 - Emptied cuttings dumpster. Blew 10-15 gallons of water at startup.
80	GRAB				N/8 TO 5GY 7/1			Calc-silicate hornfels - mostly quartz and calcite w/ minor K feldspar and biotite. Slight reaction w/ 10% HCl, wet, but no H_2O. Very hard and competent, med grained	1328 RAD=43uR/h Slow drill rate. white to light greenish gray.
85	GRAB				5GY 7/1 TO 10YR 4/6			Calc-silicate hornfels - as above only color change to light greenish gray and dark yellowish brown. damp, no H_2O production.	1400 RAD=38uR/h Very slow drilling
90	GRAB				5GY 7/1 TO 10YR 4/6			Calc-silicate hornfels - as above Damp, no H_2O production.	1432 RAD=34uR/h Very slow drilling
95	GRAB				N/4			Amphibolite?? - dark gray, very hard and competent, slightly moist, fine-grained, pure.	1517 RAD=39uR/h Very slow drilling
100						↓	↓		

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-06
	Project Location: Midnite Mine	PAGE 4 OF 5
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'	GRAB				10GY 4/1	BEDROCK		Quartzite - extremely hard slight moist, fine grained to crystalline, dark greenish gray.	1612 RAD=56uR/h. Drill bit chatter Very slow drill rate
105'	GRAB				N/3 TO 5GY 4/1			Calc-silicate hornfels - very hard, dry, dusty, fine-grained mostly quartz w/ minor calcite (slight reaction w/ 10% HCl), and trace of pyrite, very dark gray to dark greenish gray	1652 RAD=39uR/h Very slow drill rate
110'	GRAB				5GY-6/1 TO N/3 TO N/8			Calc-silicate hornfels - very hard and competent, saturated, producing 1gpm, greenish gray to very dark gray quartz w/ white dolomite (powdered rock reacts w/ 10% HCl) trace of pyrite.	10-8-99 0820 SWL=22' bgs 0945- Blew water and continued drilling 0903 - at 110' RAD=46uR/h. Very slow drilling
115'	GRAB				5GY 6/1 TO N/3 TO N/8			Calc-silicate hornfels - as above only biotite (<5%) also present. Producing 1gpm	0949: RAD=39uR/h. Very slow drilling 1008-1105- Tripped hole to inspect bit.
120'	GRAB				10GY 7/1 TO 5GY 7/1 TO 2.5Y 7/3			Calc-silicate hornfels - very hard and competent, saturated, producing 1gpm, mostly quartz w/ minor calcite (slight reaction w/ 10% HCl), biotite and pyrite, light greenish gray to dark greenish gray to pale yellow	1130 - RAD=41uR/h Very slow drilling
125'	GRAB				AS ABOVE			Calc-silicate hornfels - as above Producing 1gpm.	1212: RAD=44uR/h. Very slow drilling
130'	GRAB				AS ABOVE			Calc-silicate hornfels - as above Very hard; producing 1gpm	1241 RAD=57uR/h
135'								TD=131' bgs. See next page for completion notes.	Very slow drilling. Stopped drilling at 131' and tripped borehole.

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-06
	Project Location: Midnite Mine	PAGE 5 OF 5
	Project Number: 53F4001800.03	

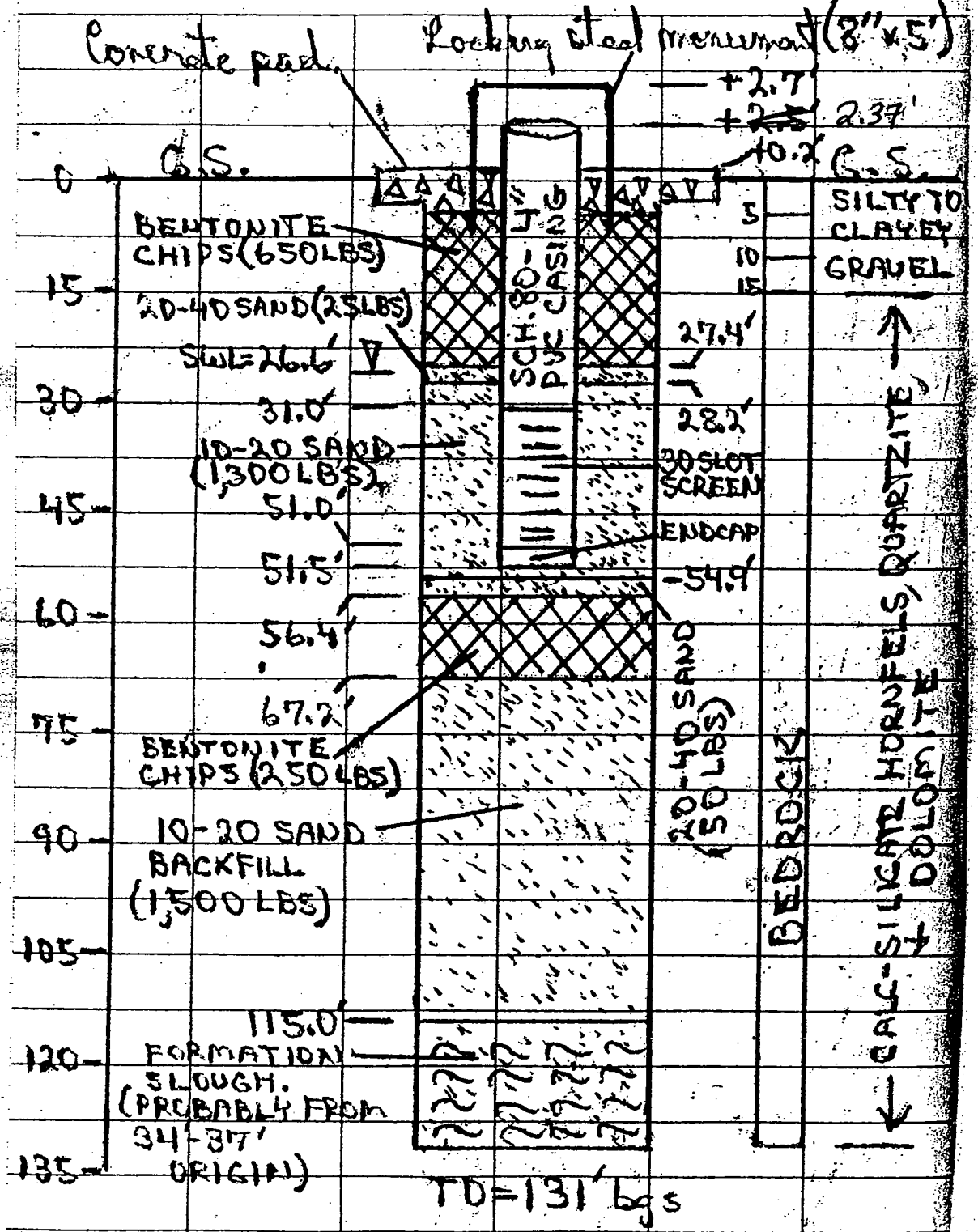
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
								Completion notes: After tripping hole of drill rods, ran caliper, temp, natural gamma, and SP logs. The SP and temp logs were not useful. The borehole had sloughed in from 131' to 115' bgs. Probably came from 34 to 37' bgs were huge fractures were indicated based on the caliper log. Caliper log also indicated a medium fracture at 50'. From 51' to 115' the caliper log showed the borehole was very unfractured w/ no deviation at all. This was also evidenced due to the very slow drilling from 50 to 130'. Decided to backfill borehole w/ sand (10-20) up to 67', then backfilled w/ bentonite chips up to 56'. Transition sand to 55', then set well w/ 30-slot screen from 37-51' bgs. This opens the large fractures (probably the source of water) at 34', 37', and 50'. The sand pack around the well is from 27.4' to 55'. Bentonite chips up above the sand pack to 3' bgs. Hydrated w/ water. Final SWL = 26.6' bgs.	

Eastern Drainage

110 Location MWED-06 Date 10-9-99

Project / Client T28N-R37E, SEC. 12, NW¼, SE¼

WELL ED-06 COMPLETION DIAGRAM



Centralizers at top and bottom of screen.

H. Brown 10-9-99

checked by DK Nicholson 4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWED-10
	Project Location: Midnite Mine	
	Project Number: 53F4001800.03	

Date(s) Drilled	9/23/99	Logged By	R. MARTIN	Total Depth of Borehole (ft)	16'
Drilling Method	HOLLOW STEM AUGER	Diameter of Borehole (in)	10"	Ground Surface Elevation (ft-msl)	2130.81
Drill Rig Type	CME-75	Drilling Company	CASCADE	Groundwater Elevation (ft-msl)	1.5 BGS
Driller's Name	SCOTT	Sampler Type	SPLIT SPOON	Checked By	DK Nicholson
Measuring Point Elevation (ft-msl)	GROUND SURFACE				
Northing	349407	Easting	2672447		
Locations / Comments	NEXT TO RUNNING STREAM (Eastern Drainage)				

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	~~PID (ppm)~~	~~Penetrometer~~ ~~SAMPLER~~	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1.5	6 6 6	100	20	X		OL		ORGANIC SILTS, DK. BROWN ORGANIC ODOR. WET	
5 6.5	11 11 11	100	15	X		SP-GP		SAND/GRAVEL CONTACT, F-C GRAVEL IN BOTTOM OF SAMPLER WET	
10 11.5	7 15 19	100	15	X		SP		POORLY GRADED SAND, WET COARSE SAND.	
15 16.5	50/4	100	30	X		SP		POORLY GRADED SAND WET SAME AS ABOVE	
20								TOTAL DEPTH OF BORING 16'.	
10									
12									
14									

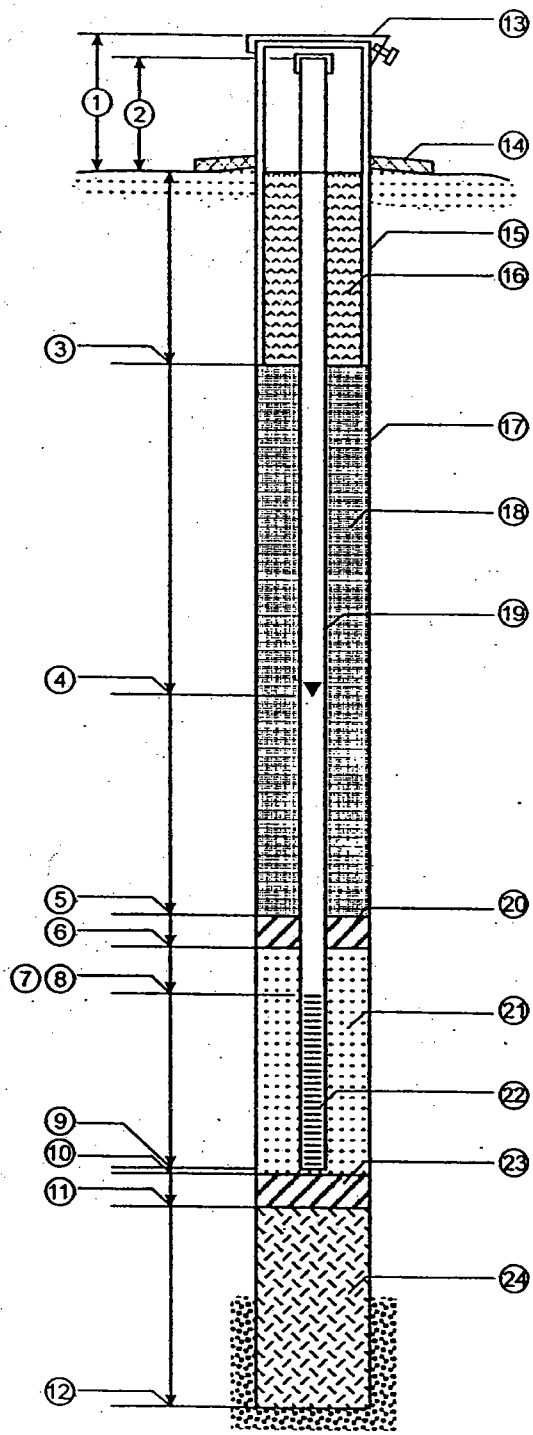
URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number	Project Name	Date/Time Started
53F4001800.03	MIONITE MINE	9/23/99 11:20
Well/Borehole Number	**Well/Borehole Location**	**Date/Time Completed**
MWED-10	Eastern Drainage	9/23/99 13:10

Installation Team	Type of Drilling	Ground Surface Elev.	Top of Well Casing Elev.
TEAM #4	AUGER	2130.81 ft.msl	2133.41 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.45 ft.
2. Stick-Up Well Casing Above Ground: 2.6' ~~3.15~~ ft.
3. Depth to Bottom of Upper Seal/Protective Casing: ____ ft.
4. Depth to Initial Ground Water Surface Elevation: ____ ft.
5. Depth to Top of Top Seal: 1 ft.
6. Depth to Bottom of Top Seal: 3 ft.
7. Depth to Top of Well Point or Screen: 5 ft.
8. Total Length of Blank Casing: 5 ft.
9. Bottom Depth of Well Screen: 15 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: ~~15~~ 16 ft.
13. Protective Casing: [X] Yes [ ] No Locking Cap: [X] Yes [ ] No
14. Sanitary Seal: [ ] Yes [ ] No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: concrete
17. Borehole Diameter: 10 in.
18. Type of Upper Backfill: bentonite chips
19. Type of Well Casing: PVC SCH 40 Diameter: ~~6~~ 4 in.
20. Type of Top Seal (IF Installed): PURE GOLD BENTONITE CHIPS
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10x20 Diameter: 10 in.
22. Type of Screen Material: PVC SCH 40 Slot Size: 0.010 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

Recorded By	Date	Checked By	Date
[signature]	9/23/99	DK Nicholson	4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW ED-11
	Project Location: Midnite Mine	PAGE 1 OF 4
	Project Number: 53F4001800.03	

Date(s) Drilled 10-10-99 TO 10-11-99	Logged By GARRETT BROWN/CHAD HILL	Total Depth of Borehole (ft) 108.9' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 8¼" HAMMER BIT	Ground Surface Elevation (ft-msl) ~~TBD~~ 2128.23	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER	Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2130.12
Locations / Comments 9¾" OD (8½" ID) THREADED STEEL CASING			Northing ~~TBD~~ 349389 Easting 2672497

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	GRAB				10YR 3/3	GM		Surface soil is silty gravel, dark brown, moist, non-cohesive, loose. Rock outcrop on hill immediately above borehole is porphyritic quartz monzonite.	ED-11 is located 55' east of well ED-10. 1149 - Started drilling and driving steel casing. RAD = 39 uR/h. Rapid drill rate.
5	GRAB				10YR 4/4	GW		Gravel - wet but no H_2O, dark yellowish brown, loose, very little fines, looks like parent material is decomposed qtz. monzonite.	1151 - RAD = 29 uR/h. Rapid drill rate.
10	GRAB				10YR 4/4	BEDROCK		Decomposed qtz. monzonite - wet, no H_2O, soft, loose, unweathered is dark yellowish brown, weathered and stained surfaces, moderately de-composed.	1202 RAD = 64 uR/h. Becoming hard at 11'. Set casing at 12' and began open hole. Burning dusty at 12'.
15	GRAB				10YR 7/2			Porphyritic qtz. monzonite - dry, dusty, moderately hard, competent, unweathered. Unweathered is light gray, very coarse grained, K feldspar (40%), smoky qtz. (30%), plagioclase (30%), biotite (10%).	1230 RAD = 37 uR/h. Moderate, consistent drill rate. Started injecting H_2O at 18' to control dust.
20	GRAB				5YR 6/2 TO 5G 5/2			Porphy. qtz. monzonite - as above, mod. hard, competent, slightly moist from H_2O injection. K feldspar (40%) is pinkish gray, plagioclase (30%) is grayish green, qtz. is smoky (30%), biotite is black (10%), very coarse.	1242 RAD = 41 uR/h. K feldspar phenocrysts up to 2 cm.
25	GRAB				AS ABOVE			Porphy. qtz. monzonite - as above, slightly moist from H_2O injection. No sign of fractures.	1256 RAD = 54 uR/h. Consistent moderate drill speed.
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-11
	Project Location: Midnite Mine	PAGE 2 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				5YR-6/2 TO 5G 5/2	BEDROCK		Porphyritic qtz. monzonite - as above Slightly moist from H_2O injection	1307 RAD=32uR/h Moderate consistant drill rate.
35	GRAB							Porphy. qtz. monzonite - as above. Slightly moist from H_2O injection Shut off injected water at 36'.	1315 RAD=31uR/h Moderate consistant drill rate.
40	GRAB							Porphy. qtz. monzonite - as above only dry and dusty. no H_2O injection. Mod. hard and competant.	1334 RAD=41uR/h Moderate consistant drill rate.
45	GRAB							Porphy. qtz. monzonite - as above Dry and dusty	1347 RAD=47uR/h Moderate consistant drill speed.
50	GRAB							Porphy. qtz. monzonite - as above Dry and dusty	1400 RAD=44uR/h. Moderate consistant drill speed.
55	GRAB							Porphyritic qtz. monzonite - as above. Dry and dusty.	1417 RAD=55uR/h Moderate consistant drill speed
60	GRAB							Porphyritic qtz. monzonite - as above. Dry and dusty. Began only collecting grab samples every 10' since geology and drill speed are so consistently the same.	1434 RAD=32uR/h. Moderate consistant drill speed.
65									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-11
	Project Location: Midnite Mine	PAGE 3 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65					5YR 6/2 TO 5G 5/2	BEDROCK		Started collecting grab samples only every 10' since geology and drill speed are so consistently the same.	
70	GRAB							Porphy. qtz. monzonite - as above Dry and dusty.	1514 RAD=34uR/h Moderate consistent drill speed.
75									1548 - at rod change (79'), swiped out cuttings dumpster + finished drilling. 1613 - Continued drill
80	GRAB							Porphy. qtz. monzonite - as above only becoming slightly moist and plagioclase has slightly stained rust-colored surfaces. No dust. Dry and dusty again at 83'. Continued dry and dusty at 85'	1621 - RAD=45uR/h. Moderate consistent drill speed, other than slight jump of drill rods around 82'.
85									
90	GRAB				5YR 6/2 TO 10G 5/1			Porphy. qtz monzonite - dry, dusty, moderately hard and competent, fresh, no weathered surfaces, very coarse grained w/ smoky quartz (30%), K feldspar (40%) which is pinkish gray, black biotite (10%), and greenish gray plagioclase. K feldspar phenocrysts 1 to 2cm in diameter	1658 RAD=39uR/h Moderate, consistent drill rate.
95									
100									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring ED-11
	Project Location: Midnite Mine	PAGE 4 OF 4
	Project Number: 53F4001800.03	

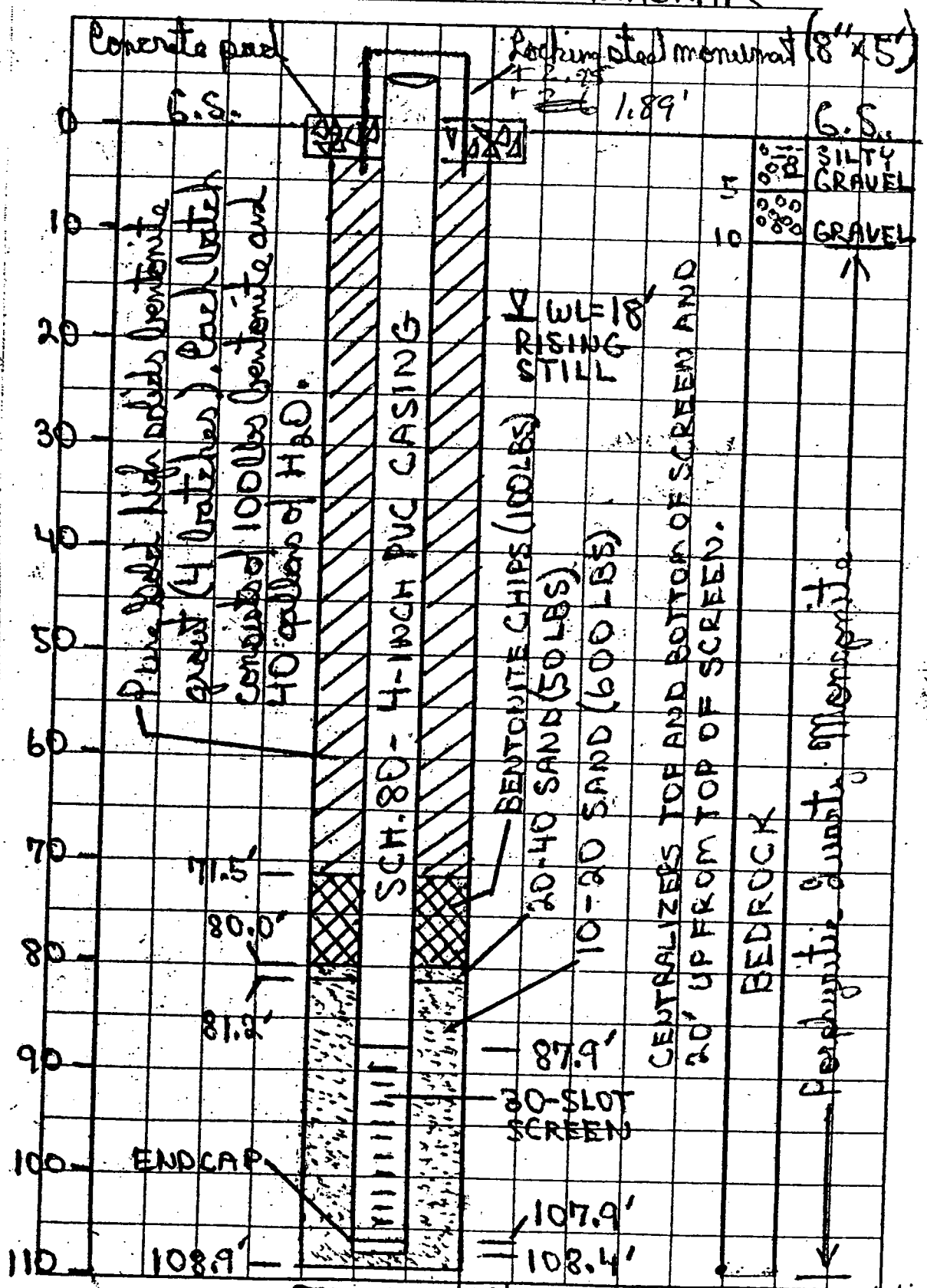
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'	GRAB				5YR 6/2 TO 10GY 6/1	BEDROCK		Porphy. qtz. monzonite, as above only drill speed is a bit slower, but still at a consistent rate. Small fracture possibly at 102'	1750 RAD=42uR/h. Moderate to slow drill rate.
105	GRAB				5YR 6/2 TO 10GY 6/1			Porphy. qtz. monzonite - as above. Dry but not dusty. Started injecting water at 107' to clean out the borehole.	1815 RAD=36uR/h
110'	GRAB							Porphy. qtz monzonite as above only wet from H_2O injection. Drilled to 110' but tagged bottom at 108.9' bgs.	1833 RAD=48uR/h Circulated hole for 5 minutes then tripped out 50'. E.O.D. Left site.
115'								Completion notes: After tripping borehole, ran caliper, SP, temp, and natural gamma logs. The SP, natural gamma and temp logs were not useful. The caliper log showed only two small fractures, one at 73' and the other at 104' bgs. No widening of the borehole anywhere else. Decided to screen across the lower fracture at 104'. Placed 20-feet of 30 slot PVC screen from 88 to 108' bgs. The sand pack around the well screen is from 80.0' to the bottom of borehole at 108.9' bgs. Bentonite chips from 71.5' to 80.0' bgs, then high solids bentonite grout above that, up to ground surface. Water level in well was at 18' bgs, but still slowly rising.	10-11-99 0755-0802 Tripped remaining drill rods. 0810-950 - Geophysical logging. 1000 - Well completion began. 1315 - Finished well completion and grouting and pulled steel casing.
120'									
125'									
130'									
135'									

Eastern Drainage

Location MWED-11 Date 10-11-99 121

Project / Client T28N-R37E-SEC.13-NW1/4, SE1/4

WELL ED-11 COMPLETION DIAGRAM



TD=108.9' bgs

checked by DK Nicholson 4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW NE01
	Project Location: Midnite Mine	Page 1 of 2
	Project Number: 53F4001800.03	

Date(s) Drilled 9/25/99 to 9/26/99	Logged By M. Henry / CH2M HILL		Total Depth of Borehole (ft) 66.0
Drilling Method Air Rotary w/ hammer bit. Temp casing to 6'	Diameter of Borehole (in) 8		Ground Surface Elevation (ft-msl) 3099.13
Drill Rig Type Failing Star 30K	Drilling Company Cascade Drilling		Groundwater Elevation (ft-msl)
Driller's Name T. Mecham	Sampler Type Cuttings from cyclone	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) 3101.26
Locations / Comments Northeast drainage near slide area			Northing 358108 Easting 2672591

Depth (ft-bgs)	Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD (cpm)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
								SLIDE DEBRIS	
0									RAD background = 80-200 uR/hr
5'				80-120	5YR 6/1	SW-SM		Well graded sand and gravel w/silt lt. tan, dry	Open hole from 6', (couldn't advance casing through boulder)
10'				35-70	5YR 4/4	SW-SM		As above, med-dark brown	
15'				30-70	5YR 4/4	SW-SM		Well graded sand and gravel w/silt sands and gravels are subangular, moist to wet, med-dark brown	cuttings are moist
								WEATHERED BEDROCK - ~~MIDNITE~~	Hard at 17'
20'				55-95	10YR 6/6			Well graded sand, dark yellowish orange, sand grains show orange weathering (phyllite and plag)	drills like decomposed bedrock
25'				40-70	10YR 6/2			As above, lighter in color (pale yellowish brown	
									transitional contact to highly weather/altered bedrock
30'									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	MWNEØ1 Log of Boring
	Project Location: Midnite Mine	
	Project Number: 53F4001800.03	PAGE 2 OF 2

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION: Highly weathered/altered bedrock	REMARKS
30				50-70	10YR 6/2			Highly weathered/altered: pale yellowish brown matrix w/ grayish "banded" frags, which are very friable and look like talc → soapy feel, very lt weight	Well completion Summary • TD Borehole @ 66 • Natural slough to 59.5' • 10-20 sand from 35.3-39 • Sch 40 10 slot screen from 39-59 • 20-40 sand 33.3-35.3 • bentonite grout from 6-33.3
35					10YR 6/2			As above	
40				40-70	N6			As above, medium gray. Rock frags totally weathered and returns like "clay balls". Clay balls are white to gray w/ green streaks	First sign of potential water - moist cuttings at 40'
45				50-60	10YR 7/4			As above, rock frags similar to 30' sample, showing some banding but still very friable and talk like. 5% frags showing pinkish color	color change to grayish orange
50				60-110	5Y 6/4			As above, similar to 40' but different color - actually looks like water is allowing clay balls to break up and form sploge	dusky yellow Producing 1-2 gpm caliper log from NEØ2 shows large fractures (9-14 inch) from 50-61'
55				30-50	5Y 6/4			As above, grayish rock frags (talc-like) very friable and show some orangish banding, ~5% pinkish dolomite frags - very silicious - no HCl reaction	dusky yellow
60				30-50				quartz rich silicate, qtz is smokey gray to yellow, 60% of sample 5-10% greenish talc fragments, some grayish banded "felt-like" frags are somewhat friable, but stronger than observed from 30-40	
65				30-50				As above	Producing 2-5 gpm

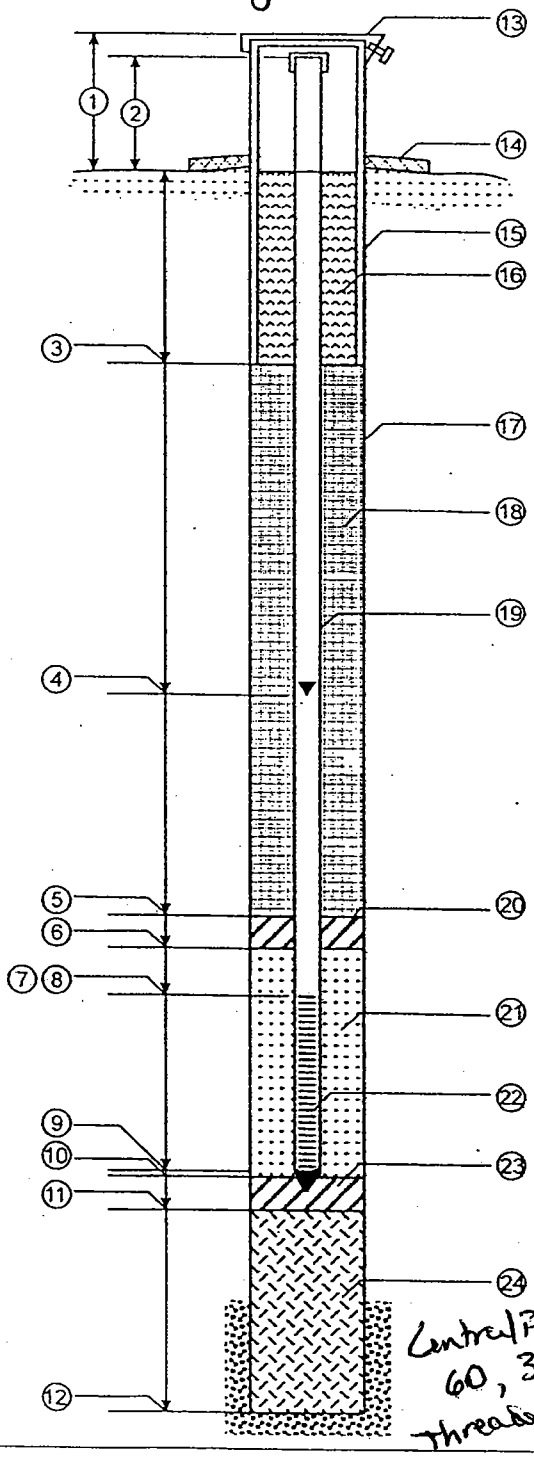
TD Borehole at 66' bgs

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53F4001800.03	Project Name: Midnite Mine Phase 1A RI/FS	Date/Time Started: 9/25/99 1200
Well/Borehole Number: MW NE Ø1	Well/Borehole Location: Slide area near head of NE drainage	Date/Time Completed: 9/26/99 1200
Installation Team: Cascade Drilling	Type of Drilling: 8-inch air rotary w/ temp casing to 6'	Ground Surface Elev.: 3099.13 ft.msl
		Top of Well Casing Elev.: 3101.26 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.5 ft.
2. Stick-Up Well Casing Above Ground: 2.13' ~~2.56~~ ft.
3. Depth to Bottom of Upper Seal/Protective Casing: ____ ft.
4. Depth to Initial Ground Water Surface Elevation: 15' bgs ft.
5. Depth to Top of Top Seal: 31.3 see #16 ft.
6. Depth to Bottom of Top Seal: 35.3 ft.
7. Depth to Top of Well Point or Screen: 39 ft.
8. Total Length of Blank Casing: 45 ft.
9. Bottom Depth of Well Screen: 59 ft.
10. Depth to Top of Bottom Seal (If Installed): — ft.
11. Depth to Bottom of Bottom Seal (If Installed): — ft.
12. Depth of Borehole: 66 ft.
13. Protective Casing: [X] Yes [ ] No ~~To be installed~~ Locking Cap: [X] Yes [ ] No
14. Sanitary Seal: [X] Yes [ ] No ~~To be installed~~
15. Type of Protective Casing: Steel Diameter: 8 in.
16. Type of Upper Seal: 2 feet 20/40 sand and 2 feet of bentonite chips / concrete
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: Bentonite grout
19. Type of Well Casing: Sch 40 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): ~~#4~~ concrete
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10-20 sand Diameter: ____ in.
22. Type of Screen Material: Sch 40 PVC Slot Size: 0.010 in.
23. Type of Bottom Seal (If Installed): —
24. Type of Lower Backfill: Borehole sloughed from TD of 66 feet to 62 prior to install.

Recorded By	Date	Checked By	Date
		DK Nicholson	4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	MWNE Ø2 Log of Boring Page 1 of 5
	Project Location: Midnite Mine	
	Project Number: 53F4001800.03	

Date(s) Drilled 9/26/99 to 9/29/99	Logged By M. Henry / CH2M HILL		Total Depth of Borehole (ft) 150.8
Drilling Method Air Rotary – Temp. casing advanced to 17' bgs	Diameter of Borehole (in) 8 inch		Ground Surface Elevation (ft-msl) 3099.66
Drill Rig Type Failing Star 30K	Drilling Company Cascade Drilling		Groundwater Elevation (ft-msl)
Driller's Name T. Meehan	Sampler Type Cuttings from Cyclone	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~30~~ 3101.52
Locations / Comments Northeast drainage near slide area, adjacent to MWNE Ø1			Northing 358126 Easting 2672612

Depth (ft-bgs)	Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD (uR/hr)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Background RAD = 40-80 uR/hr REMARKS
								SLIDE MATERIAL/COLLUVIUM	13:00 9/26/99
5'				15-50	10YR 5/4	SW		well graded sand and gravel w/ silt, yellowish brown, sands and gravels are subangular (gravels are phyllite fragments), dry	
10'				25-50	10YR 5/4	SW		As above, most phyllite fragments show orangish weathering, mod yellow brown, moist	
15'				20-40	5Y 5/6			As above, color change to lt. olive brown, moist	Hard at 16-17'
								WEATHERED BEDROCK	Temp. casing to 17', open hole drilling below
20'				20-50	10YR 7/4			Decomposed, highly weathered phyllite – ~60% clay mineralogy w/ some orange-weathered phyllite fragments	
25'				25-45	5YR 4/1			Highly weathered/altered, brownish gray, moist, coarse-sized fragments appear to be clayey material	transitional contact to highly weathered/ highly altered bedrock
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	MWNE02 Log of Boring
	Project Location: Midnite Mine	
	Project Number: 53F4001800.03	Page 2 of 5

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD ~~tot~~	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30'				20-40	10YR 4/2			highly weathered/alter clayey material (clay balls are grayish on outside surfaces, but very weak, friable, and buff colored on fresh surfaces)	14:30 9/26/99
35'								"	No return, discharge hose plugging - likely in very clayey material
40'								"	No return, see above
45'				20-60	5Y 6/4			Highly weathered/altered - dusky yellow matrix w/ grayish rock fragments - which are very friable, talc-like material (can break with thumbnail)	
50'								As above	No return
55'								cuttings show similar clayey matrix, but coarse-grained sand sized smokey qtz crystals	No return → transitional contact to silicic bedrock (calc-silicate hornfels)
60'				15-40	5Y 6/4			dusky yellow matrix w/ quartz and silicic-rich rock fragments. Occasional gray and greenish talc fragments (very soft, soapy feel, with some banding)	1-2 gpm ~~for~~ 14-15" fracture noted while logging at 59-62'
65'									

URS GREINER
Woodward Clyde

Project Name:	Phase 1A RI/FS
Project Location:	Midnite Mine
Project Number:	53F4001800.03

MWNEØ2

Log of Boring

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD ~~tsf~~ mR/hr	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION Calc-silicate hornfels	REMARKS
65'				15-40	5Y 6/4			Dusky yellow clayey matrix w/ large percentage of qtz and non-descript silicic rock fragments w/ gray and green talc	Begin injecting water at 65'
									Producing 1-2 gpm
70'				15-40	5YR 4/4			As above	
									No reaction to HCl on rock fragments
75'				15-40	5YR 4/4			As above	
80'				15-35	5YR 4/4			As above	
85'				—	5YR 4/4			As above, occasional greenish talc fragment visible	
									Hard from 88-93
90'				—	5YR 4/4			As above, no talc though	
95'								As above	No HCl reaction
100'									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWNE02
	Project Location: Midnite Mine	PAGE 4 OF 5
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD (cpm)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'								very silicic rock fragments (med gray to black) in dusky yellow clayey matrix	
								color change @ 104	
105'				20-60	N5			Quartzite, medium gray to black, generally massive, some banding visible	Hard drilling from 104
110'				20-50	5G 6/1			Quartzite, qtzite fragments generally massive, but vary in color from med-gray to black to grayish green. Some fragments appear to be almost slately	5-10 gpm ← first sign of pyrite
115'				20-45	5G 6/1			As above with occasional large smokey quartz crystals with some very fine pyrite	5-10 gpm
120'				20-30	5G 6/1			As above	10-15 gpm
125'					5Y 7/2			As above, but color change to yellowish gray - approx 10-15% of fragments are "ruggy" and appear like dolomite - however no HCl reaction	124-127 softer ← could be silicic dolomite
130'				15-30	N5			Quartzite, medium gray to black, massive, occasional color banding, small stringers of pyrite	softer @ 133-137
135'					N5				

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	MWNEØ2 Log of Boring
	Project Location: Midnite Mine	Page 5 of 5
	Project Number: 53F4001800.03	

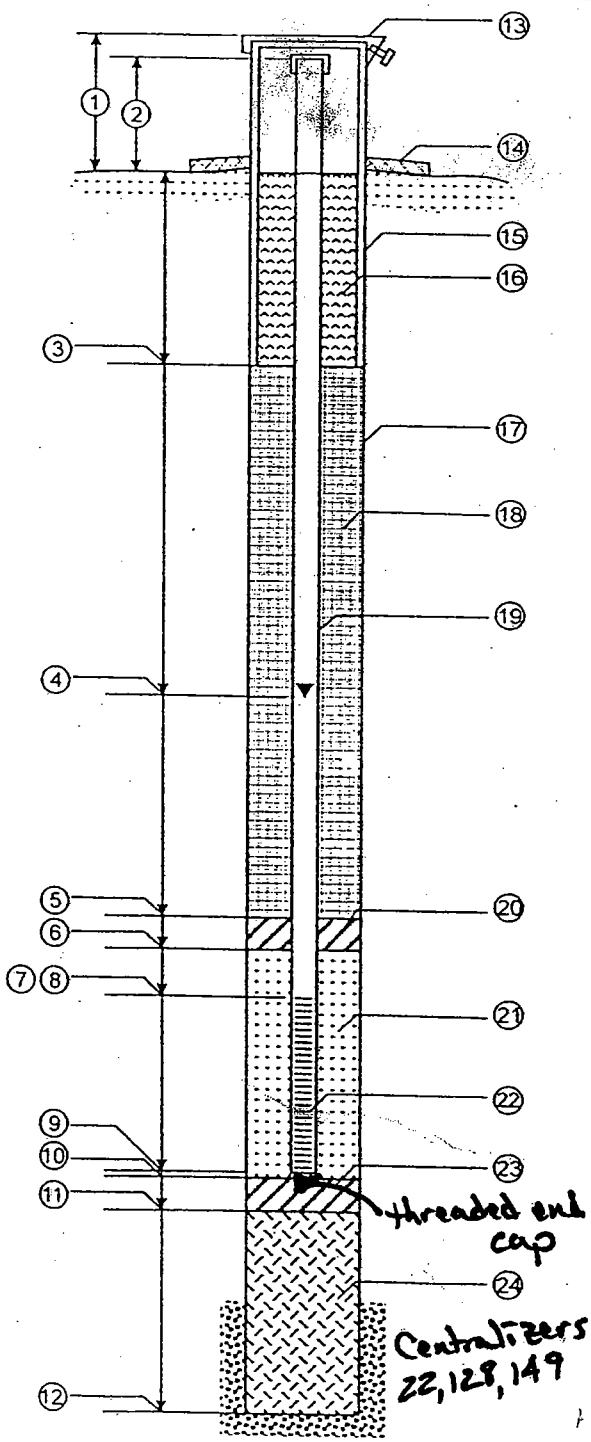
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD (µR/h)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
135					N5			Quartzite, medium gray to black, massive quartzite with pyrite stringers	Producing 30-35 gpm softer zone 133-137
140'				20-45	N4-N7			Quartzite, light gray to medium gray massive quartzite w/ abundant pyrite stringers. Occasional lt orange-to buff colored (banded) fragments that are quite friable	
145'				15-35	N-4			Granitic intrusive, medium gray overall color, but grayish qtz with plag/feldspar, and biotite some greenish gray fragments Abundant pyrite, muscovite, and some orange weathered fragments Quartzite as above	Producing 40-50 gpm
150'									
155'								TD Borehole @ 150.8' bgs Well completion summary • 10-20 sand from 125.1 to 150.8' bgs • Sch. 80, 30 slot screen from 130.2 to 150.2' bgs (4 inch) • 20-40 sand from 122.5 to 125.1' bgs • bentonite chips from 121.0 to 122.5' bgs • bentonite grout to 6' bgs	
160'									
165'								Geophysical log highlights temp - no inflows discernible caliper - major fracture set 139-147, 117-129, 78, 59-62 gamma - kicks up to 300 cps at 34-38, 73-78, 98-102, 145-147	
170'									

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53F4001800.03	Project Name: Midnite Mine Phase 1A RI/FS	Date/Time Started: 9/26/99 1300
Well/Borehole Number: MWNE Ø2	Well/Borehole Location: NE Drainage near slide area	Date/Time Completed: 9/29/99 0900
Installation Team: Cascade Drilling	Type of Drilling: Air Rotary, 8-inch temp casing to 17'	Ground Surface Elev.: 3099.63 ft.msl
		Top of Well Casing Elev.: 3101.52 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.55 ft.
2. Stick-Up Well Casing Above Ground: 1.89' ~~2.5~~ ft.
3. Depth to Bottom of Upper Seal/Protective Casing: ____ ft.
4. Depth to Initial Ground Water Surface Elevation: 15' bgs ft.
5. Depth to Top of Top Seal: 122.5 ft.
6. Depth to Bottom of Top Seal: 121.0 w/ bentonite grout on top ft.
7. Depth to Top of Well Point or Screen: 130.2 ft.
8. Total Length of Blank Casing: 130.2 to surface ft.
9. Bottom Depth of Well Screen: 150.2 ft.
10. Depth to Top of Bottom Seal (If Installed): — ft.
11. Depth to Bottom of Bottom Seal (If Installed): — ft.
12. Depth of Borehole: 150.8 ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: steel Diameter: 8 in.
16. Type of Upper Seal: ~~Bentonite grout~~ Concrete
17. Borehole Diameter: 8 (nominal) in.
18. Type of Upper Backfill: cement/bentonite grout
19. Type of Well Casing: Sch 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 2.5 ft 20-40 sand, 1.5 ft bentonite chips, bentonite grout
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: Colorado Silica #10-20 Diameter: — in.
22. Type of Screen Material: Sch 80 PVC Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): —
24. Type of Lower Backfill: —

Recorded By	Date	Checked By	Date
		DK Nicholson	4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW NE03
	Project Location: Midnite Mine	PAGE 1 of 3
	Project Number: 53F4001800.03	

Date(s) Drilled	9/13/99 to 9/16/99	Logged By	M. Henry / CH2M Hill	Total Depth of Borehole (ft)	137' bgs
Drilling Method	Air rotary 8-inch nominal bit	Diameter of Borehole (in)	8-inch	Ground Surface Elevation (ft-msl)	3119.34
Drill Rig Type	Failing Star 30K	Drilling Company	Cascade Drilling	Groundwater Elevation (ft-msl)	
Driller's Name	T. Mecham	Sampler Type	Cuttings from cyclone	Measuring Point Elevation (ft-msl)	3121.74
Locations / Comments	Fill area east of Pit 4 Dump, adjacent to MWNE03	Checked By	DK Nicholson	Northing / Easting	357077 / 2672077

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD ~~tsf~~ uR/hr	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
0								FILL	Initially using hammer bit RAD background 10-30 uR/hr Boring location located east of Pit 4 road line
5'				20-50	5YR 6/4	SM		Silty sand with gravel, lt brown, well graded angular-subangular sand and gravel (to 2") , dry	
10'				30-70	5YR 4/4	SW-SM		Well graded sand with silt and gravel mod brown, sands and gravels subangular to angular, moist.	
15'				30-60	5YR 4/4	SM		Silty sand with gravel, lt. to med. brown, well graded sands and gravels to 1/4" - subrounded to rounded, moist	
20'				40-90	5YR 4/4	SW-SM		Well graded sand with silt, mod. brown, sands subangular to angular, phyllite fragments show some degree of weathering, moist	
25'				30-80	5YR 4/4	SW-SM		As above	
30'				30-60	5YR 4/4	SW-SM			

Woodward Clyde

Project Location: Midnite Mine

Project Number: 53F4001800.03

Log of Boring

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetration Resistance	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30				30-60	5YR 4/4	SW-SM		Well graded sand with silt, med. brown, subangular to angular sands and gravels, gravels (rock fragments) somewhat weathered	Temp casing initially drilled to 32' bgs 0900 9/14/99
40				35-80	5YR 4/4	SM		Silty sand with gravel, medium brown, well graded sands and gravels to 1/4", moist	
50				35-70	5YR 4/4	SM		As above.	
					5YR 4/4	SM		As above	
60								See note →	Fill material ranging from silty sand with gravel to a well graded sand with gravel and silt.
				20-50					
70								As above	
80				30-50				As above, same composition, but slight color change ~~do~~ due to injecting water	
90				35-60				As above	
									transitional contact from fill to Native alluvium
100						SW-SM		Well graded sand w/ silt and rock fragments (partially weathered phyllite)	Harder drilling from 97'

URS GREINER
Woodward Clyde

Project Name:	Phase 1A RI/FS
Project Location:	Midnite Mine
Project Number:	53F4001800.03

MW NE Ø3

Log of Boring

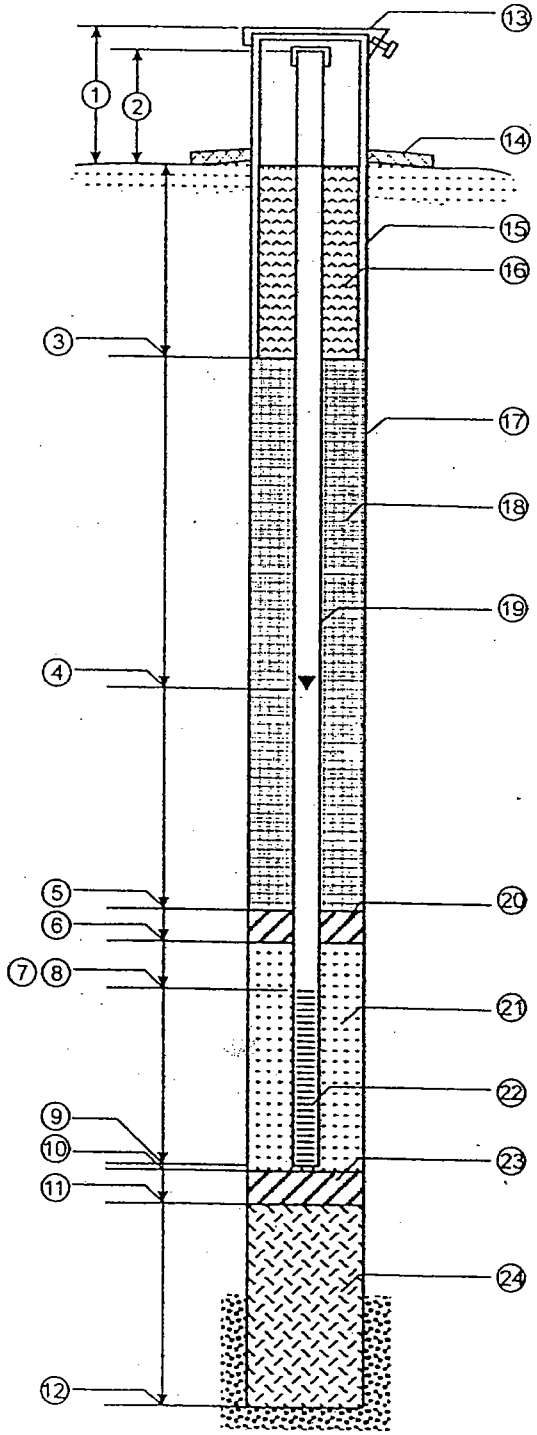
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Background ~~(ppm)~~	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100									
				30-70	5YR 4/4	SW-SM		well graded sand with silt, mod brown, moist.	
								No cuttings 107-117'	May be first indication of water
110									
					N7			As above	Slight color change to light gray
								No cuttings 117-127'	
120								Implied contact with weathered phyllite bedrock	Driller having difficulty w/ insufficient air to blow cuttings out-injecting water but no return.
								No cuttings	
130									Cuttings from adjacent well NE Ø4 suggest transition to weathered phyllite bedrock at 117' bgs
140								TD Borehole @ 137' bgs	
								Well construction Summary	
150								• 10 slot Sch 80 screen from 116.5-136.5	
								• Added 1.5 bags 10-20 sand + tagged bottom at 134, then boring collapsed to 118 therefore ~~sand~~ screened section is native	pack around material (silts, weathered phyllite)
								• 10-20 sand from 115-118	
160								• 20-40 sand from 108-115	per DEN tech team
								• bentonite chips from 105.8-108	
								• bentonite grout from 105.8 to 6 ft bgs	
170								static water level (after 9 days) 95.6' bgs	

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53F4001800.03	Project Name: Midrite Mine Phase 1A RI/FS	Date/Time Started: 9/13/99 1500
Well/Borehole Number: MWNE 03	Well/Borehole Location: Fill area east of Pit 4 Dump	Date/Time Completed: 9/15/99 1700
Installation Team: Cascade Drilling	Type of Drilling: Air rotary: 8-inch ID temporary casing	Ground Surface Elev.: 3119.34 ft.msl; Top of Well Casing Elev.: 3121.74 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.35 ft.
2. Stick-Up Well Casing Above Ground: 2.4' ~~2.9~~ ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 6 ft.
4. Depth to Initial Ground Water Surface Elevation: 117 ft.
5. Depth to Top of Top Seal: 105.8 ft.
6. Depth to Bottom of Top Seal: 108 ft.
7. Depth to Top of Well Point or Screen: 116.5 ft.
8. Total Length of Blank Casing: 116.5 ft.
9. Bottom Depth of Well Screen: 136.5 ft.
10. Depth to Top of Bottom Seal (If Installed): — ft.
11. Depth to Bottom of Bottom Seal (If Installed): — ft.
12. Depth of Borehole: 137 ft.
13. Protective Casing: ☒ Yes ☐ No ~~To be installed~~ Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No ~~To be installed~~
15. Type of Protective Casing: Steel Diameter: 8 in.
16. Type of Upper Seal: ~~cement/bentonite grout~~ concrete
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: Surface casing to 137 ~~Cement/bentonite grout~~
19. Type of Well Casing: Sch 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): bentonite chips
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10-20 sand & plus native Diameter: in.
22. Type of Screen Material: Sch 80 PVC Slot Size: 0.01 in.
23. Type of Bottom Seal (If Installed): —
24. Type of Lower Backfill: —

Centralizers 135, 112, 20'
Threaded bottom cap

Recorded By	Date	Checked By	Date
		DK Nicholson	4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW NE Ø4
	Project Location: Midnite Mine	PAGE 1 of 5
	Project Number: 53F4001800.03	

Date(s) Drilled 9/16/99 - 9/25/99	Logged By M. Henry / CH2M HILL		Total Depth of Borehole (ft) 247' bgs
Drilling Method Air Rotary	Diameter of Borehole (in) 8 inch, Temporary casing driven to 143' bgs		Ground Surface Elevation (ft-msl) 3120.33
Drill Rig Type Failing Star 30K	Drilling Company Cascade Drilling		Groundwater Elevation (ft-msl)
Driller's Name T. Mechan	Sampler Type Cuttings from cyclone	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) 3122.68
Locations/ Comments Fill area east of Pit 4 dump. Adjacent to MW NE Ø3			Northing 357089 Easting 2672073

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RAD (uR/hr)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
0								FILL MATERIAL	Under-reaming bit used w/ temporary casing to 143. RAD background = 10-30 uR/hr
5'				20-50	5YR 6/4	SM		Silty sand with gravel, lt brown, well graded sands - angular to subangular, gravels up to 2 inches, dry	Boring location located east of Pit 4 ready line
10'				40-80	5YR 6/4	SW-SM		Well graded sand w/ silt and gravel, lt brown, sand and gravels are weathered phyllite, dry	
15'				30-60	5YR 5/6	SM		Silty sand with gravel, lt brown, well graded sands and gravels (to 1/4 inch, subrounded brounded sand and gravels, moist	
20'				40-75	5YR 4/4	GM		Silty gravel with sand, med brown, sands & gravels subangular subrounded, moist	
25'				30-80	5YR 4/4	SW-SM		Well graded sand with silt, med. brown, subangular-angular, sands comprised of somewhat weathered qtz, feldspar, moist	
30'				40-90					

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MWNE04
	Project Location: Midnite Mine	Page 2 of 5
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES Blows/Foot	Recovery (ft)	PID (ppm)	~~Penetrometer~~ RADIUM pCi/g	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
								FILL	
30				40-90	5YR 6/4	SW-SM		Well graded sand with silt lt brown, subangular sands (phyllite fragments) moist	FILL MATERIAL
				30-60				As above	
40				40-100	5YR 6/4	SM		Sandy silt, lt brown, sands are subangular phyllite fragments, moist	
								As above	
50				40-65	5YR 4/4	SM		Sandy silt, med brown, occasional gravels to 1/4 inch, moist	
				35-70				As above	
60				45-80	5YR 6/4	SW-SM		Well graded sand with silt, lt brown, sands are phyllitic material, moist	
70				45-75	5YR 4/4	SW-SM		Well graded sand w/ silt and gravel, subangular to subrounded sands and gravels (to 1/4 inch), sl. moist. med brown	
80				40-65	5YR 6/4	SW		Well graded sand with gravel, lt brown, subangular-subangular sands and gravels (to 1/2 inch), moist	
90				20-50	5YR 6/4	SW		As above higher % of rock fragments than above	Harder drilling, more rig chatter
				30-50	5YR 6/4	SW-GW		Well graded sand and gravel w/silt lt brown, most rock fragments show brownish-orange weathering	transitional contact from fill to native alluvium
100				20-45					ALLUVIUM

URS GREINER
Woodward Clyde

Project Name: Phase 1A RI/FS
Project Location: Midnite Mine
Project Number: 53F4001800.03

Log of Boring MW NE 04

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer ~~RAD cpm~~	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100								ALLUVIUM	
				20-45	5YR 4/4 to NS	SW		Well graded gravel and sand, lt brown and gray, gravels to 3/4 inch, subrounded-subangular moist	
				20-45				As above	Hard at 107-108 1st sign of water @ 108 - muddy cuttings
110									No return 110-117
				40-70	5YR 4/4	SW		Well graded sand w/ silt and gravel, lt brown w/ grayish tint, gravels to 3/8 inch, wet	Hammer plugged, trip rods out and steamclean hammer
								WEATHERED PHYLLITE	↑ transitional contact
120				40-60	10YR 6/6	SP		Poorly graded sand (~~SP~~), yellowish brown, medium-fine grained, wet	118-123 soft drilling
					5YR 3/4	SW-SM		Well graded sand w/ silt, dk brown, subangular rock fragments, moist	128-130 soft
130									No return 130-137
									muscovite flakes in limited discharge
								Rock fragments up to 3/4 inch	← 137 clay/silt coating phyllite fragments
140								Phyllitic rock fragments showing considerable orange-brownish weathering	
				20-60	N4 to 5B 5/1		142'	PHYLLITIC BEDROCK 145 - Rock fragments are gray-bluish gray some pyrite visible, but generally massive	- Switch over to open hole drilling using hammer bit
150				30-50	"			As above	Much less weathering after 142', much harder drilling to Producing 5-12 gpm
				20-60	"			As above	
160				30-45				As above	
				30-70				As above, shows more weathering with some qtz (10-15%)	← showing more schistose properties
170									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW NE Ø4
	Project Location: Midnite Mine	Page 4 of 5
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
								PHYLLITIC BEDROCK	
170				30-40	N4			Phyllitic rock fragments, generally massive, mid gray-blue gray, 5-10% qtz visible	167-177 soft and hard zones alternating
									175-177 hard
180				25-40	N4			As above, more massive with occasional pyrite	Rotten egg odor, beginning at 177' (H_2S)
									30 minutes/10 ft
190				20-50				As above, generally very hard	producing 10-15 gpm at this point
				20-55				As above, still encountering H_2S	30 minutes/10 ft
									Replaced bit, several buttons missing
200					N3			Phyllitic schist, dark gray w/ slight propylitic alteration, abundant pyrite on fracture faces	Dave Nicholson logs from 200-247' bgs
					N3			1g qtz blasts	
								As above	
210								As above, but finer-grained	270 cpm
								As above	
220								As above	
								As above, abundant pyrite on fracture faces	
230				230 cpm				As above	
								At 233' - aplite dike to 235 fine grained, white to buff w/ abundant pyrite	Increase in water up to ~20 gpm
								Phyllite, as above	
240									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring MW NE Ø4
	Project Location: Midnite Mine	Page 5 of 5
	Project Number: 53F4001800.03	

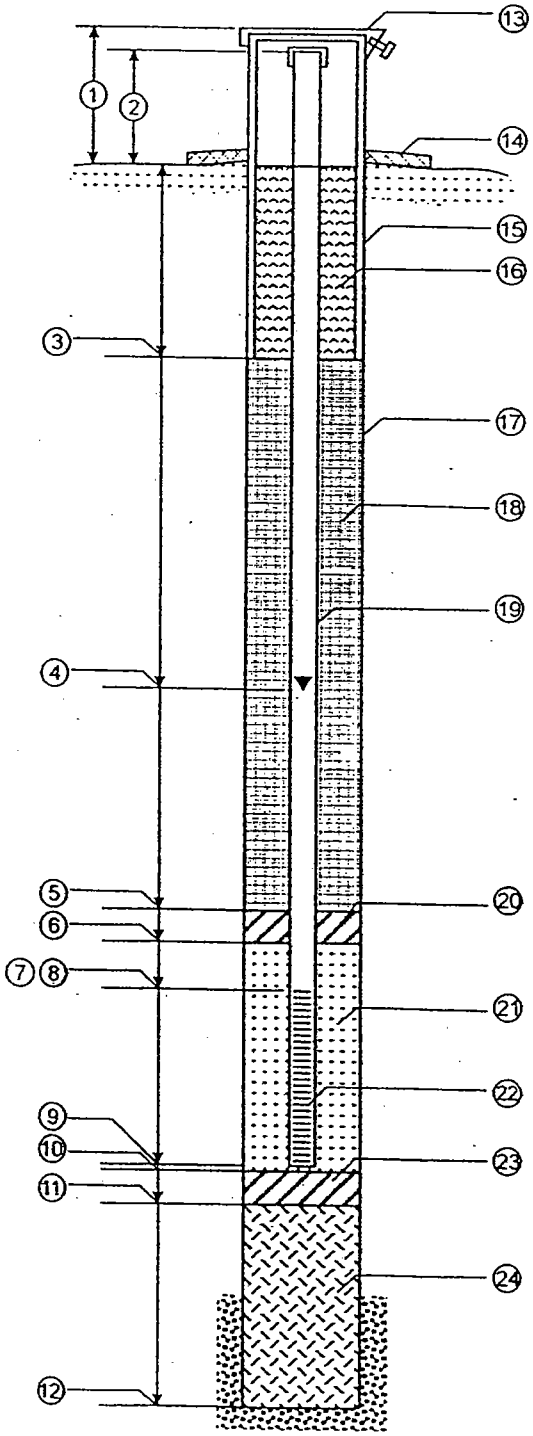
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
240								As above - phyllitic bedrock	
250								TD Borehole @ 247 'bgs	
								Borehole geophysical logging Summary	
								Temperature log	
								• DTW @ 101 'bgs	
								• slight change around 222' bgs	
260								Caliper log	
								• fracture @ 230	
								• fracture sets @ 216-221, 213-208	
								• ran log only from 247-190 (had cable catch at 185)	
270								Gamma log	
								• highest activity from 10-50 'bgs	
280								Well construction Summary	
								• Backfill borehole w/ 10-20 sand from 238.2-247	
								• 30 slot Sch 80 screen from 237.5-217.5	
								• 10-20 sand up to 212.5 'bgs	
290								• 20-40 sand/seal to 209.6	
								• bentonite chips to 208.0	
								• bentonite grout to surface (initially settled to 40 'bgs, topped off to 6 'bgs next morning)	
300								Static Water Level ~101 'bgs following installation	
310									

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53F4001800.03	Project Name: Midnite Mine Phase 1A RI/FS	Date/Time Started: 9/16/99 0900
Well/Borehole Number: MW NE #4	Well/Borehole Location: Fill area east of Pit 4 Dump	Date/Time Completed: 9/24/99 1800
Installation Team: Cascade Drilling	Type of Drilling: Air rotary w/ 8-inch ID temporary casing	Ground Surface Elev.: 3120.33 ft.msl
		Top of Well Casing Elev.: 3122.68 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 2.55 ft.
2. Stick-Up Well Casing Above Ground: 2.35' ~~2.70~~ ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 6 ft.
4. Depth to Initial Ground Water Surface Elevation: 100.3 bgs 9/24/99 ft.
5. Depth to Top of Top Seal: ~~209.6~~ 6 ft.
6. Depth to Bottom of Top Seal: 209.6 ft.
7. Depth to Top of Well Point or Screen: 217.5 ft.
8. Total Length of Blank Casing: 217.5 ft.
9. Bottom Depth of Well Screen: 237.5 ft.
10. Depth to Top of Bottom Seal (If Installed): — ft.
11. Depth to Bottom of Bottom Seal (If Installed): — ft.
12. Depth of Borehole: 247 ft.
13. Protective Casing: ☒ Yes ☐ No ~~To be installed~~ Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No ~~To be installed~~
15. Type of Protective Casing: Steel Diameter: 8 in.
16. Type of Upper Seal: ~~Cemented/bentonite grout~~ Concrete
17. Borehole Diameter: 8 (nominal) in.
18. Type of Upper Backfill: cement/bentonite grout
19. Type of Well Casing: Sch 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): bentonite chips (1 bag)
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10-20 Colorado Diameter: ____ in.
22. Type of Screen Material: Sch 80 PVC Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): —
24. Type of Lower Backfill: 10/20 sand

Centralizers 13, 15, 22

Threaded end cap

Recorded By	Date	Checked By	Date
		DK Nicholson	4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring NE-07
	Project Location: Midnite Mine	PAGE 1 OF 3
	Project Number: 53F4001800.03	

Date(s) Drilled 9/26/99-9/27/99	Logged By GARRETT BROWN/CHAM HILL	Total Depth of Borehole (ft) 89.9' bgs	
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 8¼" HAMMER BIT	Ground Surface Elevation (ft-msl) ~~TBD~~ 2851.02	
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE	Groundwater Elevation (ft-msl) TBD	
Driller's Name ROB LEININGER	Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2853.06
Locations / Comments 9¾" OD (8½" ID) THREADED STEEL CASING			Northing ~~TBD~~ 356016 Easting 2672239

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
	GRAB				10YR-5/4	ML+ FILL		Fill material - silt, yellowish brown, dry, non-cohesive, very dusty, and rock fill (phyllite).	9/26/99 - 1800 Started drilling and driving casing. Hard drilling
5	GRAB				10YR-5/4	ML+ FILL		Fill material - silt, yellowish brown, dry and rock fill that was not identifiable. Probably fill is phyllite (dark gray).	1810; RAD=67uR/h
10	GRAB				10YR 4/2	GM-GP		Silt, sand, gravel and organic debris (wood) - dark grayish brown, slightly moist, fine to coarse w/ sub-rounded gravel up to 2cm. Organic debris indicates native contact	1829 RAD=82uR/h Soft easy drilling
15	GRAB				10YR-4/3	GM-GP		Silt, sand and gravel - moist brown, fine to coarse, w/ sub-rounded gravel up to 2cm.	1833 RAD=30uR/h
20	GRAB				10YR 4/6	DECOMPOSED BEDROCK AND CLAY (Soil)		Clay and unidentified bedrock - slightly moist, highly decomposed and weathered, sticky, cohesive, dark yellowish brown, soft	1844 RAD=36uR/h Easy drilling and driving
25	GRAB				10YR 4/6			Clay and unidentified bedrock - as above. Appears to be calc-silicate hornfels, fine-grained no reaction w/ 10% HCl.	1849 RAD=63uR/h Easy drilling and driving
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring NE-07
	Project Location: Midnite Mine	PAGE 2 OF 3
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				10YR 5/6	BEDROCK		Calc-silicate hornfels - yellowish brown, dry, fine-grained, weathered and iron stained, mod. hard. Predominantly quartz, epidote and unidentified mafics.	1900 RAD=37uR/h
35	GRAB								1906 RAD=51uR/h
					10YR 5/6			Calc-silicate hornfels - as above	Shut down for day. Still driving casing. 9/27/99 0809
40	GRAB				2.5Y-6/4			Calc-silicate hornfels - dry, mod. hard slightly ~~cohesive~~ G.B. weathered light yellowish brown, predom. qtz, epidote, and calcite, reacts w/ 10% HCl.	RAD=49uR/h
45	GRAB								0815 RAD=46uR/h
					2.5Y 6/4			Calc-silicate hornfels - as above only becoming very dry. Begin injecting water at 48' to control dust.	Set casing at 47' Open hole now.
50	GRAB				2.5Y 7/3			Calc-silicate hornfels - dry pale yellow very hard, competent. Qtz, epidote diopside and trace of biotite. Minor calcite slight reaction w/ HCl	0843; RAD=19uR/h
55	GRAB				5GY 6/1			Marble - massive, fine grained wet from H_2O injection, very hard, competent, greenish-gray. Readily reacts w/ 10% HCl.	0901 RAD=46uR/h. Slow drilling
60	GRAB				5GY 7/1			Dolomitic marble - massive, very hard, competent, wet from H_2O injection, except shut off water at 62'-64' (dry, dusty again) fine-grained, light greenish gray, 10% HCl reaction w/ powdered rock	0920 RAD=62uR/h. Injected Water off 62'-64' Got dusty again. Water back on at 64'.
65									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring NE-07
	Project Location: Midnite Mine	PAGE 3 OF 3
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65	GRAB				10GY 7/1	BEDROCK	x x x	Calc-silicate hornfels - wet from H_2O injection, massive, hard, competent, light greenish gray, Predom. qtz, diopside, epidote, and trace of biotite.	0959 RAD=36 uR/h Slow drilling 1012-1046 - Rig down to empty dumpster. H_2O injection off. 1048 RAD=82 uR/h
70	GRAB				10YR 7/1		x x x + + + x x x + + + x x x + + +	Dolomitic marble and calc-silicate hornfels, as described earlier. very competent and hard. light gray, saturated, producing 1 gpm, no H_2O injection	
75	GRAB				10Y 7/1		x x x x x x x x x x x x x x x	Calc-silicate hornfels - saturated but no yield, very hard, competent readily reacts w/ 10% HCl. lt. greenish gray, qtz, epidote, calcite	1114 RAD=59 uR/h
80	GRAB				10Y 7/1		x x x x x x x x x x x x x x x	Calc-silicate hornfels - as above	1135 RAD=32 uR/h 1138 - Shut down to measure WL. Can't get probe past mudcake at 48'. Inject water to clean. Water off again at 82'
85	GRAB				10Y 8/1		+ + + + + + + + + + + + + + +	Dolomitic marble - massive, produces 2-3 gpm, light greenish gray, hard, 10% HCl reaction only w/ rock powder. light gray (N-7/) at 90'.	1220 RAD=37
90	GRAB							TD = 89.9' bgs.	1258 - Stopped drilling and flushed hole w/ water to clean up. 1330 - Finished tripping drill rods. 1415-1630 Set well and pulled steel casing.
95									
100									

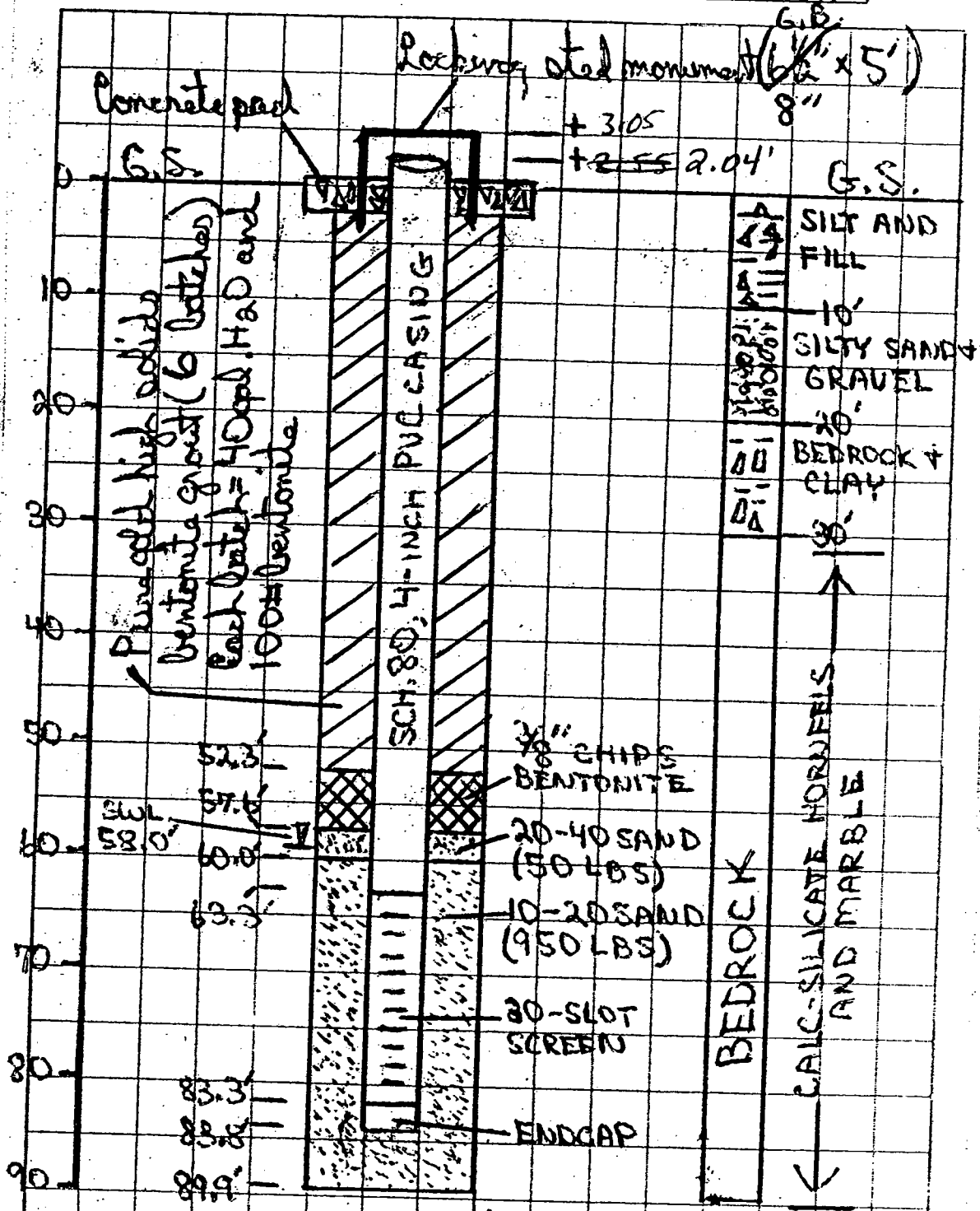
Notes: After drilling, let borehole sit for 45 minutes. WL was at 60.2' and still rising, but at a slower pace. Appears formation may be partially confined. Dry dusty conditions existed when drilling at 64'. Did not see first water until 68 or 70'. Set well across from water-bearing zone between 63.3' and 83.3' bgs w/ 20 feet of 30-slot screen. Sand is between 57.6 to 89.9' bgs.

Northeastern Drainage

Location MWNE-07 Date 9-27-99

Project / Client T28N-R37E-SEC12-SW1/4 NE1/4

WELL NE-07 COMPLETION DIAGRAM



TD=89.9' bgs

Centralizers at bottom and top of screen.

W. Brown 9-27-99

Checked by DK Nicholson 4/26/00

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring WD-01
	Project Location: Midnite Mine	PAGE 1 OF 4
	Project Number: 53F4001800.03	

Date(s) Drilled 9/14/99 - 9/15/99	Logged By GARRETT BROWN/CH2M HILL		Total Depth of Borehole (ft) 119.6' BGS
Drilling Method AIR ROTARY WITH CASING DRIVER	Diameter of Borehole (in) 7 7/8" HAMMER BIT		Ground Surface Elevation (ft-msl) ~~TBD~~ 2404.08
Drill Rig Type INGERSOLL-RAND T3W	Drilling Company CASCADE, SEATTLE		Groundwater Elevation (ft-msl) TBD
Driller's Name ROB LEININGER	Sampler Type CYCLONE GRAB SAMPLE	Checked By DK Nicholson	Measuring Point Elevation (ft-msl) ~~TBD~~ 2406.49
Locations / Comments 9 3/4" OD (8 1/2" ID) THREADED STEEL CASING			Northing 352242 Easting ~~TBD~~ 2670910

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
								G.B. WD-01 IS LOCATED 30' SOUTH ~~N NW~~ OF WELL MW-1	
								Silt, gravel, and organic debris at ground surface.	9-14-99 Began drilling at 11:55.
5	GRAB				2.5Y-4/2	SM		Silty sand - dark grayish brown, slightly moist, non-cohesive, loose, fine to med-grained sand w/ 10-20% silt	11:59; RAD=45 uR/h 1203-1250 - Casing driver malfunctions Down for repairs. SWL=6 to 8' bgs.
10	GRAB				10YR-5/2	GW		Gravel - grayish brown, saturated, producing several gpm, clean, well graded (poorly sorted), angular to sub-rounded; up to 2cm; little fines	1305; RAD=48 uR/h
14					10YR-3/3	GM		Silty gravel	
15	GRAB				2.5Y-5/2	BEDROCK		Porphyritic qtz monzonite. Bedrock went dry. See description below.	1320 Set casing (temporary) in bedrock at 16'.
20	GRAB				2.5Y 5/2			Porphy. qtz. monzonite - dry, hard, slightly weathered and iron stained, predominantly pink K feldspar, and smoky qtz. Minor plagioclase and less than 5% biotite. Also unidentified greenish mineral. Perhaps altered K feldspar or plagioclase? Coarse-grained phenocrysts, especially K feldspar. No formation water.	1334; RAD=34 uR/h
25	GRAB								1346; RAD=49 uR/h Injecting water to control dust. Cuttings still dry. No formation water
30									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring WD-01
	Project Location: Midnite Mine	PAGE 2 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
30	GRAB				2.54 6/1	BEDROCK		Porphyritic qtz. monzonite - gray, dry even though injecting water to control dust, clean, unweathered hard, competent.	1410 - RAD=53uR/h
35	GRAB				2.54-7/1			Porphy. qtz monzonite - as above only color change to light gray.	1430; RAD=56uR/h H_2O injection to control dust.
40	GRAB							As above. H_2O injection, yet cuttings dry.	1450; RAD=73uR/h
45	GRAB							As above, cuttings dry even w/ H_2O injection to control dust.	1507; RAD=49uR/h
50	GRAB							As above, cuttings dry	1537; RAD=32uR/h
55	GRAB							As above, cuttings dry	1550; RAD=42uR/h
60	GRAB							As above, cuttings dry.	1615; RAD=39uR/h
65									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring WD-01
	Project Location: Midnite Mine	PAGE 3 OF 4
	Project Number: 53F4001800.03	

Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
65	GRAB				2.54 7/1	BEDROCK		Porphy. qtz. monzonite - as above, dry, even w/ injected water to control dust.	1628; RAD=64uR/h. 1645-1720 - Stripped hole to load 20' rods.
70	GRAB				2.54-7/1			As above, only wet from H_2O injection and slightly weathered surfaces.	1725; RAD=63uR/h
75	GRAB				2.54-6/1			Porphy. qtz. monzonite - moist from H_2O injection, med. hard, gray.	1740; RAD=54uR/h Faster drill speed.
80	GRAB				2.54 7/1			Porphy. qtz. monzonite - light gray, moist from H_2O injection, hard, competent, clean. no weathering	1805; RAD=48uR/h
85	GRAB							As above, only dry even though injecting water to control dust.	1827; RAD=71uR/h
90	GRAB							As above, very hard and dry.	1850; RAD=74uR/h
95	GRAB							As above.	1910; RAD=113uR/h
100									

URS GREINER Woodward Clyde	Project Name: Phase 1A RI/FS	Log of Boring WD-01
	Project Location: Midnite Mine	PAGE 4 OF 4
	Project Number: 53F4001800.03	

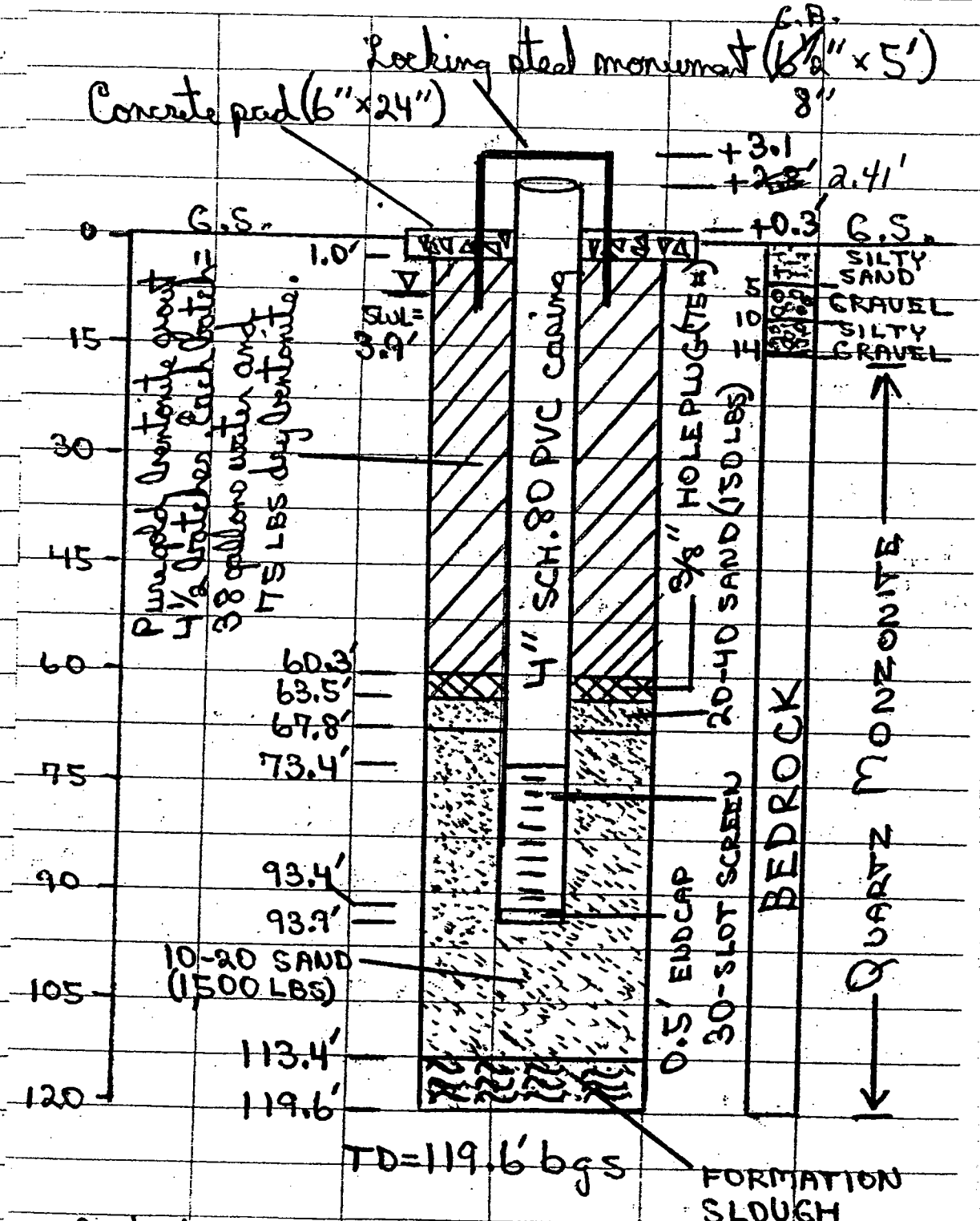
Depth (ft-bgs)	SAMPLES: Blows/Foot	Recovery (ft)	PID (ppm)	Penetrometer (tsf)	Munsell Color	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS
100'					2.5Y-7-1	BEDROCK		Porphyritic qtz. monzonite – as above, dry.	
105	GRAB							As above, only cuttings muddy I injecting water to control dust.	1958; RAD=98uR/h
110'	GRAB							As above.	2018; RAD=108
115'									Flushed borehole for 10 minutes at 5-10 gpm to clean out. Tripped borehole of drill rods.
120'								TD=119.6' BGS	9-15-99 0800 - Tagged bottom at 113.4' Hole sloughed approx 6' overnight. SWL=3.9' BGS
125'									
130'									
135'									

Notes: After tripping out of borehole, the tagged depth at 119.6' BGS was 10 feet deeper than expected. Lost track of borehole depth between 70' and 119.6' bgs. It is all porphyritic qtz. monzonite, however. Geophysical caliper log indicates major fracture and borehole widening between 81' and 83' bgs. The rest of the borehole is very even. Set screen between 73.4 and 93.4' BGS. Sand pack from 63.5' to 113.4' BGS.

30 Location Weston Drainage MWWD-01 Date 9-15-99

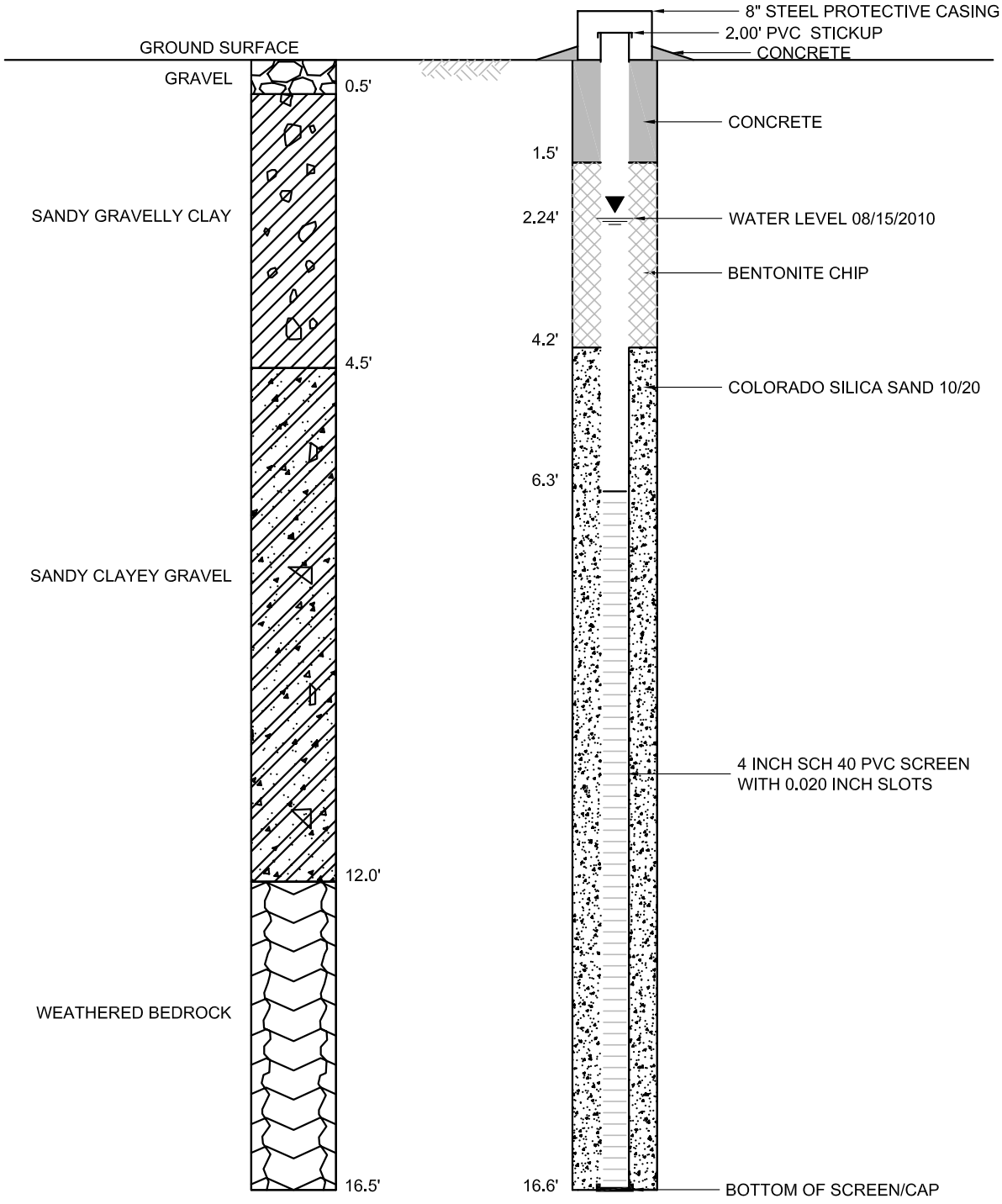
Project / Client T28N-R37E-SEC13-NW¼NW¼

WELL WD-01 COMPLETION DIAGRAM



Centralizers at bottom and top of screen and 20' above top of screen.

checked by DK Nicholson 4/24/00



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

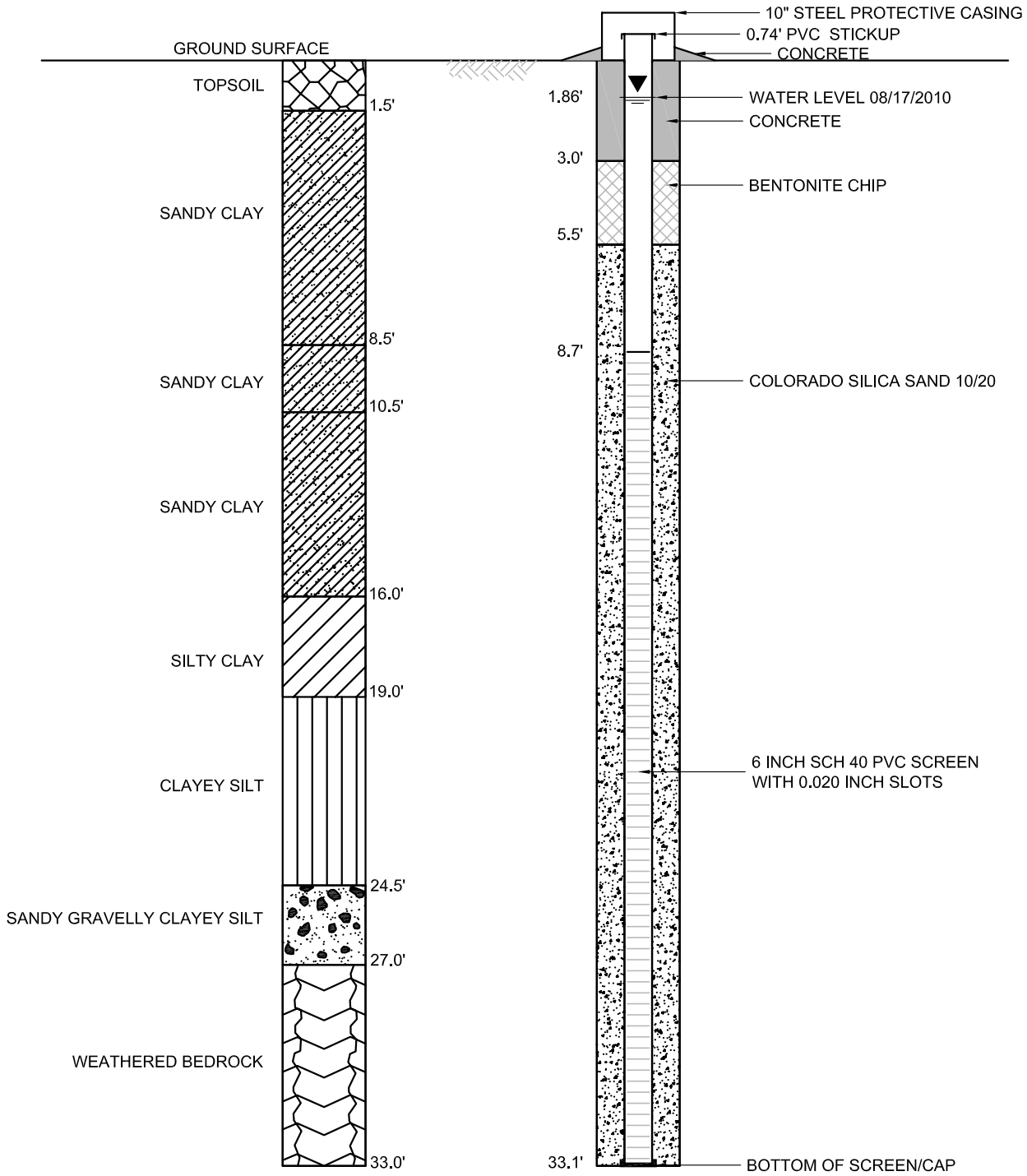
E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED:11/11/10 PRINTED:12/20/10 BY:NEIL.BRENNAN

Project No. 181850

November 2010

Note - Two wells were installed with the "MWWD-02" designation. This well was later designated "-02b"

Figure 7
Well Completion Diagram MWWD-02



ALL DEPTHS BELOW GROUND SURFACE.

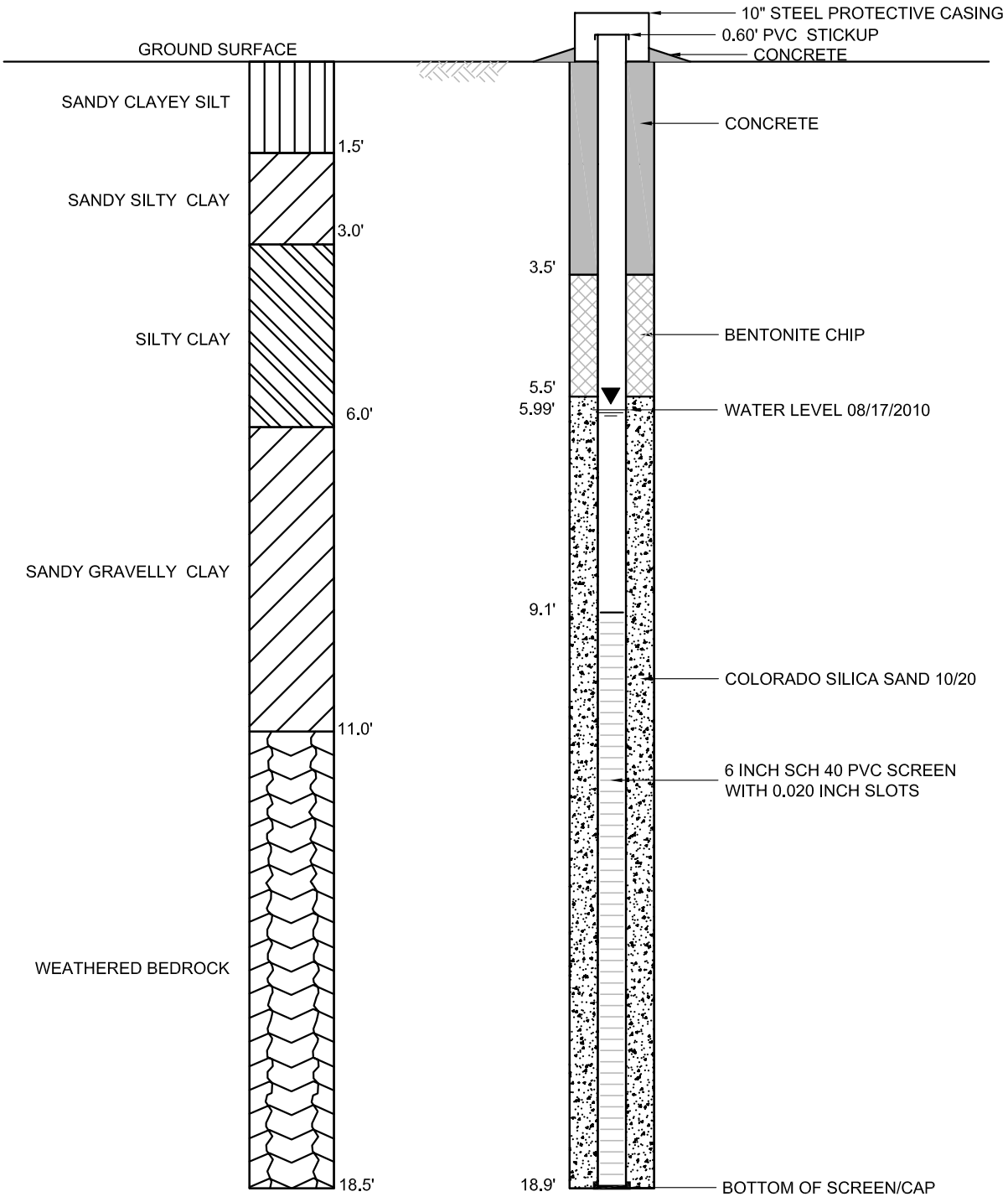
NOT TO SCALE

E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED:11/11/10 PRINTED:12/20/10 BY:NEIL.BRENNAN

Project No. 181850

November 2010

Figure 1
Well Completion Diagram PBC-01



ALL DEPTHS BELOW GROUND SURFACE.

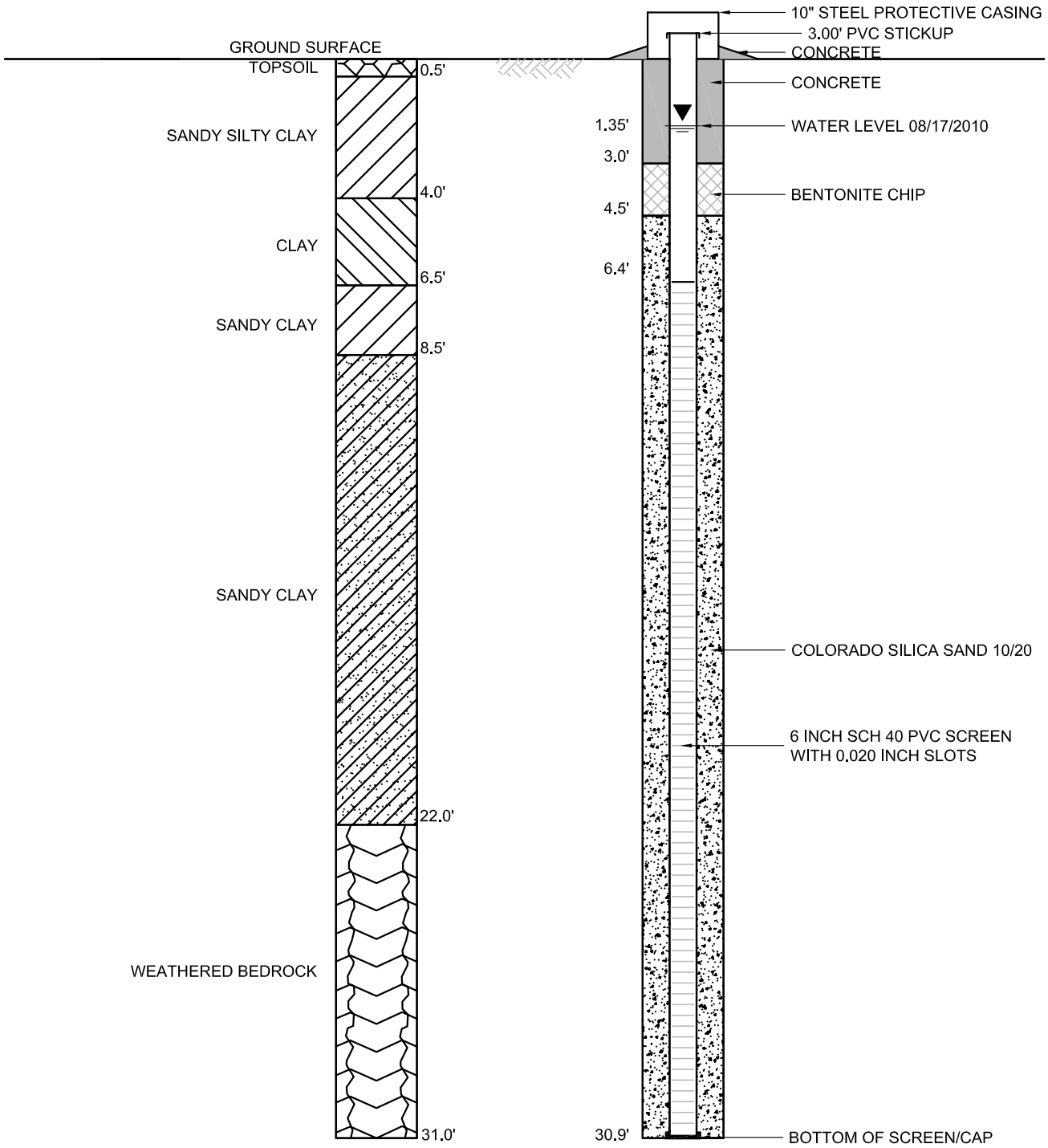
NOT TO SCALE

E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED: 11/11/10 PRINTED: 12/20/10 BY: NEIL.BRENNAN

Project No. 181850

November 2010

Figure 2
Well Completion Diagram PBC-02



ALL DEPTHS BELOW GROUND SURFACE.

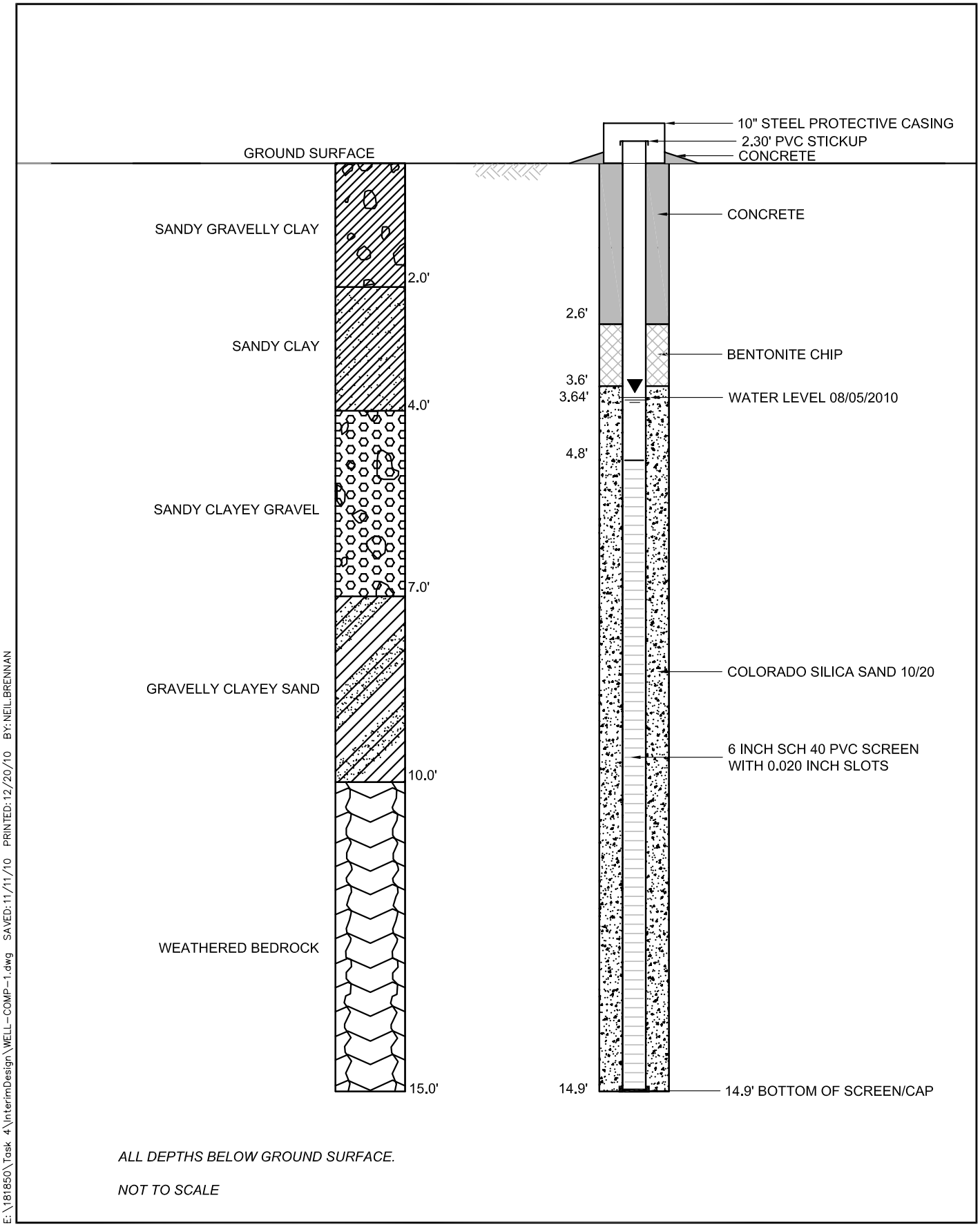
NOT TO SCALE

E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED: 11/11/10 PRINTED: 12/20/10 BY: NEIL.BRENNAN

Project No. 181850

November 2010

Figure 3
Well Completion Diagram PBC-03

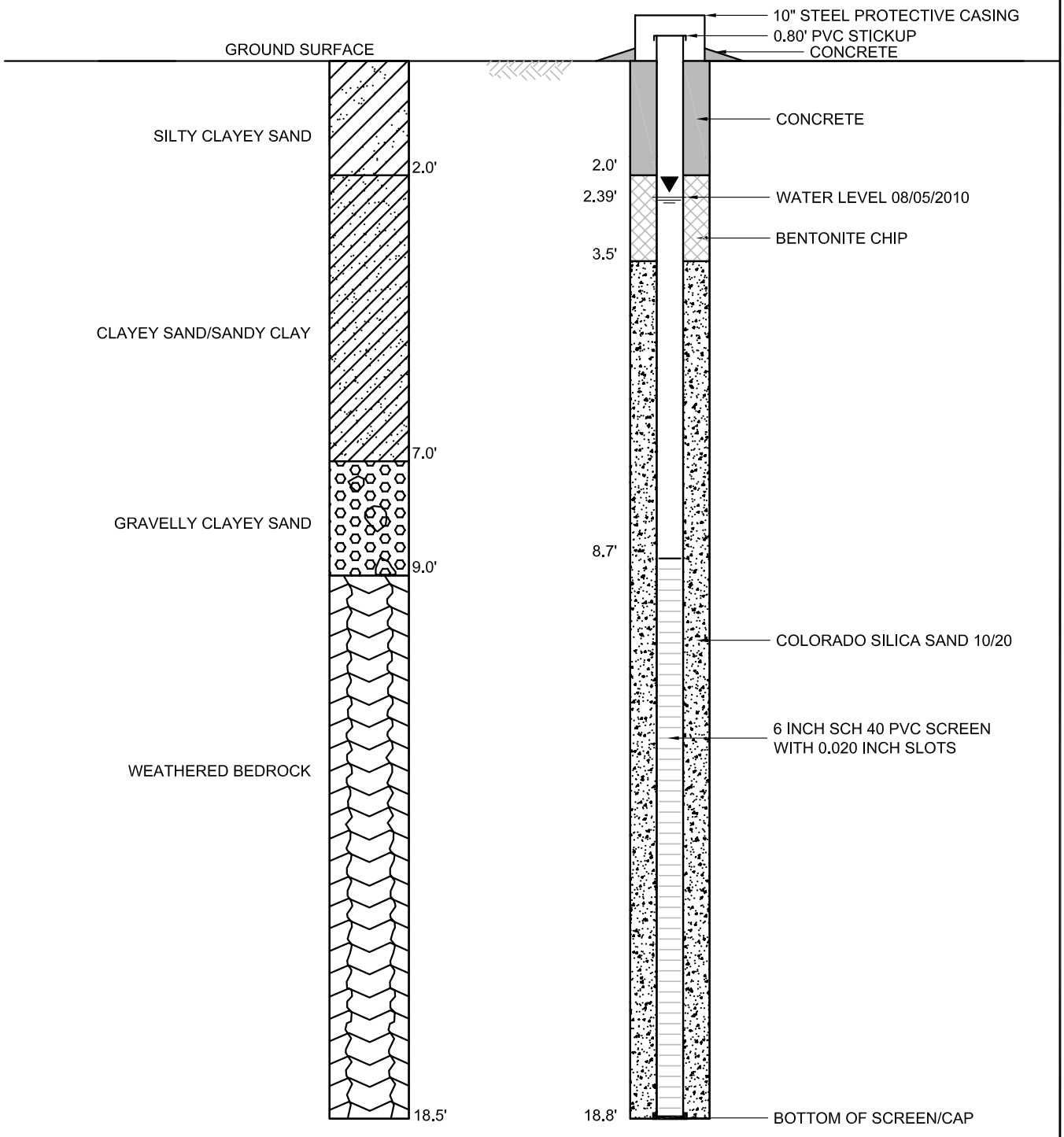


E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED: 11/11/10 PRINTED: 12/20/10 BY: NEIL.BRENNAN

Project No. 181850

November 2010

Figure 5
Well Completion Diagram PBW-01



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

E:\181850\Task 4\InterimDesign\WELL-COMP-1.dwg SAVED:11/11/10 PRINTED:12/20/10 BY:NEIL.BRENNAN

Project No. 181850

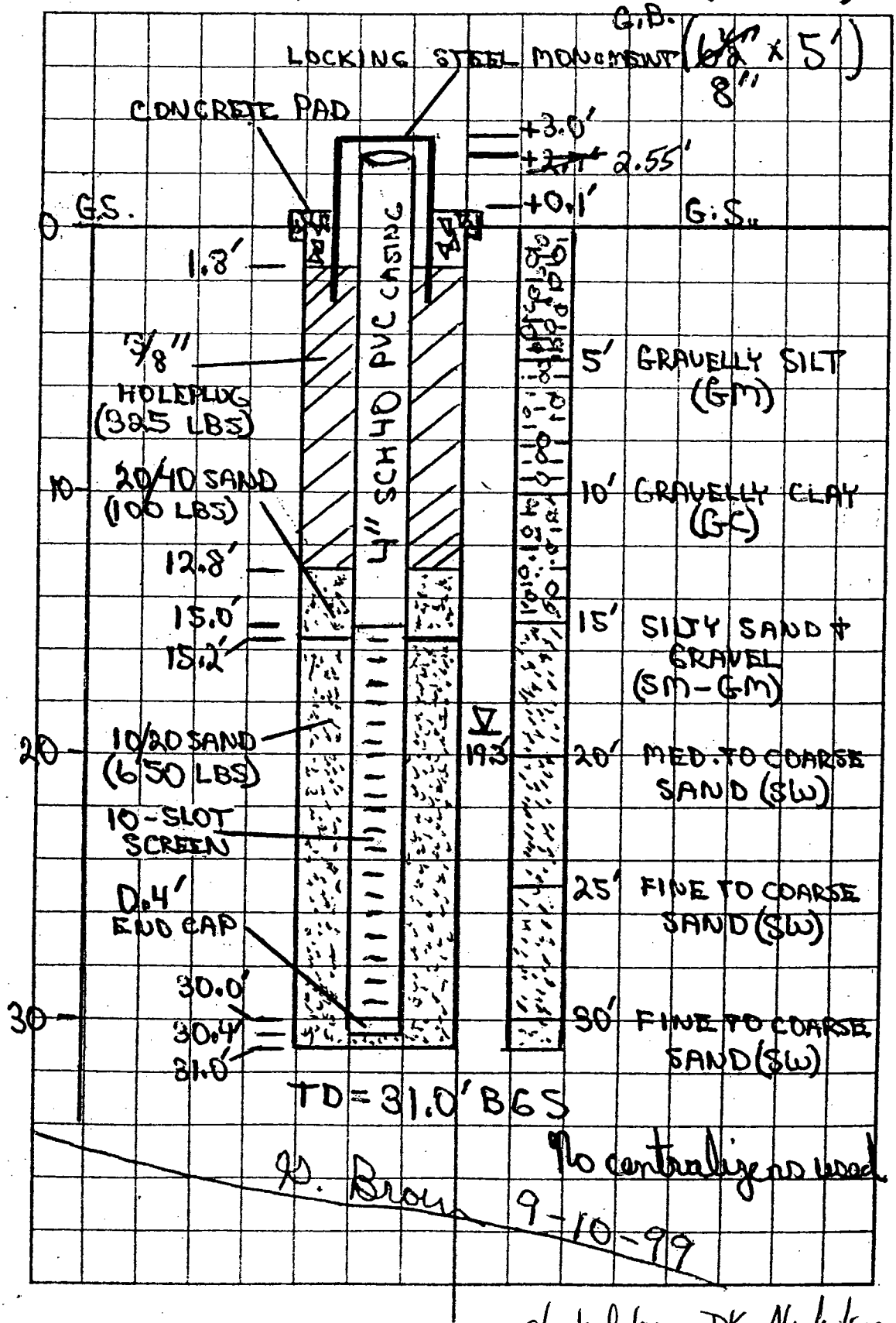
November 2010

Figure 6
Well Completion Diagram PBW-02

Location tar West Drainage FW-01 Date 9-10-99

Project / Client T28N-R37E; SEC11-SE¼SE¼

BORING LOG / WELL CONSTRUCTION (FW-01)



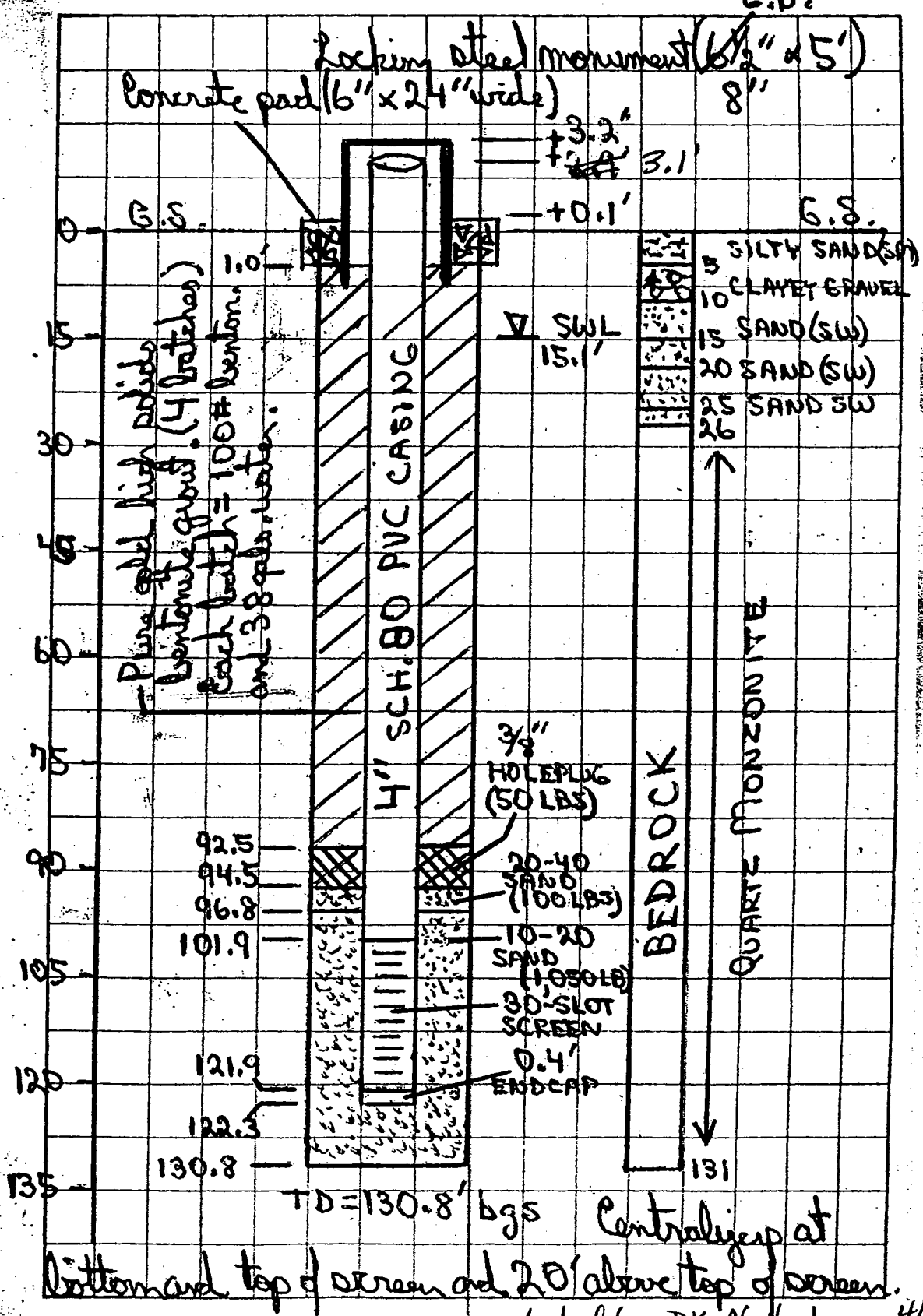
Checked by: DK Nicholson 4/26/00

Far West Drainage

Location FW-02 Date 9-14-99

Project / Client T28N-R37E-SEC.11-SE1/4SE1/4

FW-02 WELL COMPLETION



Centralizer at bottom and top of screen and 20' above top of screen.

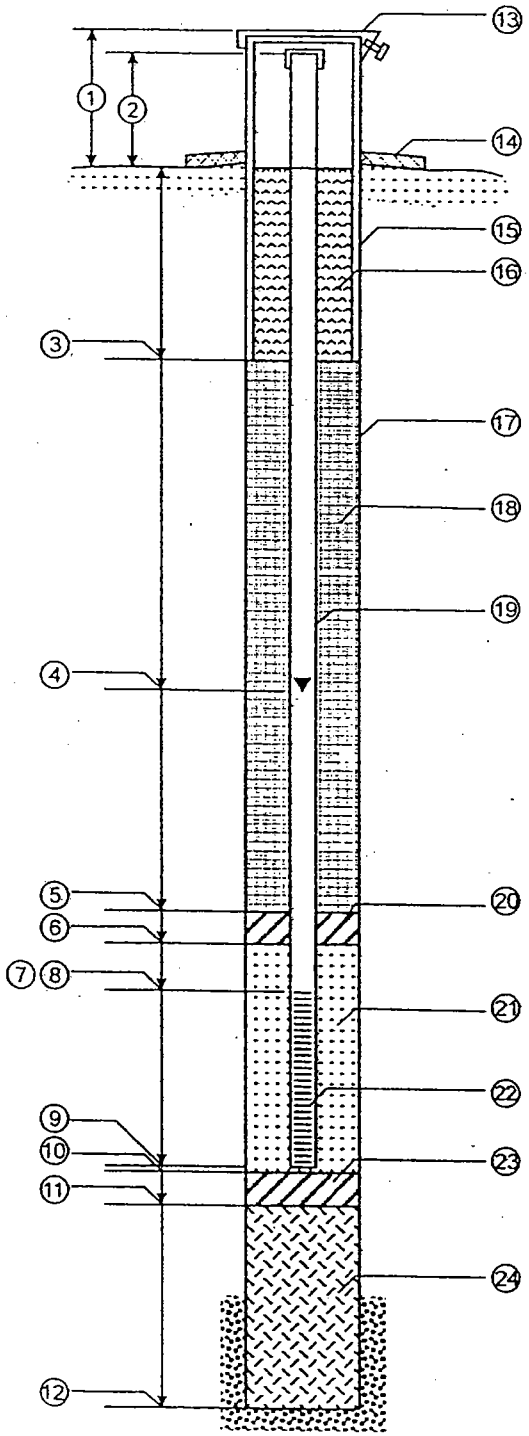
checked by DK Nicholson 4/26/00

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: C3F400 1E00-03	Project Name: MIDNITE MINE	Date/Time Started: 9-10-99 / 1400
Well/Borehole Number: MWNW01	Well/Borehole Location: Northwest Ridge	Date/Time Completed: 9-11-99 / 1130
Installation Team: RIG 1	Type of Drilling: AIR ROTARY	Ground Surface Elev.: 3424.71 ft.msl
		Top of Well Casing Elev.: 3426.66 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.15 ft.
2. Stick-Up Well Casing Above Ground: ~~1.2~~ 1.95 ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 15 ft.
4. Depth to Initial Ground Water Surface Elevation: 85 ft.
5. Depth to Top of Top Seal: 64 ft.
6. Depth to Bottom of Top Seal: 73 ft.
7. Depth to Top of Well Point or Screen: 80 ft.
8. Total Length of Blank Casing: 80 ft.
9. Bottom Depth of Well Screen: 100.8 HG 9.16 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 101 ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: PORTLAND CEMENT
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: BENTONITE SLURRY
19. Type of Well Casing: Sch. 40 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 20/40 (2') BENT. PELLETS (5.5')
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10/20 Diameter: 4 in.
22. Type of Screen Material: Sch. 40 PVC Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

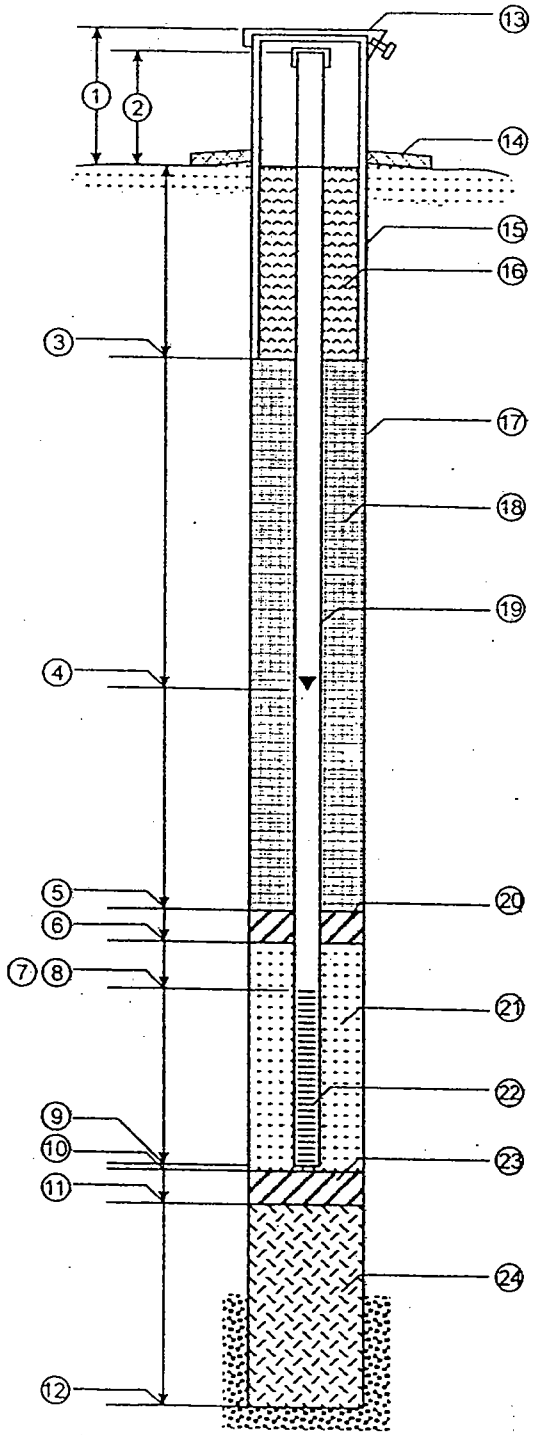
Recorded By: [signature]	Date: 9-11-99	Checked By: DK Nicholson	Date: 4/26/00

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53F4001500 03	Project Name: MOONLIGHT MINE	Date/Time Started: 9-11-99 / 1600
Well/Borehole Number: MWNW02	Well/Borehole Location: Northwest Ridge	Date/Time Completed: 9-13-99
Installation Team: R16 1	Type of Drilling: AIR ROTARY	Ground Surface Elev.: 3524.85 ft.msl
		Top of Well Casing Elev.: 3527.09 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.2 ft.
2. Stick-Up Well Casing Above Ground: ~~2.0~~ 2.24 ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 15 ft.
4. Depth to Initial Ground Water Surface Elevation: 186 ft.
5. Depth to Top of Top Seal: 64 ft.
6. Depth to Bottom of Top Seal: 172 ft.
7. Depth to Top of Well Point or Screen: 180 ft.
8. Total Length of Blank Casing: 180 ft.
9. Bottom Depth of Well Screen: 200 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 206 ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: PORTLAND CEMENT
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: BENTONITE SLURRY
19. Type of Well Casing: SCH. 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 20/40 SAND & BENT. Pellets
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10/20 Diameter: 4 in.
22. Type of Screen Material: ~~0.030~~ HG 9-13-99 SCH. 80 Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: 10/20 SAND

Recorded By	Date	Checked By	Date
[signature]	9-13-99	DK Nicholson	4/26/00

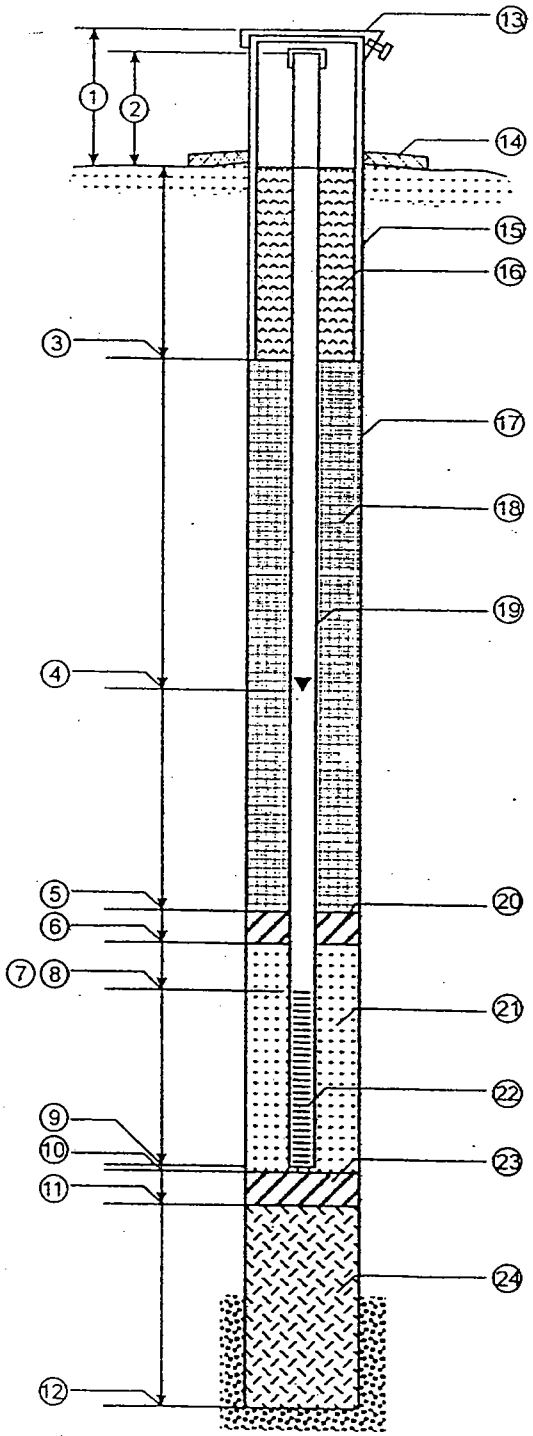
URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number	Project Name	Date/Time Started
53F4001800.03	MIDNITE MINE	9-13-99/1413
Well/Borehole Number	**Well/Borehole Location**	**Date/Time Completed**
MWNW03	Northwest Ridge	9-14-99/1600

Installation Team	Type of Drilling	Ground Surface Elev.	Top of Well Casing Elev.
RIG 1	AIR ROTARY	3557.86 ft.msl	3560.71 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.55 ft.
2. Stick-Up Well Casing Above Ground: ~~3.34~~ 2.85 ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 27 ft.
4. Depth to Initial Ground Water Surface Elevation: 103 ft.
5. Depth to Top of Top Seal: 82.9 ft.
6. Depth to Bottom of Top Seal: 91.2 ft.
7. Depth to Top of Well Point or Screen: 97 ft.
8. Total Length of Blank Casing: 97 ft.
9. Bottom Depth of Well Screen: 117 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 120 ft.
13. Protective Casing: [X] Yes [ ] No Locking Cap: [X] Yes [ ] No
14. Sanitary Seal: [X] Yes [ ] No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: PORTLAND CEMENT
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: BENTONITE SLURRY
19. Type of Well Casing: Sch. 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 20/40 SAND AND BENTONITE CHIPS
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10/20 Diameter: 4 in.
22. Type of Screen Material: ~~0.030~~ Sch. 80 PVC Slot Size: 0.030 in. HB 9-14-99
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

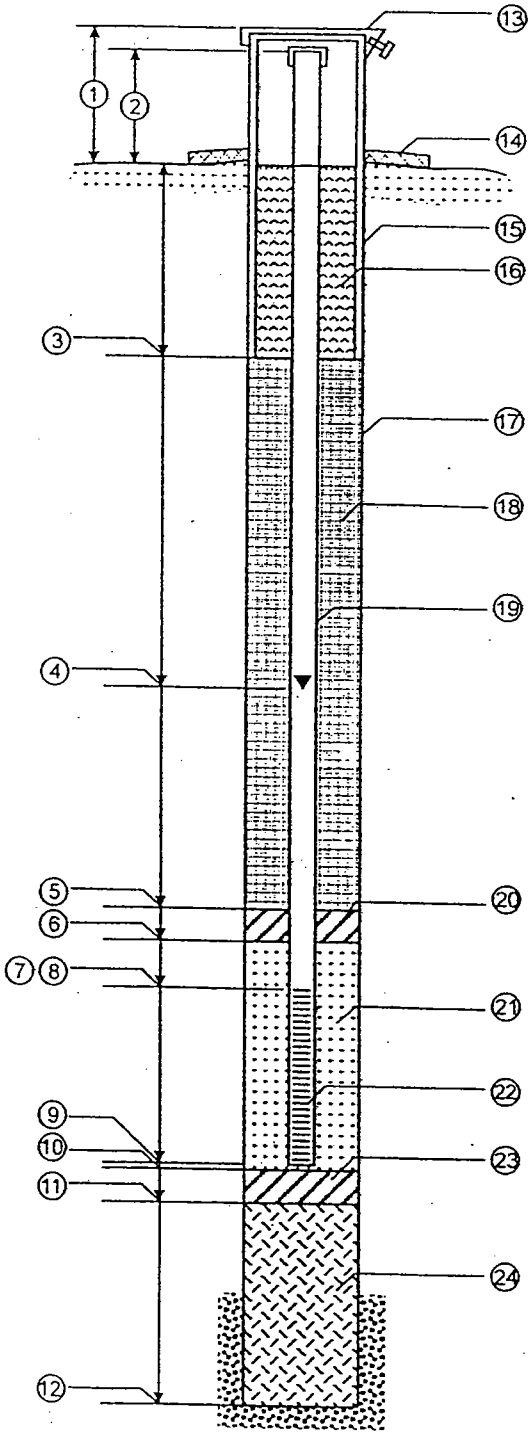
Recorded By	Date	Checked By	Date
[signature]	9-14-99	DK Nicholson	4/26/00

URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

Project Number: 53 F400 1800-03	Project Name: MIDNITE MINE	Date/Time Started: 9/14/99 / 1635	
Well/Borehole Number: MWNW04	Well/Borehole Location: Northwest Ridge	Date/Time Completed: 9/16/99 1330	
Installation Team: R16 1	Type of Drilling: AIR ROTARY	Ground Surface Elev.: 3494.30 ft.msl	Top of Well Casing Elev.: 3496.90 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.25 ft.
2. Stick-Up Well Casing Above Ground: ~~3.7~~ 2.60 ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 37 ft.
4. Depth to Initial Ground Water Surface Elevation: 170 ft.
5. Depth to Top of Top Seal: 156 ft.
6. Depth to Bottom of Top Seal: 162 ft.
7. Depth to Top of Well Point or Screen: 171 ft.
8. Total Length of Blank Casing: 171 ft.
9. Bottom Depth of Well Screen: 191 ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 193.2 ft.
13. Protective Casing: ☒ Yes ☐ No Locking Cap: ☒ Yes ☐ No
14. Sanitary Seal: ☒ Yes ☐ No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: PORTLAND CEMENT
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: BENTONITE SLURRY
19. Type of Well Casing: SCH. 80 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 20/40 SAND / BENTONITE CHIPS
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 20/20 SAND Diameter: 4" in.
22. Type of Screen Material: SCH. 80 PVC Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

Recorded By	Date	Checked By	Date
[signature]	9-16-99	DK Nicholson	4/26/00

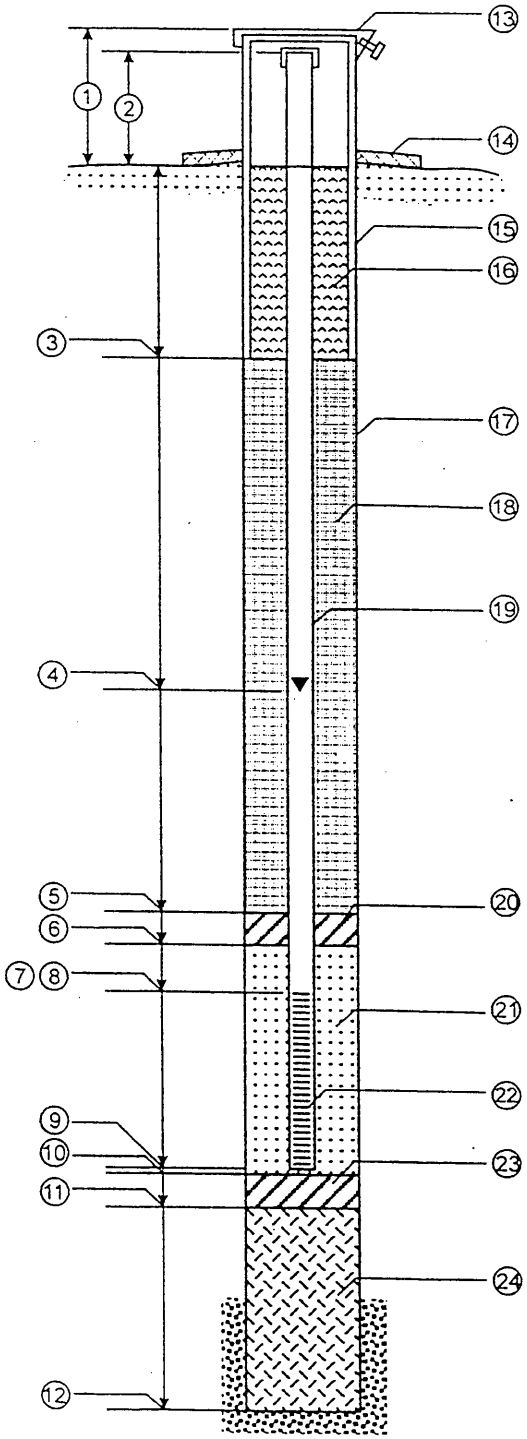
URS Greiner Woodward-Clyde

Monitoring Well Installation Log

Records Management Data

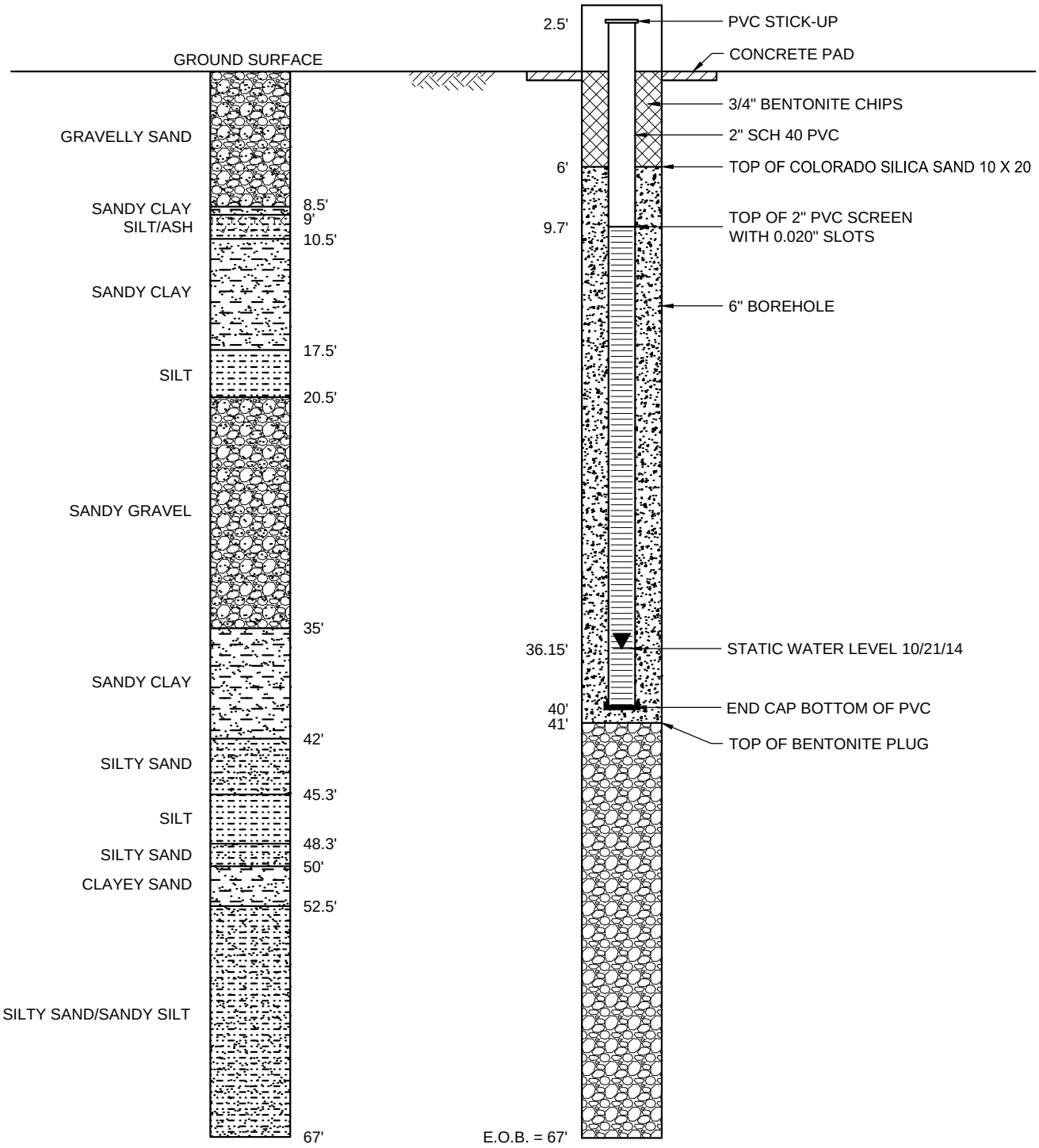
Project Number	Project Name	Date/Time Started
53F400 1800-03	MINNITE MINE	9-8-99 / 1627
Well/Borehole Number	**Well/Borehole Location**	**Date/Time Completed**
MWNW-07	Northwest Ridge	9-10-99 / 1200

Installation Team	Type of Drilling	Ground Surface Elev.	Top of Well Casing Elev.
RIG 1	AIR ROTARY	3430.10 ft.msl	3432.77 ft.msl



1. Stick-Up of Protective Casing (If Any) Above Ground: 3.43 ft.
2. Stick-Up Well Casing Above Ground: ~~3.08~~ 2.67 ft.
3. Depth to Bottom of Upper Seal/Protective Casing: 15' ft.
4. Depth to Initial Ground Water Surface Elevation: 137 ft.
5. Depth to Top of Top Seal: 120 ft.
6. Depth to Bottom of Top Seal: 123 ft.
7. Depth to Top of Well Point or Screen: 129.5 ft.
8. Total Length of Blank Casing: 140 ~~130~~ 129.5 ft.
9. Bottom Depth of Well Screen: 9-10-99 149.5' ft.
10. Depth to Top of Bottom Seal (If Installed): N/A ft.
11. Depth to Bottom of Bottom Seal (If Installed): N/A ft.
12. Depth of Borehole: 150 ft.
13. Protective Casing: [X] Yes [ ] No Locking Cap: [X] Yes [ ] No
14. Sanitary Seal: [X] Yes [ ] No
15. Type of Protective Casing: STEEL Diameter: 8 in.
16. Type of Upper Seal: PORTLAND CEMENT
17. Borehole Diameter: 8 in.
18. Type of Upper Backfill: BENTONITE SLURRY
19. Type of Well Casing: SCH. 40 PVC Diameter: 4 in.
20. Type of Top Seal (IF Installed): 20/40 2 FT' BENTONITE PELLETS 5'
21. Type/Size of Gravel/Sand Pack Around Well Point or Screen: 10/20 Diameter: ~~HOP~~ 8 4 9-12-99 in.
22. Type of Screen Material: SCH. 40 PVC Slot Size: 0.030 in.
23. Type of Bottom Seal (If Installed): N/A
24. Type of Lower Backfill: N/A

Recorded By	Date	Checked By	Date
[signature]	9-10-99	DK Nicholson	4/26/00



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

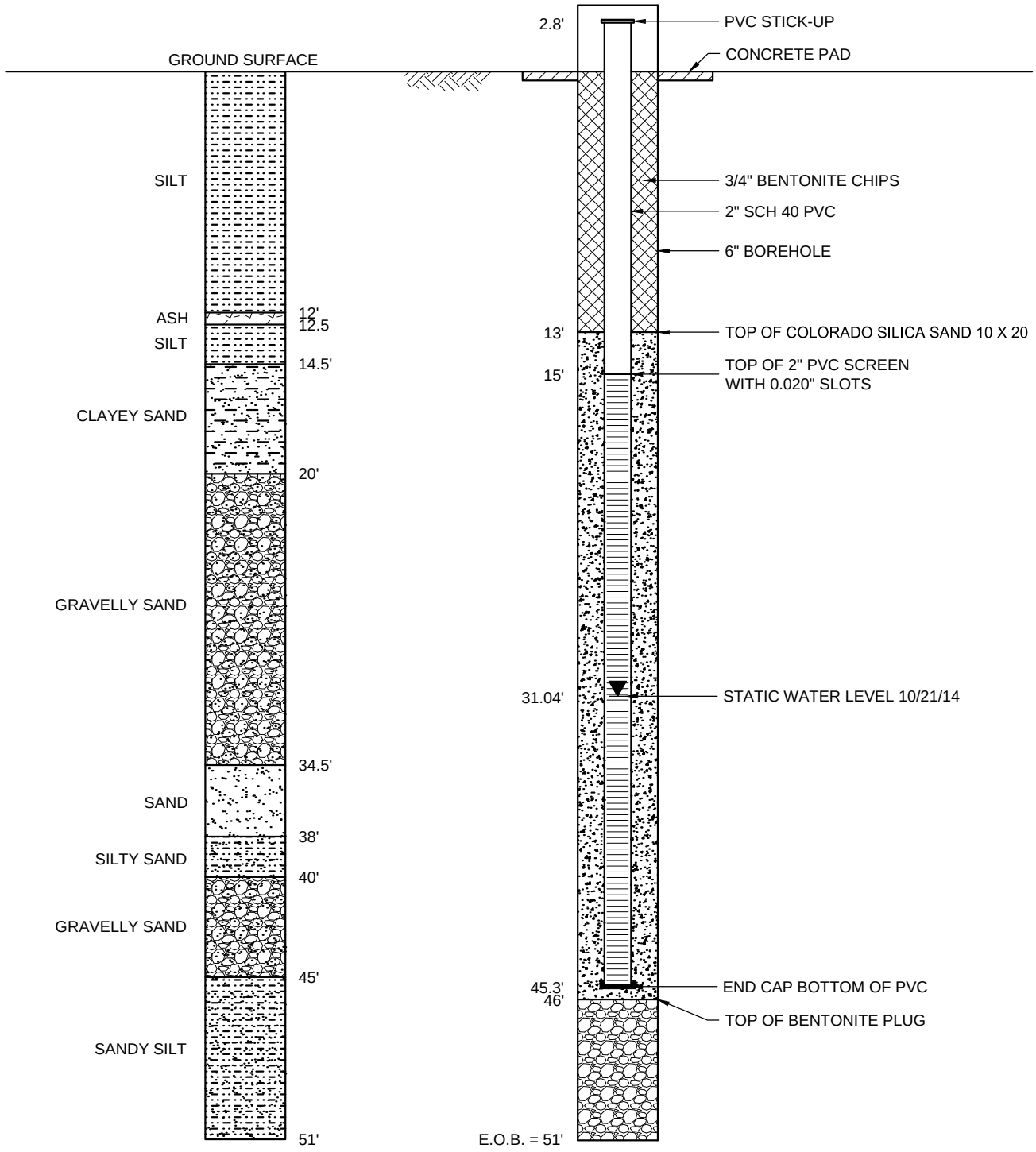
WORTHINGTON
MILLER
ENVIRONMENTAL, LLC.

MWBC-02*
WELL COMPLETION DIAGRAM
(* ID corrected for 100% BODR)

Date:	NOVEMBER 2014
Project:	MIDNITE
File:	WELL COMP-BC WELLS

Attachment 2

Z:\Project Files\Midnite\AutoCAD Files\Midnite Mine CAD Files\WME\Logs\Well Comp-BC Wells.dwg SAVED:11/19/14 PRINTED:11/19/14 BY:TOM



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

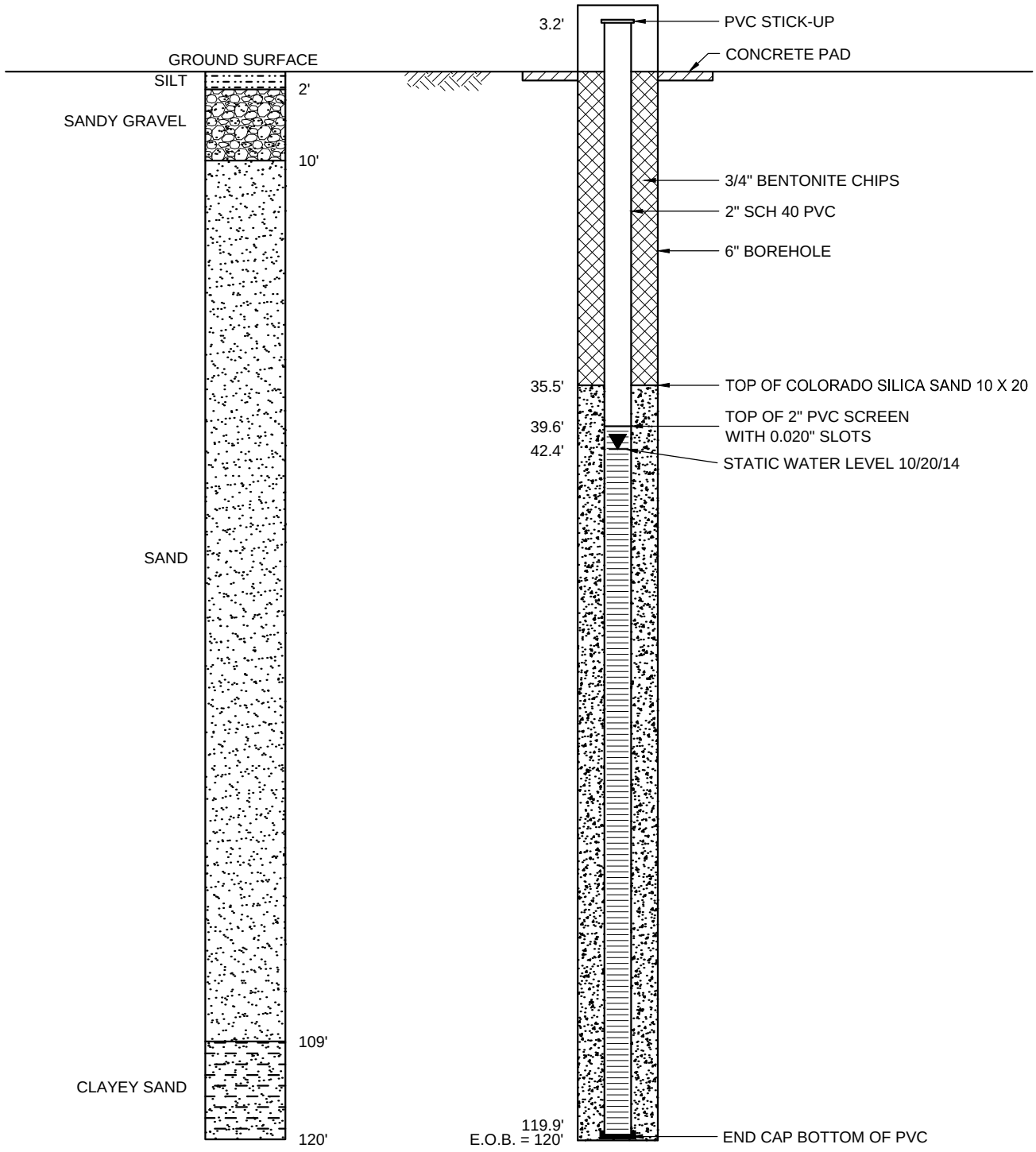
WORTHINGTON
MILLER
ENVIRONMENTAL, LLC.

MWBC-03*
WELL COMPLETION DIAGRAM
(*ID corrected for 100% BODR)

Date:	NOVEMBER 2014
Project:	MIDNITE
File:	WELL COMP-BC WELLS

Attachment 2

Z:\Project Files\Midnite\AutoCAD Files\Midnite Mine CAD Files\WME\Logs\Well Comp-BC Wells.dwg SAVED:11/19/14 PRINTED:11/19/14 BY:TOM



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

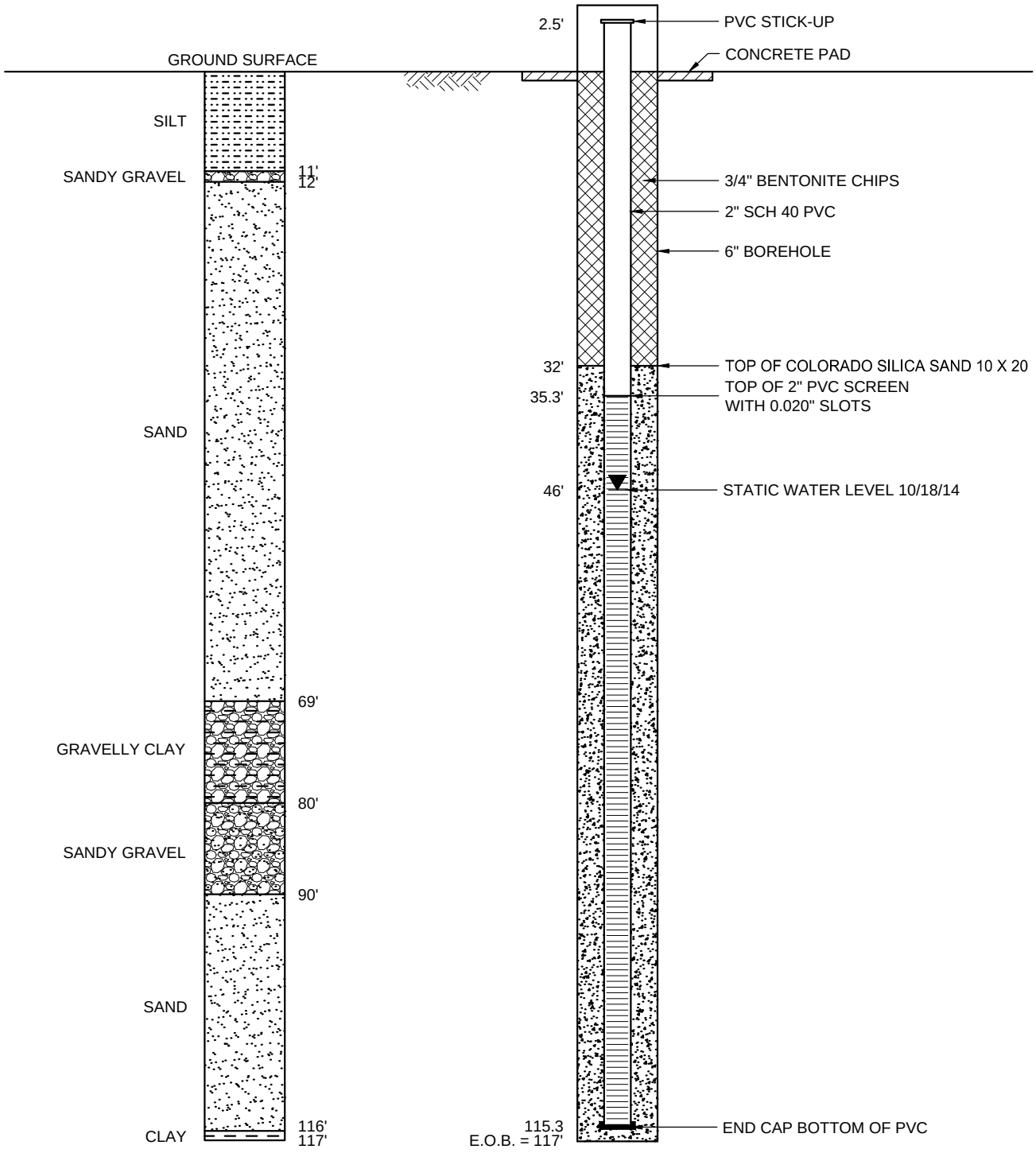
WORTHINGTON
MILLER
ENVIRONMENTAL, LLC.

MWBC-04*
WELL COMPLETION DIAGRAM
(*ID corrected for 100% BODR)

Date:	NOVEMBER 2014
Project:	MIDNITE
File:	WELL COMP-BC WELLS

Attachment 2

Z:\Project Files\Midnite\AutoCAD Files\Midnite Mine CAD Files\WME\Logs\Well Comp-BC Wells.dwg SAVED:11/19/14 PRINTED:11/19/14 BY:TOM



ALL DEPTHS BELOW GROUND SURFACE.

NOT TO SCALE

Z:\Project Files\Midnite\AutoCAD Files\Midnite Mine CAD Files\WME\Logs\Well Comp-BC Wells.dwg SAVED: 11/20/14 PRINTED: 11/20/14 BY: TOM

WORTHINGTON
MILLER
ENVIRONMENTAL, LLC.

MWBC-05*
WELL COMPLETION DIAGRAM
(*ID corrected for 100% BODR)

Date:	NOVEMBER 2014
Project:	MIDNITE
File:	WELL COMP-BC WELLS

Attachment 2

Attachment Q1-B

Job Safety Analyses

JOB SAFETY ANAYSIS
Midnite Mine Superfund Site
Site-Wide Monitoring Plan

ACTIVITY: **Groundwater Sampling/Water Level Measurement** PREPARED BY: Aaron Pettley REVIEWED BY: Tami Renkoski

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
▪ Use water level meter to measure elevation. ▪ Sample groundwater. ▪ Cleanup ▪ Decontamination: Decon procedures for personnel and equipment shall be conducted in accordance with the current approved decontamination SOP at the time of sampling.	Chemical/Toxicological Hazards: • Exposure to decontamination liquids • Possible exposure to contaminated groundwater. • Exposure to sample preservative. Radiological Hazards: • Possible exposure to radioactive material through contaminated groundwater or soil. Biological Hazards: • Stinging and biting insects. • Wildlife (bears, mountain lions, wolves) • Reptiles (snakes) Physical Hazards: • Slip / Trip / Fall on same or lower level • Splash hazard • Heat stress, sunburn • Cold, frostbite • Hand injury from hand tools • Heavy lifting and awkward postures while cleaning tools and sampling equipment	Chemical/Toxicological Hazards: ▪ Engineering and Work Practice Controls ▪ Personal Protective Equipment (PPE) - Initial Level D, upgrade according to identified conditions. ▪ Sample containers will be preserved with nitric acid and hydrochloric acid. Take care when handling pre-preserved sample containers. ▪ Material Safety Data Sheets (MSDSs) shall be available on-site. Radiological Hazards: ▪ Avoid contact with the groundwater and soil. No eating or drinking during the sampling event. Biological Hazards: ▪ Ticks and mosquitoes are of concern in the area. Use insect repellant as needed. ▪ Bear spray. ▪ Use caution watching for potential reptiles and wildlife, make noise. Physical Hazards: ▪ Use care when removing water from the monitoring wells. Wear all appropriate PPE, including safety glasses, long sleeve shirts, pants, steel-toed boots, and gloves; a tyvek barrier should be worn if the water may splash on clothing. Secure pump tubing to reduce potential for discharge in an unexpected direction. ▪ Watch where you step; be aware of uneven terrain. Keep footwear and work area free of water and mud. Watch your footing to prevent slips. ▪ When lifting, be sure to size up the load, get assistance when possible and follow proper lifting techniques. ▪ Use heavy work gloves when handling tools or equipment with sharp edges. Select hand tools carefully, considering the relative safety of the tool compared to others (e.g., choose cutters over knives for cutting things). Use a knife as last resort; call a short timeout and discuss its use with the rest of the field team to be sure that it is the best tool and the safest method will be employed. ▪ Practice safe lifting and ergonomics. ▪ As a standard rule of practice, check that items being hauled in vehicles are secured in sturdy containers and held from sliding with bungee cords, ties, or compartments. Any

		compressed gas cylinders (e.g., for equipment calibration) must be secured upright or in a carry case.
Equipment List: ▪ Carrier vehicle ▪ Hand tools ▪ Pump or bailers ▪ Electronic water level meter ▪ Sample containers ▪ Appropriate PPE	Training: • Current HAZWOPER Training • Current Midnite Mine Radiation Safety Training	Inspections: ▪ Initial site and site-specific indoctrination training. ▪ Daily tailgate safety meetings: ▪ Identify nearest assembly area ▪ Prepare for adverse weather ▪ Review team roles and responsibilities, schedule, and goals. ▪ Continuous observation of site for identified hazards. ▪ Use Buddy-System when wading into ponding or using a boat. ▪ Ensure adequate communication (cell phone, radio) device is available

JOB SAFETY ANAYSIS
Midnite Mine Superfund Site
Site-Wide Monitoring Plan

ACTIVITY: **Surface Water and Sediment Sampling** PREPARED BY: Aaron Pettley REVIEWED BY: Tami Renkoski

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. If collecting samples from shore: • Collecting water/sediment sample directly into sample containers • Packaging samples for shipment to laboratory. 2. If wading into pond: • Wade into pond wearing waders • Collecting water sample directly into sample containers • Using sediment collection device to acquire sediment sample • Packaging samples for shipment to laboratory. 3. If collecting samples from a boat: • Rowing out to sample collection point • Collecting water sample directly into sample containers • Using sediment collection device to acquire sediment sample • Packaging samples for shipment to laboratory. 4. Decontamination: • Decon procedures for personnel and equipment shall be conducted in accordance with the current approved decontamination SOP at the time of sampling.	Chemical/Toxicological Hazards: • Exposure to decontamination liquids • Possible exposure to contaminated surface water and sediment. • Exposure to sample preservative. Radiological Hazards: • Possible exposure to radioactive material in the water or sediment. Biological Hazards: ▪ Stinging and biting insects. ▪ Wildlife (bears, mountain lions, wolves) ▪ Reptiles (snakes) Physical Hazards: • Slip / Trip / Fall on wet/muddy terrain or into water. • Splash hazard • Heat stress, sunburn • Cold, frostbite • Heavy lifting and awkward postures while cleaning tools and	Chemical/Toxicological Hazards: ▪ Engineering and Work Practice Controls ▪ Personal Protective Equipment (PPE) - Initial Level D, upgrade according to identified conditions. ▪ Sample containers will be preserved with nitric acid and hydrochloric acid. Take care when handling pre-preserved sample containers. ▪ Material Safety Data Sheets (MSDSs) shall be available on-site. Radiological Hazards: ▪ Avoid contact with surface water and sediment. No eating or drinking during sampling event. Biological Hazards: ▪ Ticks and mosquitoes are of concern in the area. Use insect repellant as needed. ▪ Use Bear spray. ▪ Use caution and watch of wildlife and reptiles, make noise. Physical Hazards: ▪ Use care when sampling surface water. Wear all appropriate PPE, including safety glasses, long sleeve shirts, pants, steel-toed boots, and gloves. ▪ Watch where you step; be aware of uneven terrain. Keep footwear and work area free of water and mud. Watch your footing to prevent slips. ▪ Wear a life jacket when in a boat or if wading into water that can be deeper than your head. ▪ Uses caution when moving positions within a boat. Throwable ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. ▪ When lifting, be sure to size up the load, get assistance when possible and follow proper lifting techniques. ▪ Use heavy work gloves when handling tools or equipment with sharp edges. Select hand tools carefully, considering the relative safety of the tool compared to others (e.g., choose cutters over knives for cutting things). Use a knife as last resort; call a short timeout and discuss its use with the rest of the field team to be sure that it is the best tool and the safest method will be employed.

	sampling equipment • Falling overboard and drowning	▪ Practice safe lifting and ergonomics. ▪ As a standard rule of practice, check that items being hauled in vehicles are secured in sturdy containers and held from sliding with bungee cords, ties, or compartments. Any compressed gas cylinders (e.g., for equipment calibration) must be secured upright or in a carry case.
<u>Equipment List:</u> ▪ Carrier vehicle ▪ Hand tools ▪ Pump or bailers ▪ Electronic water level meter ▪ Sample containers ▪ Appropriate PPE ▪ US Coast Guard approved personal flotation device (PFD)	<u>Training:</u> • Current HAZWOPER Training • Current Midnite Mine Radiation Safety Training • Personal floatation device training. • Know proper rescue procedures for man overboard	<u>Inspections:</u> ▪ Initial site and site-specific indoctrination training. ▪ Daily tailgate safety meetings: ▪ Identify nearest assembly area ▪ Prepare for adverse weather ▪ Review team roles and responsibilities, schedule, and goals. ▪ Continuous observation of site for identified hazards. ▪ Inspect barge or boat for integrity and load rating ▪ Use Buddy-System when wading into ponding or using a boat. ▪ Ensure adequate communication (cell phone, radio) device is available

Midnite Mine Superfund Site
100 Percent Design

Appendix Q2 –
Site Wide Monitoring Quality Assurance Project Plan

June 2015

Prepared for:

Dawn Mining Company
PO Box 250
Ford, Washington 990413

and

Newmont USA Limited
6363 South Fiddler's Green Circle
Greenwood Village, Colorado 80111

Prepared by:

Worthington Miller Environmental, LLC

1027 W Horsetooth Rd, Suite 200
Fort Collins, Colorado 80526

MWH

2890 E. Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

Approval Sheet

Jill Richards, Worthington Miller Environmental

Project Quality Assurance Manager

Lou Miller, Worthington Miller Environmental

Supervising Contractor

Nick Cotts, Dawn Mining Company/Newmont USA Limited

Project Coordinator

Bill Lyle, Dawn Mining Company/Newmont USA Limited

Alternate Project Coordinator

Karen Keeley

EPA Remedial Project Manager

Gina Grepo-Grove

EPA Quality Assurance Manager

Distribution List

QAPP Recipient Name	Organization
Karen Keeley	U.S. Environmental Protection Agency
Gina Grepo-Grove	U.S. Environmental Protection Agency
Randy Connolly	Spokane Tribe of Indians
Nick Cotts	Dawn Mining Company/Newmont USA Ltd.
Bill Lyle	Dawn Mining Company
Louis Miller	Worthington Miller Environmental
Vance Drain	MWH
To be determined	Laboratory Project Manager

TABLE OF CONTENTS

Q2-1.0 INTRODUCTION 1

Q2-1.1 Project Scope and Objectives 1

Q2-2.0 PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES 2

Q2-2.1 Environmental Protection Agency 2
Q2-2.2 Spokane Tribe of Indians 2
Q2-2.3 Dawn Mining Company/Newmont USA Limited 2
Q2-2.4 Supervising Contractor 2
Q2-2.5 Project Designer 3
Q2-2.6 Field Supervisor 3
Q2-2.7 Quality Assurance Manager 4
Q2-2.8 Project Staff 4
Q2-2.9 Analytical Laboratory Project Manager 5

Q2-3.0 DATA QUALITY OBJECTIVES AND CRITERIA 5

Q2-3.1 Data Quality Objectives 5
Q2-3.2 Data Quality Indicators 6
Q2-3.2.1 Precision 6
Q2-3.2.2 Accuracy 7
Q2-3.2.3 Completeness 8
Q2-3.2.4 Representativeness 8
Q2-3.2.5 Comparability 8

Q2-4.0 SAMPLING PROCESS DESIGN 9

Q2-4.1 Sampling Locations and Frequencies 9
Q2-4.2 Sampling Methods 9
Q2-4.3 Sample Containers, Filtration, Preservation and Holding Times 9
Q2-4.3.1 Sample Filtration 9
Q2-4.3.2 Sample Preservation 9
Q2-4.3.3 Holding Times 10
Q2-4.4 Field Sample Handling and Custody 10
Q2-4.4.1 Sample Labeling and Identification 10
Q2-4.4.2 Sample Preparation and Shipping 10
Q2-4.4.3 Chain of Custody 11
Q2-4.5 Laboratory Sample Handling and Custody 12

Q2-5.0 DOCUMENTS AND RECORDS 13

Q2-5.1 Field Operation Records 13
Q2-5.2 Laboratory Records 13

Q2-6.0 CALIBRATION PROCEDURES 14

Q2-6.1 Field Instruments and Equipment 14
Q2-6.2 Laboratory Instruments 14

Q2-7.0 ANALYTICAL PROCEDURES....15
Q2-8.0 QUALITY CONTROL....16
Q2-8.1 Field Quality Control....16
Q2-8.1.1 Field Duplicate....16
Q2-8.1.2 Equipment Blanks....16
Q2-8.2 Laboratory Quality Control....17
Q2-8.2.1 Method Blank Samples....17
Q2-8.2.2 Matrix Spike Samples....17
Q2-8.2.3 Laboratory Control Samples....17
Q2-8.2.4 Analytical Duplicate Samples....17
Q2-8.2.5 Serial Dilution....18
Q2-8.2.6 Frequency....18
Q2-9.1 Data Review and Validation....19
Q2-9.2 Data Reporting Format....20
Q2-9.3 Data Management....22
Q2-10.0 PERFORMANCE AND SYSTEM AUDITS....22
Q2-10.1 Internal Field Performance and System Audits....22
Q2-10.1.1 Internal Field Audit Responsibilities....22
Q2-10.1.2 Internal Field Audit Procedures....22
Q2-10.2 External Field Performance and System Audits....23
Q2-10.3 Internal Laboratory Performance and System Audits....23
Q2-10.3.1 Internal Laboratory Audit Responsibilities....23
Q2-10.3.2 Internal Laboratory Procedures....23
Q2-11.0 PREVENTATIVE MAINTENANCE....24
Q2-11.1 Routine Preventative Maintenance Procedures and Schedules....24
Q2-11.2 Field Instruments and Equipment....24
Q2-11.3 Laboratory Instruments....24
Q2-11.4 Acceptance Requirements For Supplies and Consumables....24
Q2-12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA....24
Q2-12.1 Field Measurement Data....24
Q2-12.2 Laboratory Data....25
Q2-13.0 CORRECTIVE ACTIONS....25
Q2-14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT....26
Q2-14.1 Data Validation Reports....26
Q2-15.0 REFERENCES....27

LIST OF TABLES

Table Q2-1 Summary of Quality Control Limits for Laboratory Analyses

Table Q2-2 Sample Container, Preservation, and Holding Time Requirements for Water Samples

Table Q2-3 Sample Containers, Preservation, and Holding Time Requirements for Sediment Samples

Table Q2-4 Sediment Sample Analysis Parameters, Methods, and Method Detection Limits

Table Q2-5 Water Laboratory Parameters, Analytical Methods, Detection Limits and Cleanup Levels

Table Q2-6 Analytical Method QC Specifications

LIST OF FIGURES

Figure Q2-1 QAPP Organizational Chart

Figure Q2-2 Alternate Actions Decision Diagram

LIST OF ATTACHMENTS

Attachment Q2-A – Data Quality Objective Summary Tables

Attachment Q2-B - Standard Operating Procedures

Attachment Q2-C – Laboratory Quality Assurance Plans and NELAP Certifications

Attachment Q2-D – Corrective Action Form

Attachment Q2-E – Indicator Parameters and Action Levels for Select Surface Water and Groundwater Locations

Attachment Q2-F - Indicator Parameters and Action Levels for Select Sediment Locations

LIST OF ACRONYMS

BODR	Basis of Design Report
CD	Consent Decree
C-O-C	Chain of Custody
DMC	Dawn Mining Company
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HASP	Health and Safety Plan
ICP	inductively coupled plasma
LCS	laboratory control sample
LFB	laboratory fortified blank
LFM	laboratory fortified matrix
LFMD	laboratory fortified matrix duplicate
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols
MDC	minimum detectable concentration
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
Newmont	Newmont USA Limited
OM&M	Operation, Maintenance and Monitoring
pCi/L	picocuries per liter
PDF	portable document format
PQL	practical quantitation limit
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RD	Remedial Design
RER	Replicate Error Ratio
RL	reporting limit
ROD	Record of Decision
RPD	relative percent difference

Site	Midnite Mine Superfund Site
SMP	Site-wide Monitoring Plan
SOP	Standard Operating Procedure
Tribe	Spokane Tribe of Indians
WME	Worthington Miller Environmental LLC
WTP	Water Treatment Plant
WQX	Water Quality Exchange

Q2-1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is a component of the *Midnite Mine Superfund Site Remedial Action Site Wide Monitoring Plan* (SMP) and was prepared to support data collection during and following the Remedial Action (RA) at the Midnite Mine Superfund Site located in Wellpinit, Washington. The SMP comprises a Field Sampling Plan (FSP) and this QAPP, and is intended to describe the project requirements for all field, laboratory, and data assessment activities associated with site-wide monitoring during and following the RA. The SMP, FSP, and this QAPP are components of the *Midnite Mine Superfund Site Basis of Design Report* (BODR), which presents the background and supporting information relevant to the Site and the planned RAs. In addition to supporting data collection described in the SMP/FSP, this QAPP is intended to support data collected as required by the Operation, Maintenance, and Monitoring (OM&M) Plan contained in the BODR and the future Remedy OM&M Plan that will be prepared for the completed RA.

This QAPP was prepared in accordance with the requirements of *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001), *Guidance for Quality Assurance Project Plans* (EPA, 2002), and the *Statement of Work for the Remedial Design and Remedial Action for the Midnite Mine Superfund Site* (EPA, 2011).

Q2-1.1 PROJECT SCOPE AND OBJECTIVES

The sampling activities associated with the SMP/FSP include monitoring of groundwater, surface water, and sediment samples for the parameters developed through the Data Quality Objectives (DQO) process, described in Section Q2-3.0. Sampling activities associated with the OM&M Plan include continued monitoring of the existing water treatment plant (WTP) effluent for parameters listed in the ROD (EPA, 2006). Details of the environmental air monitoring plan have yet to be developed. Once the air monitoring plan has been determined, the details of the plan will be incorporated into the SMP and this QAPP. The activities described in both the SMP/FSP and OM&M Plan will continue for the duration of the RA. This QAPP will be amended or revised if necessary to support changing data needs during the RA, to support post-RA monitoring, and to support monitoring of the new WTP when it is built and becomes operational. The specific objective of this QAPP is to provide the guidance that will be followed for chemical analysis of surface water, groundwater, soil, or sediment samples to ensure that these data are of sufficient quality to support the data end uses.

This QAPP is required reading for all staff participating in the work effort. The QAPP will be in the possession of the field team during sample collection and in possession of the laboratory providing analytical services. All field, office, and analytical laboratory personnel working on this project will be required to comply with the procedures documented in this QAPP to maintain comparability and representativeness of the resulting data.

Q2-2.0 PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES

The following individuals who will be involved and the tasks for which they are responsible are discussed below. An organizational chart for the project is provided in Figure Q2-1.

Q2-2.1 ENVIRONMENTAL PROTECTION AGENCY

The EPA is the lead agency governing the remediation of the Midnite Mine Superfund Site (Site). The EPA issued the Record of Decision (ROD) and Consent Decree (CD), and is responsible for approving all plans and reports related to implementing the Selected Remedy, including this QAPP. The EPA Remedial Project Manager is Ms. Karen Keeley. The EPA Quality Assurance Manager is Ms. Gina Grepo-Grove.

Q2-2.2 SPOKANE TRIBE OF INDIANS

The Site is located on lands owned by the federal government and held in trust for the Spokane Tribe of Indians (Tribe) and individual tribal members. Mr. Randy Connolly is the Tribe Superfund Coordinator. The Tribe has access to contract technical support from AESE, Inc. The AESE, Inc. point of contact is Dr. F. E. Kirschner.

Q2-2.3 DAWN MINING COMPANY/NEWMONT USA LIMITED

As the responsible party, Dawn Mining Company/Newmont USA Limited (DMC/Newmont) is implementing the Selected Remedy in accordance with the CD. DMC/Newmont has overall responsibility for procuring consultants and contractors to perform the work, budgeting and securing the necessary funds, and assuring that the requirements of the CD are met. The DMC/Newmont Project Coordinator is Mr. Nick Cotts and the Alternate Project Coordinator is Mr. William Lyle.

Q2-2.4 SUPERVISING CONTRACTOR

Mr. Louis Miller, P.E. of Worthington Miller Environmental (WME) is the Supervising Contractor procured by DMC/Newmont to implement the Selected Remedy. As the Supervising

Contractor, Mr. Miller will direct and supervise all aspects of the RD/RA in accordance with the CD. The Supervising Contractor will be responsible for collecting, or directing environmental consultants to collect, environmental samples in accordance with the SMP/FSP, OM&M Plan, and this QAPP.

The Supervising Contractor will be responsible for coordinating the Site activities between the DMC/Newmont Project Coordinator, other consultants and contractors, and the regulatory agencies. As the Supervising Contractor, Mr. Miller will:

- Orient the project team concerning project requirements and special considerations
- Review the work performed on each task to help ensure its quality, responsiveness and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Develop technical reports and other project documents
- Represent the project team at meetings, if necessary
- Ensure that the SMP/FSP, OM&M Plan, this QAPP, and any necessary corrective actions are implemented to the best of his ability

Q2-2.5 PROJECT DESIGNER

The Project Designer is an independent, duly qualified, licensed design firm, retained directly by DMC/Newmont to provide design and engineering services in connection with the project. MWH Americas, Inc. (MWH) is the Project Designer for the Midnite Mine Superfund Site Remedial Design (RD). MWH prepared the BODR and supported preparation of this QAPP. The MWH Project Manager is Mr. Vance Drain and the MWH Engineering Manager is Mr. Clint Strachan, P.E.

Q2-2.6 FIELD SUPERVISOR

The Field Supervisor will be responsible for all aspects of fieldwork performed as part of the FSP Monitoring and Standards section of the OM&M Plan. The Field Supervisor reports directly to the Supervising Contractor, providing the principal point of contact and control for matters concerning the field investigation implementation. Duties of the Field Supervisor will include:

- Ensuring that all field activities, including measurements, data collection, and field recording activities are performed in accordance with the work plans, FSP or OM&M Plan, and the QAPP
- Ensuring that field personnel are properly trained, equipped, and familiar with Standard Operating Procedures (SOPs)
- Overseeing sample collection, handling and shipping, and ensuring proper functioning of field equipment
- Ensuring that appropriate personal protective equipment will be worn and disposed of according to the Remedial Action Health and Safety Plan (HASP; Appendix L of the BODR)

Q2-2.7 QUALITY ASSURANCE MANAGER

The Project Quality Assurance Manager (QAM) ensures that the project's QA program is conforming to the project requirements. Duties will include:

- Coordination of the receipt of data from the laboratory
- Ensuring that all data is properly reviewed, verified and validated
- Evaluation of the data and any concerns that may arise with laboratory, and communicates with the Supervising Contractor regarding laboratory data reports or data validation concerns
- Performing QA audits on various phases of the project's operations as necessary, and providing QA technical assistance to project staff
- Notifying the Supervising Contractor of particular circumstances that may adversely affect the quality of data and ensure implementation of corrective actions needed to resolve nonconformance's noted during assessments

The QAM will not actively participate in the collection of samples, thereby establishing independence from the data generating team.

Q2-2.8 PROJECT STAFF

Each member of the project staff will be responsible for understanding, implementing, and completing their project tasks in conformance with this QAPP.

Q2-2.9 ANALYTICAL LABORATORY PROJECT MANAGER

The Laboratory Project Manager will work directly with the Laboratory QA Officer and will be responsible for the following:

- Reviews and approves the Project QAPP
- Supervising in-house chain of custody (C-O-C)
- Scheduling sample analyses
- Coordinating laboratory analyses
- Defining appropriate laboratory QA procedures
- Overseeing laboratory QA and QA/QC documentation
- Ensuring all resources of the laboratory are available to meet project schedules
- Determining whether to implement laboratory corrective actions, if required
- Overseeing laboratory data review
- Ensuring all QA/QC objectives, policies, and procedures are followed according to the laboratory Quality Assurance Plan (QAP)
- Overseeing production and final review of analytical reports

Q2-3.0 DATA QUALITY OBJECTIVES AND CRITERIA

The objectives of the sampling and monitoring for this project have been developed following a systematic planning process, the results of which are presented in Section Q2-3.1. The Performance and Acceptance Criteria (data quality indicators) for the results from sampling are presented in Section Q2-3.2.

Q2-3.1 DATA QUALITY OBJECTIVES

Data Quality Objectives for the environmental sampling and monitoring to be performed during the RA were developed using the seven-step DQO process described in the *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2000). The DQOs for the planned data collection activities during and following implementation of the remedy and during operation of the WTP are summarized in detail on the tables included in Attachment Q2-A. The summary table format will facilitate future updates to this QAPP as DQOs are revised or refined,

or if new data collection activities are added or deleted as the RA progresses. The Alternate Actions Decision Diagram associated with the DQOs is presented on Figure Q2-2.

Q2-3.2 DATA QUALITY INDICATORS

Measurement performance criteria are established for each field and laboratory measurement parameter. Measurement performance criteria are established by defining acceptance criteria and quantitative or qualitative goals (e.g., control limits) for accuracy, precision and completeness. Quality control acceptance criteria for accuracy, precision and completeness of data to meet the data objectives of the project are shown in Table Q2-1. Definitions for accuracy, precision, completeness, representativeness, and comparability are provided below. The level of quality control effort is described in Section Q2-8.0. Project required method detection limits (MDLs) are included in Tables Q2-4 and Q2-5.

Q2-3.2.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Determining the agreement among replicate measurements of the same sample assesses the precision of the analytical method; combined precision of sampling and analysis methods is assessed from the agreement between measurements of field duplicate samples.

Q2-3.2.1.1 Field Precision Objectives

Precision of sampling and analysis methods will be assessed through the collection of field duplicate samples. Field duplicates are collected to measure the sampling and analytical variability or imprecision associated with the sample results. The relative percent difference (RPD) in the results for each analyte will be computed for each field duplicate pair using the equation provided in Section Q2-8.2. The goal for precision of field duplicate results is ± 50 percent RPD for sediment samples and ± 35 percent RPD for water samples. However, if one or both samples in a field duplicate pair have a concentration less than 10x the laboratory reporting limit (RL), the field precision goal will be ± 5 x the RL. It is noted here that natural variation in sediment will affect how closely these goals are met; that is, if variation is high, then these goals may be unrealistic. Consequently, RPD results from field duplicates of sediment samples will not be used as a basis of invalidating any analytical data.

Q2-3.2.1.2 Laboratory Precision Objectives

Precision of the analytical method will be assessed through duplicate analyses of laboratory QC and field samples. The RPD in the results for each analyte will be computed for each analytical

duplicate pair using the equation provided in Section Q2-8.2. Data for duplicate analysis will be evaluated only if both of the samples in the duplicate pair have a concentration greater than the laboratory RL. The limit for precision of laboratory analytical duplicates, matrix spike/matrix spike duplicate (MS/MSD) and laboratory fortified matrix/laboratory fortified matrix duplicate (LFM/LFMD) is 20 percent RPD (water samples) and 35 percent RPD (sediment samples) for samples greater than 5x the RL. Precision for radiochemical analyses will also be assessed by the Replicate Error Ratio (RER) using the equation provided in Section Q2-8.2. The laboratory RER goal is less than 2.0.

Where appropriate, laboratory precision goals for each method and each sample type are included in Table Q2-1. The frequency at which laboratory duplicates should be analyzed is to be at a minimum rate of one duplicate per sample media (water, sediment), provided there is sufficient sample.

Q2-3.2.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value. Data accuracy will be evaluated using the results from laboratory control samples (LCS), laboratory fortified blanks (LFB), and matrix spikes (MS)/laboratory fortified matrix (LFM) samples, expressed as the percent recovery or the percentage of the true (known) concentration that is measured.

Q2-3.2.2.1 Field Accuracy Objectives

Accuracy in the field will be assessed through collection of equipment blanks and adherence to all sample handling, preservation, and holding time requirements. The accuracy objective for equipment blanks will be below the reporting limit (< RL) for all analytical parameters of interest.

Q2-3.2.2.2 Laboratory Accuracy Objectives

Laboratory accuracy may be evaluated by the analysis of LCS, LFB, MS and LFM samples, with results expressed as a percentage recovery measured relative to the true (known) concentration. Laboratory LCS, LFB, MS and LFM recovery goals are provided in Table Q2-1. In addition, laboratory preparation blank results may be used to measure contamination introduced during the analytical process. The accuracy objective for laboratory preparation blanks will be below the reporting limit (<RL).

Q2-3.2.3 Completeness

Completeness is the percentage of valid measurements or data points obtained, as a proportion of the number of measurements or data points planned for the project. Completeness is affected by such factors as access to monitoring locations, sample bottle breakage and acceptance/non-acceptance of analytical results. Percentage completeness (C) is calculated by the following equation:

$$C(\%) = \frac{V}{P} \times 100$$

where: V = number of valid measurements/data points obtained

P = number of measurements/data points planned

The laboratory completeness goal is 95 percent.

Q2-3.2.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the characteristic of a population, the parameter variations at a sampling point, the process condition, or an environmental condition. Representativeness is achieved by collecting a sufficient number of unbiased samples and implementing a quality control program for the sample analyses and data interpretation. The sampling approaches developed for a project should provide for samples that are representative of actual Site conditions. Representativeness of analytical results may be evaluated based on blank results (field and laboratory), laboratory QC results, sampling locations and methodologies, and sampling frequencies.

Representativeness of individual sample analyses will be described on the basis of results obtained from associated field and laboratory quality control samples. The representativeness of sample analyses will be considered acceptable as long as concentrations of metals and radionuclide parameters in associated blanks are less than 5 times the method detection limit reported by the laboratory.

Q2-3.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another. Comparability is achieved by the use of appropriate sampling methods and standard operating procedures, analytical methods and performing data evaluation. Comparability is also

dependent on similar QA objectives. All data should be calculated and reported in units consistent with standard reporting procedures so that the results of the analyses can be compared with those of other laboratories, if necessary.

Q2-4.0 SAMPLING PROCESS DESIGN

Q2-4.1 SAMPLING LOCATIONS AND FREQUENCIES

Surface water, groundwater and sediment samples will be collected at selected locations and frequencies as specified in the FSP. Treatment Plant effluent water will be sampled as indicated in the OM&M Plan.

Q2-4.2 SAMPLING METHODS

Field sampling methods, equipment utilized, and decontamination procedures for this effort are documented in the provided in the Site Wide Monitoring Standard Operating Procedures (SMP-SOPs), attached to this QAPP. The sampling procedures provided in the SMP-SOPs are designed to provide the type and quality of data consistent with the objectives of this project. Tables Q2-2 and Q2-3 provide volume, container-type, preservation, and holding time specifications for each sample type and analytical method.

Q2-4.3 SAMPLE CONTAINERS, FILTRATION, PRESERVATION AND HOLDING TIMES

Proper sample preparation practices will be observed to minimize sample contamination and potential repeat analyses due to anomalous analytical results. Sample containers depend on sample type, and are described in Tables Q2-2 and Q2-3 for each individual sampling activity and media. Sample containers will be labeled as described in the following Section Q2-4.4.

Q2-4.3.1 Sample Filtration

Samples requiring dissolved analyte concentration analysis will be filtered at the time of sample collection. Sample filtration methods for groundwater, surface water and effluent samples are covered in SMP-SOP1, SMP-SOP2 and SMP-SOP6, respectively.

Q2-4.3.2 Sample Preservation

Samples are preserved to prevent or minimize chemical changes that could occur during transit and storage. Sample preservation will be performed immediately upon sample collection to ensure that laboratory results are not compromised by improper coordination of preservation

requirements and holding times. Descriptions of sample preservation and storage are summarized in Tables Q2-2 and Q2-3.

Q2-4.3.3 Holding Times

Sample holding times are established to minimize chemical changes in a sample prior to analysis and/or extraction. A holding time is defined as the maximum allowable time between sample collection and analysis and/or extraction, based on the nature of the analyte of interest and chemical stability factors. Samples will be shipped to the laboratory as soon as possible after collection or processing. Holding times for the chemical constituents for which samples will be analyzed are summarized in Tables Q2-2 and Q2-3.

Q2-4.4 FIELD SAMPLE HANDLING AND CUSTODY

Q2-4.4.1 Sample Labeling and Identification

Sample labels will be supplied by the laboratory or container manufacturer. Sample labels will be completed with an indelible, waterproof marker. All samples will be labeled with date, time, sampler's initials and the sample ID. The sample ID includes the sample location, media type, and sample type. The sample IDs will be in the form of:

ZZZZ/YYY/##

Where: ZZZZ is the sample location,

YYY is the environmental medium,

is sample type (01=primary, 02=duplicate, 03=blank),

The designated environmental media are as follows: (GW) = Groundwater samples, (SW) = Surface water samples, (SED) = Sediment samples and (EFF) = Effluent samples. For example, a primary surface water sample, collected at Central Drainage (SW12) would have the following sample ID: SW12/SW/01.

Q2-4.4.2 Sample Preparation and Shipping

After collection, samples will be labeled and prepared as described in the previous discussions, and placed in an insulated cooler with ice for delivery to the laboratory. The ice in the cooler will be double-bagged. Chain-of-custody (C-O-C) forms, listing those samples in the shipping container, and signed by the sampler to relinquish custody, will be placed in a re-closeable freezer-type plastic storage bag and taped to the inside lid of the cooler. Included with the

C-O-Cs will be a copy of the sample analysis requirements (Tables Q2-4 and Q2-5). The coolers will be taped shut and chain-of-custody seals will be attached to the outside of the cooler to ensure that the cooler cannot be opened without breaking the seal. Samples will be shipped overnight delivery for laboratory receipt and analysis within the holding times specified in Tables Q2-2 and Q2-3.

Q2-4.4.3 Chain of Custody

After samples have been collected, they will be maintained under strict chain-of-custody protocols. The field sampling personnel will complete a C-O-C form for each shipping container (i.e., cooler, ice chest or other container) of samples to be delivered to the laboratory for analysis. C-O-C forms will be provided by the laboratory. The sampler is responsible for initiating and filling out the C-O-C form. The C-O-C will be signed by the sampler when he or she relinquishes the samples to anyone else. The C-O-C for a shipping container will list only those samples in that shipping container. Information contained on the duplicate, carbonless C-O-C form will include the following:

- Project number
- Date and time of collection
- Sample identification number
- Sample type
- Analyses requested
- Number of containers/bags for each sample
- Sampler's signature and affiliation
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if the samples are shipped)
- Any additional instructions to the laboratory

The sample collector will cross out any blank spaces on the C-O-C below the last sample number listed. Each sample container will be carefully packaged in a shipping container,

typically a cooler. Custody seals will be attached to the outside of the cooler or shipping container to ensure that the container cannot be opened without breaking the seal, and will be signed and dated by the sample custodian prior to shipment. If the custody seal is broken, the laboratory will immediately notify Project QAM.

The sampling personnel whose signature appears on the C-O-C is responsible for the custody of the samples from the time of sample collection until custody of the samples is transferred to a designated laboratory, a courier, or to another project employee for the purpose of transporting the sample to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the direct possession of the sample custodian; (2) in plain view of the sample custodian; or (3) is securely locked in a restricted-access area by the sample custodian.

Custody is transferred when both parties to the transfer complete the portion of the C-O-C under "Relinquished by" and "Received by." Signatures, printed names, company names, dates and times are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the duplicate (yellow) copy of the C-O-C. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the C-O-C. Copies, receipts and carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is not necessary for courier personnel to sign the C-O-C.

Q2-4.5 LABORATORY SAMPLE HANDLING AND CUSTODY

When the samples are received by the analytical laboratory, the C-O-C will be immediately signed along with the date and time of receipt. The top sheet (white copy) or a copy of the C-O-C may be returned with the final analytical report. The laboratory will follow appropriate chain-of-custody procedures when shipping any samples to a subcontracted laboratory for analysis.

Upon receipt by the laboratory, the samples will be inspected for sample integrity and preservation, including temperature. The C-O-C will be reviewed to verify completeness. Any discrepancies between the C-O-C and sample labels and any problems noted upon sample receipt will be communicated immediately to the Project QAM. The laboratory will store the samples in a specially designated area which is clean and maintained at the appropriate preservation temperature. The laboratory will be responsible for following their internal custody procedures from the time of sample receipt until sample disposal. A Sample Receipt Checklist is generated at the laboratory providing documented details of the sample receipt including

temperature of the cooler. Acceptable cooler temperature is 4 ± 2°C. If a temperature deviation is discovered, it will be determined if the sample needs to be chilled. If the samples need to be maintained cool, the samples will be immediately chilled to within the required temperature range. The Laboratory Project Manager will evaluate the length of time that the samples were likely out of the desired temperature range along with the actual temperature when discovered, to determine if the samples are suitable for analysis or should be discarded.

Q2-5.0 DOCUMENTS AND RECORDS

Q2-5.1 FIELD OPERATION RECORDS

Field operation records include sample collection records, C-O-Cs, QC sample records, field procedures, and corrective action reports. Field sampling activities are documented on field data sheets and the field log book. The field data sheets are located within each sample type's respective SOP. At each site, location, sampling time, date, and sample collector's name/signature are recorded. If a field or lab QA/QC sample is to be collected at a site for a specific sample or if a duplicate sample is to be collected, this information will be documented on the field data sheets.

Any issues or comments related to a specific sample will also be documented on the field data sheet. Such information could include moving a station location, or if there were any circumstances at a site that prevented a sample from being collected. If a deviation in the field sampling methods or SOP is required, it will be documented indicating; what occurred, actions taken to correct the failure, as well as the effect of the action on the sample in question.

C-O-Cs will be filled out for all samples collected and include the information discussed in Section Q2-4.4.

Field data sheets, log books and C-O-C field copies from all sampling events will be retained and filed by the Field Supervisor. Once the data has been recorded to the project database, these records will be scanned to electronic files and archived.

Q2-5.2 LABORATORY RECORDS

Laboratory records will include all of the data in the data reporting package (described in Section Q2-9.2) as well as any laboratory records generated for the project samples. In addition to the items in the data reporting package, at a minimum, the following records will be maintained by the laboratory:

- Sample preparation log books
- Temperature records for storage units (standards, samples)
- Equipment calibration and maintenance records
- Instrument run logs, extraction logs, and digestion logs
- Certification records for standards
- Raw data

Laboratory records will be archived for the minimum period of ten years.

Q2-6.0 CALIBRATION PROCEDURES

Q2-6.1 FIELD INSTRUMENTS AND EQUIPMENT

Equipment used to gather, generate or measure environmental data will be calibrated each day prior to use consistent with the manufacturer's specifications to ensure that the accuracy and reproducibility of the results are obtained. Field sampling and measurement equipment will be examined to certify that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that maintenance requirements are being met. In the event that a field instrument cannot be calibrated to meet the manufacturer's specifications, it will be tagged "defective" and returned to the manufacturer or other supplier for service or replacement. Calibration procedures are also covered in the SMP-SOPs for Groundwater, Surface Water, and Treatment Plant Sampling (Attachment Q2-B).

Q2-6.2 LABORATORY INSTRUMENTS

Instruments used by the laboratory will be calibrated in accordance with the laboratory's Quality Assurance Plan (QAP), method SOPs, and any specified EPA-method requirements. When laboratory measurement instruments do not meet the calibration criteria of the QAP, Method SOP or EPA method, then the instrument will not be used for analysis of samples submitted under this project QAPP. Calibration records should be accessible and demonstration of acceptable calibration results if requested by project personnel. Maintenance records should be available for inspection.

Q2-7.0 ANALYTICAL PROCEDURES

The analytical parameters, analytical methods and required method detection limits for which the samples are to be analyzed for are summarized in Tables Q2-4 and Q2-5. Tables Q2-2 and Q2-3 include holding times, preservation guidelines, and required sample amounts for all sample types. A copy of either Table Q2-4 (sediment) or Table Q2-5 (water) will be sent with each associated batch of samples submitted to the laboratory. A copy of this QAPP will be submitted to the laboratory before the first batch of samples is received. Procedures for laboratory analysis, with any modifications, should be further documented in the laboratory SOPs, which are maintained at the laboratory and are listed in the laboratory's QAP. Analytical Method QC specifications including frequency, acceptance criteria and corrective actions are detailed in Table Q2-6. The laboratory designated for the analytical chemistry support for the project must be accredited under the National Environmental Laboratory Accreditation Program (NELAP). The approved Laboratory QAPs and current NELAP certifications are included in Attachment Q2-C. Laboratories designated for analysis of the groundwater, surface water, sediment and effluent samples will be selected from one or more of the following:

Laboratory	Proposed Analyses Capabilities
ACZ Laboratories Inc. 2773 Downhill Drive Steamboat Springs, CO 80487 800-334-5493	All metals, general chemistry
Energy Laboratories Inc. 2393 Salt Creek Highway Casper, WY 82602 888-235-0515	All metals, general chemistry and radiological analyses
Anatek Labs Inc. 1282 Alturas Drive Moscow, ID 83843 208-883-2839	All metals and general chemistry
SeaCrest Group Environmental Services 500 South Arthur Ave. Unit 450 Louisville, CO 80027 303-661-9324	Effluent Toxicity Testing

Q2-8.0 QUALITY CONTROL

Quality control may be checked by collecting and analyzing field quality control (QC) samples and performing laboratory QC analyses. Both field and laboratory QC are necessary to control the sampling and analytical process, assess the accuracy and precision of results, and identify assignable causes for anomalous results. Project control limits for accuracy and precision measurements are listed in Table Q2-1.

Q2-8.1 FIELD QUALITY CONTROL

To assess precision of field sampling and assure that contamination has not occurred in the field, the level of field QC effort includes the following:

Q2-8.1.1 Field Duplicate

A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical techniques. For sediment samples, a sample will be chosen and split (SMP-SOP3), submitted as a field sample "duplicate". Field duplicates will be submitted at a minimum of one per 20 samples per sampling event for each water and sediment. If the total number of samples from the same medium are less than 20 for a sample event, one duplicate sample per each sample media (water and soil) will be collected. These samples will measure sample variability, as well as be a check for laboratory precision. Field duplicates will be analyzed for the same suite of analytical parameters as the primary sample. There are no EPA criteria for evaluation of field duplicate sample comparability, however, the RPD between the original sample and field duplicate can be calculated for each parameter and compared to the precision goal. Field duplicate RPDs greater than the project-specified precision goal indicates a high variability associated within the sample.

Q2-8.1.2 Equipment Blanks

An equipment blank consists of analyte-free reagent water (distilled or deionized water) poured through the non-dedicated sampling device or filtration equipment, collected in a clean sampling bottle and preserved as necessary. Equipment blanks may be used to assess decontamination procedures. Equipment blanks are analyzed for the same suite of analytical parameters as the associated samples. Equipment blanks will be collected at a frequency of one per 20 samples, per sampling event for each sample media (water and sediment).

Q2-8.2 LABORATORY QUALITY CONTROL

The appropriate type and frequency of laboratory QC samples will be dependent on the sample type/media, analytical methods, and the laboratory's SOPs. With each QC batch for sample analysis, the following laboratory QC samples will be analyzed in addition to the calibration samples.

Q2-8.2.1 Method Blank Samples

No target analytes should be found in laboratory blanks. Blank contamination, if found, will be evaluated using *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (EPA, 2010).

Q2-8.2.2 Matrix Spike Samples

Laboratory matrix spike samples are used to evaluate potential matrix effects on sample analysis for inorganic parameters. Percent recoveries of target analyses from matrix spike samples should fall within control limits of 70 to 130 percent for both water and sediment samples. However, if other QA/QC results are acceptable, there is no requirement to qualify sample results. Matrix interference and other effects may cause low or high percent recoveries in investigative samples; matrix effects may be noted at the same time that recoveries from laboratory control samples indicate acceptable method performance.

Q2-8.2.3 Laboratory Control Samples

EPA (2010) guidelines specify that percent recoveries of most metals from aqueous laboratory control samples should fall within control limits of 80 to 120 percent. An appropriate laboratory control sample will be used by the laboratory based on the sample matrix.

Q2-8.2.4 Analytical Duplicate Samples

Based on EPA guidelines, laboratory replicate samples and the samples from which they are split (the investigative samples) should have RPDs whose absolute values do not exceed 20 percent (for water samples) or 35 percent (for solid samples) in cases where both sample values are greater than or equal to five times the reporting limit. The RPD is defined by the following equation:

$$RPD = \frac{\text{sample} - \text{duplicate values}}{\left(\frac{\text{sample} + \text{duplicate values}}{2}\right)} \times 100\%$$

If one or both values are less than five times the reporting limit, the difference between the primary and replicate values should not exceed the reporting limit for water samples and 2x the reporting limit for solid samples.

The precision measurement for duplicate samples for radiochemistry analyses will include the RER. The laboratory goal for the RER is < 2.0. The RER is defined by the following equation:

$$RER = \frac{|Sx - Dup|}{\sqrt{(Sx_{error})^2 + (Dup_{error})^2}}$$

Where: Sx = sample concentration in pCi/L

Sx_{error} = sample counting error (in pCi/L) at the 95 percent confidence level.

Dup = duplicate concentration in pCi/L

Dup_{error} = duplicate counting error (in pCi/L) at the 95 percent confidence level.

Q2-8.2.5 Serial Dilution

Serial dilutions are instrument-specific quality control done to check for matrix interferences for samples analyzed by inductively coupled plasma (ICP). A 1:5 dilution is performed on samples of sufficient concentration (50 times the MDL) and results should be within +/- 10 percent of the original value.

Q2-8.2.6 Frequency

Laboratory QA/QC samples method blank, matrix spike, and laboratory control samples should be run in a QC batch of one each per 20 field samples. If less than 20 field samples are submitted, then one set of these four QA/QC samples should be run per batch. Analytical duplicates will be done at a frequency of one per sample media (i.e. one each for sediment, groundwater, and surface water samples) for all analytes, when sufficient sample material is available.

Q2-9.0 DATA REDUCTION, VALIDATION AND REPORTING

Field measurement values are generally reported directly in the units of final use in the field notebook or data sheets without need for additional calculations (e.g., pH, temperature, turbidity, and specific conductance measurements). The field data will be reviewed daily by the Field Supervisor to identify anomalous data and transcriptional and/or computational errors. Corrective actions will be initiated as appropriate; these actions may consist of re-measuring a

particular parameter, collecting a new sample, or other applicable corrective action measures. Reviewed field data will be entered into the project database promptly upon return from the sampling event.

The laboratory's calculations and data review will be performed in accordance with procedures prescribed in their own QAP and the referenced analytical method.

Q2-9.1 DATA REVIEW AND VALIDATION

Validation means those processes taken independently of the data-generation processes to determine the usability of data for its intended use(s). All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the data quality indicators that are listed in Section Q2-3.0.

Laboratory results will first of all be checked for completeness to assure that all the requested analyses were performed along with the correct methodologies and detection limits. Data will also be evaluated to assess whether the measurement performance criteria for accuracy and precision (Table Q2-1) have been achieved. Laboratory method blanks, matrix spike samples, laboratory duplicate samples, laboratory control samples, and holding times will be validated in accordance with EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (2010) for inorganic parameters and MARLAP (EPA et. al, 2004) for radiological parameters. The laboratory will provide a QC summary suitable for this level of review (described below in Section Q2-9.2).

In addition, the water data will be reviewed for total versus dissolved metals concentrations. If the dissolved value is greater than the total value or a sample, than the validation procedure is as follows: a control limit of the MDL will be utilized to assess the difference between the dissolved value and the total value when one or both samples results are less than five times the MDL; otherwise a RPD of 10 percent will be applied.

Data that is not rejected during a validation process is generally considered usable with any qualifications noted in the validation results. The following data qualifiers as defined by EPA (2010) will be applied to the data:

Qualifier	Definition
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.

J- The result is an estimated quantity, but the result may be biased low.

R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

U Analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ Analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

The data to be verified are evaluated against project specifications (Section Q2-3.0) and are checked for errors, especially errors in transcription, calculations, and data input. Any suspected errors or anomalous data will be addressed by the manager of the task associated with the data, before data validation can be completed. Potential outliers are identified by the Project QAM by examining results for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier is identified, the Field Supervisor or the Laboratory Project Manager responsible for generating the data is contacted to resolve the issue. Issues that can be resolved are corrected and documented electronically or by initialing and dating the associated paperwork. If an issue cannot be corrected, the QAM consults with the Supervising Contractor to determine the appropriate course of action, or the data associated with the issue are rejected.

The Project QAM will prepare a report summarizing the results of the data validation and any qualifications of data resulting from the validation following each sampling event. In addition to the data validation results, the reports will include the laboratory report job number(s), the sample IDs associated with each laboratory report and sample collection dates. If any issues such as confirmed errors or reanalysis resulting in revised data occur, these will be noted in the report. The data validation reports will be submitted to the Supervising Contractor and included in the project's files.

Q2-9.2 DATA REPORTING FORMAT

The laboratory reporting for the environmental media analysis will include the following information. This information will be presented as an analytical hardcopy report in PDF file format and in addition, the data will also be reported as an electronic data deliverable. The

electronic format shall follow EPA data storage and deliverable requirements as found per the EPA Water Quality Exchange (WQX) Database.

- Sample identification number
- Analytes, concentrations and units
- Results that are detected between the MDL and RL/PQL
- Analysis date
- Analysis method used
- Laboratory qualifiers and definitions
- Percent solids on a dry weight basis for sediment

The laboratory QC summary should include:

- Laboratory case narrative summarizing any method deviations or analysis problems
- Method detection limits (MDL, MDC) and laboratory reporting/quantification limits (RL, PQL)
- Sample dilution information
- Method blank data
- Analytical duplicate data
- Matrix spike data
- Laboratory control sample data
- Serial dilution data (if applicable)
- Precision/error range (radiological analysis)
- Sample log-in information
- Copies of complete C-O-Cs

The laboratory reporting for the effluent sample analysis will include the above information as well as sample run logs, calibration data and all raw data.

Data reporting packages will be prepared by the Laboratory Project Manager and will be submitted to the Supervising Contractor and the Project QAM.

Q2-9.3 DATA MANAGEMENT

Once the laboratory data has been validated and qualifications noted, the analytical data and qualifiers will be entered along with field measurements and sample information (Location ID#, sample media, sample location, and date) into the project database, as well as the EPA WQX Database.

Q2-10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities may be conducted to verify that sampling and analyses are performed in accordance with the procedures established in the SMP, FSP and this QAPP. These audits are optional and not a requirement. The audits of field and laboratory activities include two independent parts: internal and external audits. Findings of these audits will be summarized in an audit report that is given to the Supervising Contractor and appropriate supervisor in charge of the audited activities (Field Supervisor or Laboratory Project Manager). The Supervising Contractor will submit a reply addressing each finding cited in the report, the corrective action (if necessary) to be taken, and a schedule for implementation. Corrective action procedures are described in Section Q2-13.0.

Q2-10.1 INTERNAL FIELD PERFORMANCE AND SYSTEM AUDITS

Q2-10.1.1 Internal Field Audit Responsibilities

Internal audits of field activities, including sampling and field measurements, may be conducted by either the Field Supervisor or the QAM. Internal field audits will verify that established procedures are being followed.

Q2-10.1.2 Internal Field Audit Procedures

The performance and system audits will include examination of field sampling records, field instrument operating records, sample collection, handing and packaging, and data handling in compliance with the established procedures and SOPs, maintenance of QA procedures, and chain-of-custody, etc. outlined in this QAPP. Follow-up audits may be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. Follow-up audits will involve review of field measurement records, instrument calibration records, and sample documentation.

Q2-10.2 EXTERNAL FIELD PERFORMANCE AND SYSTEM AUDITS

External field audits may be conducted by an outside regulatory agency (e.g., EPA). The external field audit process can include (but not limited to): sampling equipment decontamination procedures, sample bottle preparation procedures, sampling procedures, examination of field sampling and safety plans, sample preservation and preparation for shipment, as well as field screening practices, and duplicate sample collection and analysis.

The external audit findings will be reported immediately to the Supervising Contractor who will be responsible for implementing the appropriate corrective actions if any are needed.

Q2-10.3 INTERNAL LABORATORY PERFORMANCE AND SYSTEM AUDITS

Q2-10.3.1 Internal Laboratory Audit Responsibilities

Internal laboratory audits may be conducted by the laboratory QA Officer. The results of each performance audit will be reported to laboratory management. All performance audit results identified as unacceptable must be investigated. It is recommended that any results flagged as exceeding the warning limits, but within the control limits for the study shall also be reviewed. The findings of the investigation and corrective action will be documented. This documentation for all internal performance audits shall be provided to the agency or client supplying the audit, as well as being included in the QA report to the Supervising Contractor.

Q2-10.3.2 Internal Laboratory Procedures

The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The laboratory QA Officer will evaluate the analytical results of these blind performances samples to ensure the laboratory maintains acceptable QC performance.

The internal system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc., in accordance to the laboratory's QAP (Attachment Q2-C).

Q2-11.0 PREVENTATIVE MAINTENANCE

Q2-11.1 ROUTINE PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

Field equipment will be cleaned and safely stored in between each use, and routine maintenance recommended by the equipment manufacturer will also be performed. Equipment will be inspected and the calibration checked (if applicable) before it is transported to a field setting for use. Preventative maintenance of field equipment will include routine inspection and either calibration or testing as specified in the relevant SOP or manufacturer's instructions. Laboratory preventative maintenance will include routine equipment inspection and calibration at the beginning of each day or each analytical batch, per the laboratory's internal SOPs and method requirements.

Q2-11.2 FIELD INSTRUMENTS AND EQUIPMENT

Equipment will be inspected before use and field instruments that fail calibration requirements will be tagged as "nonfunctional" or "defective" and returned to the manufacturer or other supplier for repair or replacement. Field equipment that is worn or not functioning will be replaced immediately.

Q2-11.3 LABORATORY INSTRUMENTS

Instruments used by the laboratory will be maintained in accordance with the laboratory's QAP and method requirements. The laboratory will keep maintenance records and make them available for review, if requested, during laboratory audits.

Q2-11.4 ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Supplies and consumables received for a project (e.g., sample bottles, calibration standards) will be checked for damage and other deficiencies that would affect their performance. Inspections should be documented and a copy of the inspection should be kept in the project's file.

Q2-12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA

Q2-12.1 FIELD MEASUREMENT DATA

Both quantitative and qualitative field data will be obtained for use in the project. For quantitative field measurements, accuracy is usually confirmed through routine calibration of

measurement equipment. Measurement precision may be evaluated through replicate measurements. Field completeness is defined as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions, as described in Section Q2-3.0.

Field measurement data will be reviewed daily before its incorporation into the project database. Questionable results will be addressed through a timely and appropriate corrective action (Section Q2-13.0). Once field data have been approved for incorporation into the project database they will also be considered acceptable for use in the project.

Q2-12.2 LABORATORY DATA

As discussed in previous sections of this QAPP, the accuracy, precision, completeness, and representativeness of analytical data will be described relative to the project's control limits. The data quality review will be documented in reports to the Supervising Contractor and any qualification of the data resulting from that review will be attached to results that are incorporated into the project database so that all data users are aware of data quality for individual results.

Q2-13.0 CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or poor QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Proposed corrective actions will be documented as well as the steps taken to implement the corrective action. Corrective action should only be implemented after approval by the Supervising Contractor. If immediate corrective action is required, approvals secured by telephone from the Supervising Contractor should be documented by the Project QAM.

Nonconforming equipment, items, activities, conditions, and unusual incidents that could affect data quality and attainment of the project's quality objectives will be identified, controlled, and reported in a timely manner. For the purpose of this QAPP, a nonconformance is defined as a malfunction, failure, deficiency, or deviation that renders the quality of an item unacceptable or indeterminate in meeting the project's quality objectives. If the analytical results from laboratory QC samples fall outside of the measurement performance criteria, corrective actions should be initiated immediately by the laboratory. If the laboratory cannot correct the situation that caused

the nonconformance and an out-of-control situation continues to occur or is expected to occur, then the laboratory will immediately contact the Project QAM and request instructions regarding how to proceed with sample analyses. Completion of any corrective action should be evidenced by data once again falling within prescribed measurement performance criteria. If an error in laboratory procedures or sample collection and handling procedures cannot be found, the results will be reviewed by the Project QAM and Supervising Contractor to assess whether reanalysis or re-sampling is required.

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling or reanalysis of samples. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives. If the Project QAM identifies a corrective action situation, it is the Supervising Contractor who will be responsible for approving the implementation of corrective action. All corrective actions of this type will be documented by the Project QAM.

Any corrective actions taken will be documented in writing by either the Laboratory QA Manager or the Project QAM and reported to the Supervising Contractor. Corrective action records (Attachment Q2-D) will be included in the project's files.

Q2-14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Periodic QA reports will be submitted to the Supervising Contractor from the Project QAM to provide ongoing evaluation of measurement data quality. Reports will include sections that summarize the QC data collected during the program and provide a summary of data evaluation/validation results. A discussion of data usability relative to the project's quality objectives should also be included in the reports. Any anomalies or departures from the assumptions established in the planning phase of data collection will be identified.

Q2-14.1 DATA VALIDATION REPORTS

A data validation report will be issued to the Supervising Contractor from the Project QAM summarizing the data validation for the laboratory analysis reports as described in Section Q2-9.1. The report will summarize the data quality and include a list of any qualifications of data resulting from the data evaluation. The reports will be submitted after each sampling event.

Q2-15.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 2000. Data Quality Objectives Process for Hazardous Waste Site Investigations. EPA/600/R-00/007. Office of Environmental Information, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. Office of Environmental Information, Washington, D.C. March.

U.S. Environmental Protection Agency (EPA). 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. Office of Environmental Information, Washington, D.C. December.

U.S. Environmental Protection Agency (EPA), 2006. Midnite Mine Superfund Site, Spokane Indian Reservation, Washington, Record of Decision. Office of Environmental Cleanup. EPA Region 10. September.

U.S. Environmental Protection Agency (EPA), 2010. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. Publication 9240.1-51, EPA 540-R-10-011. January.

U.S. Environmental Protection Agency (EPA), 2011. Statement of Work for the Remedial Design and Remedial Action for the Midnite Mine Superfund Site, Spokane Indian Reservation, Washington. August.

U.S. Environmental Protection Agency, U.S. Department of Defense, U.S. Department of Energy, U.S. Department of Homeland Security, U.S. Nuclear Regulatory Commission, U.S. Food and Drug Administration, U.S. Geological Survey and National Institute of Standards and Technology (EPA et. al), 2004. Radiochemical Data Verification and Validation. MARLAP Manual Vol. 1, Chapter 8. July.

Tables

Table Q2-1 — Summary of Quality Control Limits for Laboratory Analyses

Sample Media	Analyte	Accuracy Measures and Control Limits	Precision Measures and Control Limits[1]	Completeness Goal
Sediment Samples	All analytes listed on Table Q2-4	LCS, LFB Recovery: 80-120% MS/MSD, LFM/LFMD Recovery: 70-130%	Analytical Duplicate RPD: -water <20% -sediment <35% MS/MSD or LFM/LFMD RPD: -water <20% -sediment <35% Field duplicate RPD: water samples <35% sediment samples <50% Radiochemical Analysis RER: <2.0	Water and sediment data 95%
Water Samples	All analytes listed on Table Q2-5			

1 Note: Due to the nature of solid samples (i.e., matrix interferences and homogeneity difficulties), higher RPD limits for sediment samples are acceptable.

LCS = laboratory control sample
LFB = Laboratory fortified blank
LFM = Laboratory fortified matrix
LFMD = Laboratory fortified matrix duplicate
MS = matrix spike
MSD = matrix spike duplicate
RPD = relative percent difference
RER = replicate error ratio

Table Q2-2 — Sample Containers, Preservation, and Holding Time Requirements for Water Samples

Analyte	Sampling Container	Filtration/ Preservation	Holding Time
Field Analysis			
pH, Specific Conductance, Temperature	Polyethylene	Unfiltered, Unpreserved	Analyze at time of sample collection
Laboratory Analysis			
Metals and Major Cations, Total	250 ml Polyethylene	Unfiltered, HNO_3, Cool to 4°C	180 days
Metals and Major Cations, Dissolved	250 ml Polyethylene	Filtered, HNO_3, Cool to 4°C	180 days
Major Anions, Total	250 ml Polyethylene	Unfiltered, Unpreserved, Cool to 4 °C	28 days
Major Anions, Dissolved	250 ml Polyethylene	Filtered, Unpreserved, Cool to 4 °C	28 days
TDS	500 ml Polyethylene	Filtered, Unpreserved, Cool to 4°C	7 days
TSS	500 ml Polyethylene	Unfiltered, Unpreserved, Cool to 4°C	7 days
Total U-234, U-238, Ra-226, Pb-210	(2) 2000 ml Polyethylene	Unfiltered, HNO_3, Cool to 4°C	**
Dissolved U-234, U-238, Ra-226, Pb-210	(2) 2000 ml Polyethylene	Filtered, HNO_3, Cool to 4°C	**

**No established recommended holding time; analyze as soon as feasible

°C = degrees Celsius, ml = milliliters, TDS = total dissolved solids, TSS = total suspended solids, HNO_3 = nitric acid

Table Q2-3 — Sample Containers, Preservation, and Holding Time Requirements for Sediment Samples

Sample Media	Analysis	Sampling Container	Preservation/Prep	Minimum Sample Mass	Holding Time (days)
Sediment	Metals	Quart–size freezer Zip-lock bags or glass jars	Cool at 4° C for transport, no preservation needed	225 g	180
	U-234, U238, Ra-226, Pb-210	Quart–size freezer Zip-lock bags or glass jars	Cool at 4° C for transport, no preservation needed	100 g	**

**No established recommended holding time; analyze as soon as feasible
g = gram, °C = degrees Celsius

Table Q2-4 – Sediment Sample Analysis Parameters, Methods, and Method Detection Limits

Analyte	Digestion/ Analytical Method	Reporting Limit	Target Method Detection Limit	Sediment Cleanup Level
Aluminum	EPA3050/EPA 6020	5 mg/kg	0.5 mg/kg	NE
Barium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Beryllium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Cadmium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Chromium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	43.4 mg/kg
Cobalt	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Copper	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Iron	EPA3050/EPA 6020	5 mg/kg	0.5 mg/kg	NE
Manganese	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	1,179 mg/kg
Lead	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Nickel	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Selenium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	1.7 mg/kg
Silver	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Uranium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	93.2 mg/kg
Vanadium	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	41 mg/kg
Zinc	EPA3050/EPA 6020	1 mg/kg	0.5 mg/kg	NE
Radium-226	EPA3050/E903.0	~0.2 pCi/g (MDC sample specific)	0.2 pCi/g	13 pCi/g
Lead-210	EPA3050/E909.0 or DOE HASL 300	~0.2 pCi/g (MDC sample specific)	0.2 pCi/g	20 pCi/g
Uranium-234	EPA3050/E908.0	~0.2 pCi/g (MDC sample specific)	0.2 pCi/g	41 pCi/g
Uranium-238	EPA3050/E908.0	~0.2 pCi/g (MDC sample specific)	0.2 pCi/g	31 pCi/g

The “Minimum Detectable Concentration,” or “MDC,” is an estimate of the detection limit under the specific conditions of the sample analysis.
mg/kg = milligrams per kilogram
pCi/g = picocuries per gram
NE = not established

Table Q2-5 - Water Laboratory Parameters, Analytical Methods, Detection Limits and Cleanup Levels (Page 1 of 2)

Analyte		Groundwater	Surface Water	Analytical Method	Reporting Limit	Target Method Detection Limit	Surface Water Cleanup Level[5]	Ground-Water Cleanup Level[5]
Aluminum	total		X	M200.8 ICP-MS	10 µg/L	5 µg/L	9,073 µg/L[1]	NE
	dissolved	X	X					
Barium	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	165 µg/L[1]	NE
	dissolved	X	X					
Beryllium	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	0.53 µg/L[1]	NE
	dissolved	X	X					
Cadmium	total		X	M200.8 ICP-MS	1 µg/L	0.05 µg/L	2.0 µg/L (acute) 0.5 µg/L (chronic)[2,3]	NE
	dissolved	X	X					
Cobalt	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	3 µg/L[1]	NE
	dissolved	X	X					
Copper	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	13.4 µg/L (acute) 8.96 µg/L (chronic)[2]	NE
	dissolved	X	X					
Iron	total		X	M200.8 ICP-MS	10 µg/L	1 µg/L	NE	NE
	dissolved	X	X					
Lead	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	64.6 µg/L (acute) 2.52 µg/L (chronic)[2]	NE
	dissolved	X	X					
Manganese[6]	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	72 µg/L[1]	1,990 µg/L[4]
	dissolved	X	X					
Nickel	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	468 µg/L (acute) 52 µg/L (chronic)[2]	NE
	dissolved	X	X					
Silver	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	3.2 µg/L (acute) 0.8 (chronic)[2]	NE
	dissolved	X	X					
Uranium[6]	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	19.6 µg/L[1]	88 µg/L
	dissolved	X	X					
Zinc	total		X	M200.8 ICP-MS	1 µg/L	0.1 µg/L	114 µg/L (acute) 105 µg/L (chronic)[2]	NE
	dissolved	X	X					
Calcium	dissolved	X	X	M200.7 ICP	10 µg/L	5 µg/L	NE	NE
Magnesium	dissolved	X	X	M200.7 ICP	10 µg/L	5 µg/L	NE	NE
Sodium	dissolved	X	X	M200.7 ICP	10 µg/L	5 µg/L	NE	NE
Potassium	dissolved	X	X	M200.7 ICP	10 µg/L	5 µg/L	NE	NE
Total Alkalinity (including Bicarbonate and Carbonate)	total		X	M2320B-Titrimetric	5 mg/L	N/A	NE	NE
	dissolved	X						
Sulfate[6]	dissolved	X	X	M300.0	0.1 mg/L	0.05 mg/L	NE	NE
Chloride	dissolved	X	X	M300.0	0.1 mg/L	0.05 mg/L	NE	NE
Total Dissolved Solids (TDS)	dissolved	X	X	M2540C-Gravimetric	10 mg/L	N/A	NE	NE
Total Suspended Solids (TSS)	total		X	M2540D-Gravimetric	1 mg/L	N/A	NE	NE
Lead-210	total		X	EPA 909.0	1.0 pCi/L	1.0 pCi/L	2.5 pCi/L[4]	NE
	dissolved	X	X					
Radium-226[6]	total		X	EPA 903.0	0.2 pCi/L	0.2 pCi/L	NE	NE
	dissolved	X	X					
Uranium-234	total		X	EPA 908.0	0.2 pCi/L	0.2 pCi/L	8.8 pCi/L[4]	37 pCi/L[4]
	dissolved	X	X					
Uranium-238	total		X	EPA 908.0	0.2 pCi/L	0.2 pCi/L	7.6 pCi/L[4]	35 pCi/L[4]
	dissolved	X	X					
Field Parameters								
pH [6]	total	X	X	Field Meter	0.1 su	N/A	NE	NE
Turbidity	total	X	X	Field Meter	1 NTU	N/A	NE	NE
Specific Conductance[6]	total	X	X	Field Meter	1 umhos/cm	N/A	NE	NE
Temperature	total	X	X	Field Meter	0.1 °C	N/A	NE	NE

Notes:
Samples submitted to the analytical laboratory will comprise an unfiltered sample (for total analysis) and/or a field-filtered sample (for dissolved analysis).

Table Q2-5 - Water Laboratory Parameters, Analytical Methods, Detection Limits and Cleanup Levels (Page 2 of 2)

Reporting limits and target method detection limits are from Anatek Labs, Inc. for all analyses except radionuclides, which are from Energy Laboratories, Inc.

mg/L	milligrams per liter
µg/L	micrograms per liter
NE	Not established
N/A	Not applicable
NTU	nephelometric turbidity units
pCi/L	picocuries per liter
su	standard units
umhos/cm	micromhos per centimeter

1) Total
2) Dissolved
3) Criteria are hardness dependent. Cleanup level calculated at a hardness of 100 mg/L as $CaCO_3$. Hardness is calculated as the sum of calcium and magnesium.
4) ROD does not distinguish total or dissolved for cleanup level.
5) Cleanup levels are established in the ROD; achievement of the groundwater and surface water cleanup levels will require a period for natural attenuation to occur after the remedy is completed.
6) Indicator constituent or parameter that has a location-specific and seasonal action level established based on historical data (see Attachment Q2-E). Indicator parameter/constituents are for use during the RA activities to evaluate if COCs are migrating down gradient as a result of the RA activities.

Table Q2-6 Analytical Method QC Specifications
(Page 1 of 5)

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
M200.8 (ICP-MS Metals)	MS tuning sample	Prior to initial calibration and calibration verification	After a minimum of running the tuning solution 5x, resulting relative std dev of absolute signals for all analytes should be < 5%	Retune instrument then reanalyze tuning solution
	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	If more than one standard is used, correlation coefficient must be ≥ 0.995	If applicable, correct problem and repeat initial calibration
	Calibration blank (ICB, CCB)	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected ≥ RL	Correct problem then analyze calibration blank and previous 10 samples
	Initial calibration verification (ICV)	Daily after initial calibration	All analytes within ±10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within ±10% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration
	Low level calibration check standard (at or below RL)	Once per analytical batch prior to sample analysis unless multi-point (3+) calibration with low std at or below RL is performed	All analyte(s) with ± 50% of expected value	Correct problem then reanalyze
	Linear range calibration (high) check standard	Every three months	Analyte within ± 10% of expected value	Correct problem then reanalyze or re-set linear range
	Lab reagent blank (LRB)	One per analytical batch	No analytes detected ≥ RL	Correct problem reprep and analyze method blank and all samples processed with the contaminated blank
	Lab fortified blank (LFB)	One per analytical batch	Method QC acceptance criteria = within 80-120% recovery	Correct problem then reanalyze; If still out, reprep and reanalyze the LFB and all samples in the affected batch
	Serial Dilution	Each matrix in an analytical batch (only applicable for analytes with concentrations >50X MDL)	Fivefold (1+4) dilution must agree within ±10% of the original determination	Perform post digestion spike addition
	Lab fortified matrix (LFM)	One LFM/LFMD per every analytical batch	Method QC acceptance criteria = 70-130% recovery	none
	Duplicate Sample (DUP)	One per analytical batch	QC acceptance criteria = 20% RPD if ≥ 5x the RL; if < 5x the RL the limit is the RL	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria
	Internal Standards (ISs)	Every sample, including blanks and standards	IS intensity within 30-120% of intensity of the IS in the initial calibration	Perform corrective action as described in method
	IDL study	Every three months	Detection limits established shall be ≤ ½ x RLs	none
	MDL study	Every 12 months		
	Results reported between MDL and RL	none	none	none

Table Q2-6 Analytical Method QC Specifications
(Page 2 of 5)

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
M200.7 (ICP Metals)	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	If more than one standard is used, correlation coefficient must be ≥ 0.995	If applicable, correct problem and repeat initial calibration
	Calibration blank (ICB, CCB)	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected ≥ RL	Correct problem then analyze calibration blank and previous 10 samples
	Initial calibration verification (ICV)	Daily after initial calibration	All analytes within ±10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analyte(s) within ±10% of expected value and RSD of replicate integrations <5%	Repeat calibration and reanalyze all samples since last successful calibration
	Low level calibration check standard (at or below RL)	Once per analytical batch prior to sample analysis unless multi-point (3+) calibration with low std at or below RL is performed	All analyte(s) with ± 50% of expected value	Correct problem then reanalyze
	Linear range calibration (high) check standard	Every three months	Analyte within ± 10% of expected value	Correct problem then reanalyze or re-set linear range
	Lab reagent blank (LRB)	One per analytical batch	No analytes detected ≥ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank
	Lab fortified blank (LFB)	One per analytical batch	Method QC acceptance criteria = within 85-115% recovery	Correct problem then reanalyze; If still out, reprep and reanalyze the FFB and all samples in the affected batch
	Serial Dilution	Each new sample matrix, at least once per analytical batch (only applicable for analytes with concentrations >50X MDL)	Fivefold (1+4) dilution must agree within ±10% of the original determination	Perform post digestion spike addition
	Spectral interference solution (SIC)	Periodically, to verify the interelement interference correction routine	Recovery within laboratory limits	SIC should be run daily for analytes that fail limits
	Lab fortified matrix (LFM)	One LFM/LFMD per every analytical batch	Method QC acceptance criteria = 70-130% recovery	none
	Duplicate Sample (DUP)	One per analytical batch	QC acceptance criteria = 20% RPD if ≥ 5x the RL; if < 5x the RL the limit is the RL	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria
	MDL study	Once per 12 month period	Detection limits established shall be ≤ ½x the RLs	none
	Results reported between MDL and RL	none	none	none

Table Q2-6 Analytical Method QC Specifications
(Page 3 of 5)

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
M6020 (ICP-MS Metals)	MS tuning sample	Prior to initial calibration and calibration verification	SW6020 paragraph 5.8	Retune instrument then reanalyze tuning solution
	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	If more than one standard is used, correlation coefficient must be ≥ 0.995	If applicable, correct problem and repeat initial calibration
	Calibration blank	Before beginning a sample run, after every 10 samples and at end of the analysis sequence	No analytes detected ≥ RL	Correct problem then analyze calibration blank and previous 10 samples
	Initial calibration verification (Second source standard)	After initial calibration before beginning a sample run –at a concentration other than used for calibration	All analytes within ±10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within ±10% of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration
	Low level calibration check standard (at or below RL)	Once per analytical batch prior to sample analysis unless multi-point (3+) calibration with low std at or below RL is performed	All analyte(s) with ± 50% of expected value	Correct problem then reanalyze
	Linear range calibration (high) check standard	Every three months	Analyte within ± 10% of expected value	Correct problem then reanalyze or re-set linear range
	Method blank	One per analytical batch	No analytes detected ≥ RL	Correct problem reprep and analyze method blank and all samples processed with the contaminated blank
	Interference check solutions (ICS-A and ICS-AB)	At the beginning and end of an analytical run or once during an 12 hour period, whichever is more frequent	ICS-A: All non-spiked analytes < RL unless they are a verified trace impurity from one of the spiked analytes. ICS-AB: Within ±20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS; reanalyze all affected samples
	Lab Control Sample (LCS)	One per analytical batch	QC acceptance criteria 80-120% recovery	Correct problem then reanalyze; If still out, reprep and reanalyze the LCS and all samples in the affected batch
	Dilution test	Each matrix in an analytical batch (only applicable for analytes with concentrations >100X MDL)	Fivefold (1+4) dilution must agree within ±10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails, or if an analyte's concentration for all samples in a batch is less than 100X MDL	Recovery within 75-125% of expected results	Dilute the sample; reanalyze post digestion spike addition
	Matrix Spike (MS)/MSD	One MS/MSD per every 20 project samples/ matrix	QC acceptance criteria 70-130% recovery	none
	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, to be reported by lab	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria
	Internal Standards (ISs)	Every sample	IS intensity within 30-120% of intensity of the IS in the initial calibration	Perform corrective action as described in method SW6020, section 8.3
	IDL study	Every three months	Detection limits established shall be ≤ ½ x RLs	none
	MDL study	Every 12 months		
	Results reported between MDL and RL	none	none	none

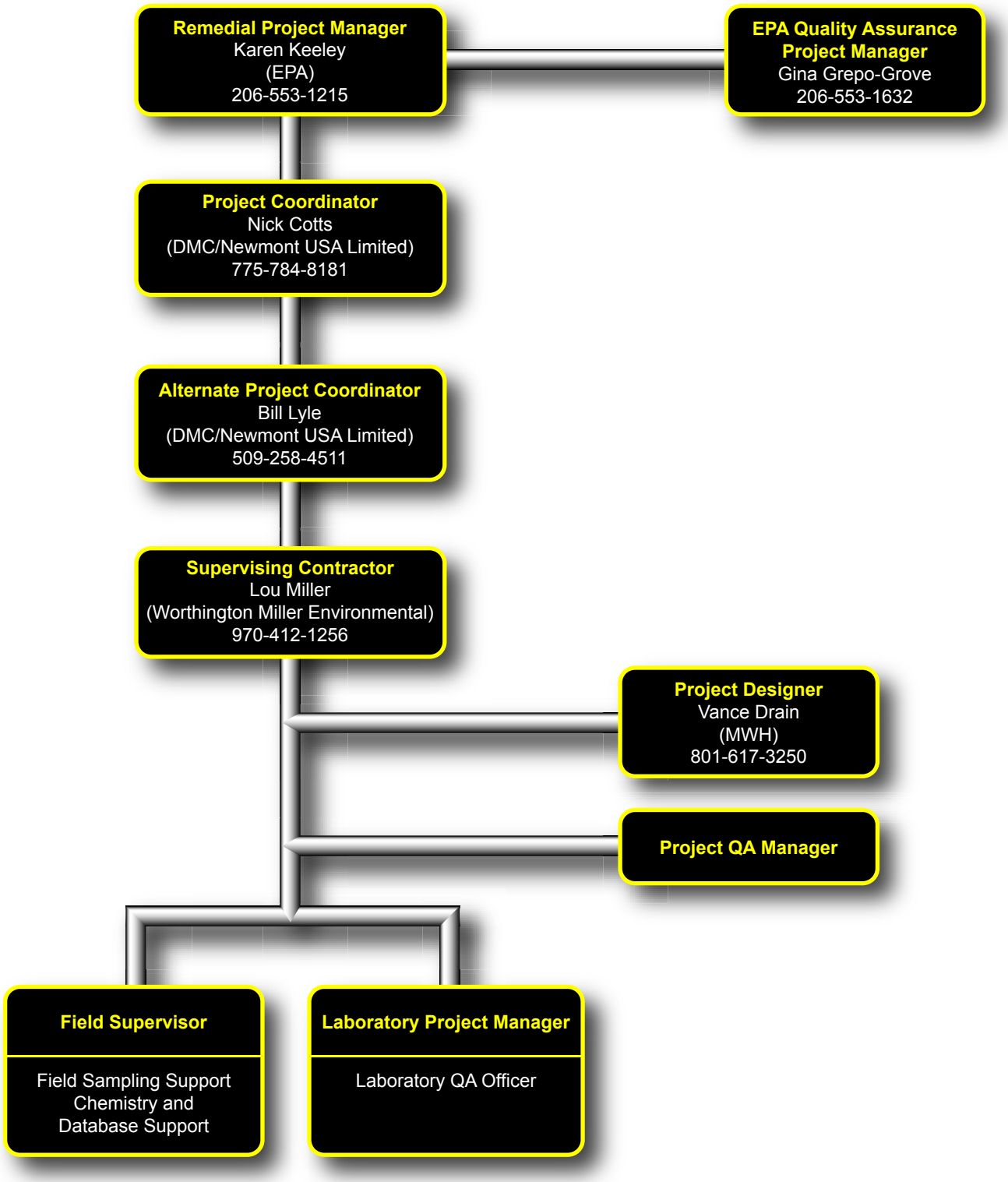
Table Q2-6 Analytical Method QC Specifications
(Page 4 of 5)

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SM2320B (Total Alkalinity, Carbonate, Bicarbonate)	Initial calibration (3 buffers at 3 pH units apart)	Daily, prior to sample analysis.	± 0.05pH units of buffer solution value.	Evaluate system; recalibrate
	Calibration verification (ICV and CCV).	ICV: daily, immediately following initial calibration. CCV: every 10 samples and at end of analytical run.	± 0.1pH units of buffer solution value.	Repeat calibration and reanalyze all samples since last successful calibration
	Method Blank (MB)	One per batch or Sample delivery group (SDG) (1 per 20 samples minimum)	< RL	If sample concentration is >10X the blank conc. or non-detect, no action. If detected sample concentrations are <10X blank conc., all associated samples must be prepared again with another method blank and reanalyzed
	Duplicate Sample (DUP)	One per batch or Sample delivery group (SDG) (1 per 20 samples minimum)	RPD <20% for samples > 20 mg/L, ± RL for samples <20 mg/L	Flag associated data with an *
	One set (two concentration levels) mineral reference samples (LCS)	One set per batch or SDG (1 set per 20 samples minimum)	± 15% from expected concentration	Terminate analysis. Identify and document the problem. Reanalyze all associated samples
	MDL study	Once per 12 month period	Detection limits established shall be ≤ ½ the RLs	none
SM2540 C,D (TDS, TSS)	Analytical Balance Check: Weights of 100mg, 1g, and 100g	Daily	Difference < 0.5 mg	Identify and document problem. Verify before sample analysis
	Method (Prep) Blank	One per analytical batch	< RL	If sample concentration is >10X the blank conc. or non-detect, no action. If detected sample concentrations are <10X blank conc., all associated samples must be prepared again with another method blank and reanalyzed
	Duplicate Sample (DUP)	One per analytical batch	RPD <20%	Flag associated data with an *
	Laboratory Control Sample (LCS)	One per analytical batch	± 20% from expected concentration	Terminate analysis. Identify and document the problem. Reanalyze all associated samples
M300.0 (Sulfate, Chloride)	Initial calibration	Daily, prior to sample analysis	Correlation coefficient must be ≥ 0.995, with intercept < ± MDL	Evaluate system; recalibrate
	Calibration Blanks (ICB,CCB)	ICB initially after initial calibration; CCB after every 10 samples and at end of each analytical run.	≤ RL	Correct problem then analyze calibration blank and previous 10 samples
	Calibration verification (ICV, CCV)	ICV initially after initial calibration; CCV after every 10 samples and at end of each analytical run.	± 10% from expected concentration	Evaluate system. Repeat either ICV or CCV, if still out, identify and correct problem. If ICV still out repeat initial calibration; if CCV still out recalibrate and reanalyze all samples since last valid CCV
	Method (Prep) Blank (LRB)	1/ batch of up to 20 samples	concentration ≤ RL	Reprep and reanalyze. If problem recurs, reprep and reanalyze blank and all associated samples
	Laboratory Fortified Blank (LFB)	1/ batch of up to 20 samples	90-110% recovery of true value	Review with lab manager. Reanalyze or justify in lab report
	Spike Sample (MS, LFM)	1/batch of up to 20 samples	90-110% recovery of true value	Reprep and reanalyze. If problem recurs, justify in data report
	Duplicate Sample (DUP)	1/ batch of up to 20 samples	RPD ≤ 20% for concentrations > 5x RL	Flag associated data with an *

Table Q2-6 Analytical Method QC Specifications
(Page 5 of 5)

Method	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Radiochemistry: (M 903.0, 908.0, 909.0)	Initial calibration	Prior to use if instrument –depending on type of instrumentation	Varied depending on instrument	Recount/recalibrate. Perform instrument maintenance or service instrument if needed.
	Tracer or carrier	Every sample when required by the method.	Appropriate counting statistics or measurement error if mass yield is determined.	Investigate for analyst error. Investigate use against analyte level present in samples and customer DQRs. Re-prepare and analyze affected samples. Discuss in narrative.
	Method (Prep) Blank	1 per batch	<Minimum Detectable Concentration (MDC), <5% sample isotope concentration or <5% decision level.	Investigate, evaluate against DQRs, correct, re-prepare and analyze as applicable.
	Laboratory Control Sample (LCS)	1 per batch	80% to 120%	Investigate and evaluate against DQRs. Correct. Re-prepare and analyze affected samples.
	Matrix Spike Sample (MS); MSD	1 per batch	75% to 125% or statistical	Investigate. If laboratory error, re-prepare and analyze. If matrix driven, evaluate against DQRs, notify client if still unacceptable. Discuss in narrative.
	Duplicate Sample (DUP)	1 per batch	≤20% relative percent difference when the two results are >5 times the MDA or individual uncertainties are <20%. Or, alternately, the duplicates should agree within 2 std. deviations.	Evaluate. If lab error, re-prepare and analyze. If matrix driven, evaluate against DQRs, notify client if still unacceptable. Discuss in narrative.
	Minimum Detectable Concentration (MDC)	Determined for each sample based on count time and volume of sample used		
	MDL study	Once per 12 month period	Required detection limits (for drinking water) must be achieved (40 CFR 141.25)	Repeat if obvious problem occurs. Determine root causes. Repeat study.
	Counter control source	One per day as the system is used or per batch (alpha/beta and liquid scintillation). One per week or after analytical run, whichever is longer (gamma and alpha spectrometry)	Control limits: 3 sigma or ± 3%, whichever is greater. Monitor resolution, efficiency, and energy calibrations to procedure-specified limits.	Investigate. Recalibrate if necessary. Readjust if keV/channel drift occurs (gamma and alpha spectrometry).
	Instrument background (blank for liquid scintillation)	One per day as system is used (alpha beta and liquid scintillation). Minimum of every other week (gamma spec), every 4 weeks (alpha spec), or after analytical run, whichever is longer.	Use background for results calculation. Monitor background for potential detector contamination.	Investigate as needed. Clean or replace parts as needed.

Figures



MWH

Midnite Mine

FIGURE Q2-1

QAPP ORGANIZATIONAL CHART

DRAWN BY D. Severson

29 May 2015

J:\Industrial Projects\MIDNITE MINE\Deliverables_Working Documents\SITE WIDE MONITORING\FIGURES\Fig Q2-1_Midnite Mine_QAPP Org Chart_May2015.ai

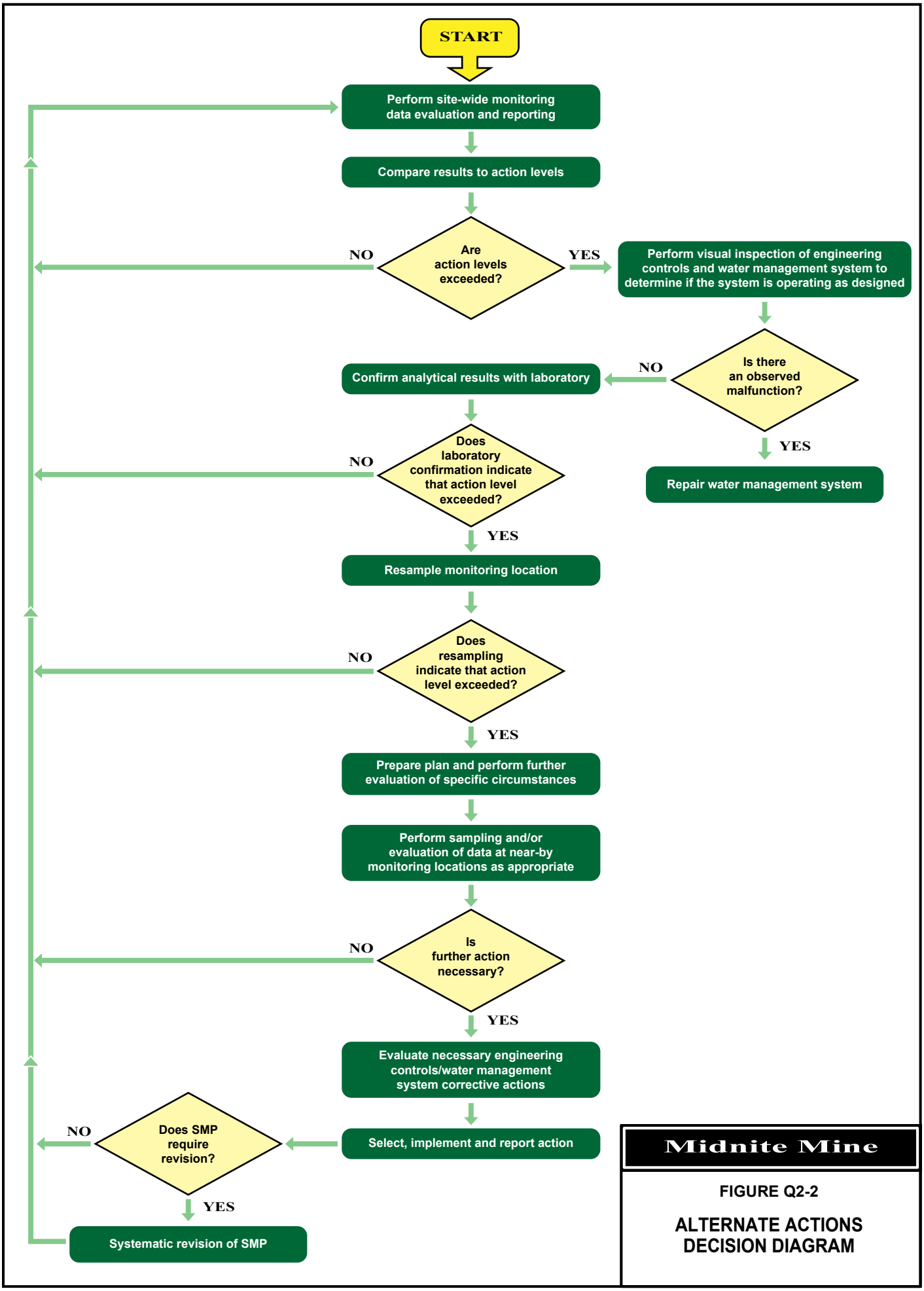


FIGURE Q2-2

ALTERNATE ACTIONS DECISION DIAGRAM

Fig Q2-2_Midnite Mine_Alt Actions Decision Diagram_May2014.ai 27 May 2014

Attachment Q2-A

Data Quality Objective Summary Tables

TABLE NO.	TITLE	REVISION DATE	COMMENTS
Q2-A-1	Data Quality Objectives for Monitoring of Surface Water, Groundwater, and Sediment During and Following Remedy Implementation	June 2015	100% design submittal
Q2-A-2	Data Quality Objectives for Surface Water Impoundment Sampling	June 2015	100% design submittal
Q2-A-3	Data Quality Objectives for Water Balance Data	June 2015	100% design submittal
Q2-A-4	Data Quality Objectives for Alluvial Groundwater Controls and Hydraulic Containment Water Level Monitoring	June 2015	100% design submittal

DQO summary tables will be added, deleted or revised as DQOs are revised or refined, or if new data collection activities are added or deleted as the RA progresses.

Table Q2-A-1 – Data Quality Objectives for Monitoring Surface Water, Groundwater, and Sediment During and Following Remedy Implementation
(Page 1 of 3)

DQO Step	During Remedial Action	Post Remedial Action
Step 1: State the Problem		
Problem Statement	Although engineering controls will be implemented to mitigate contaminant migration during the RA construction, implementation of the Selected Remedy will involve significant ground-disturbing activities and storage of mine-affected surface water, which could release contaminants to down-gradient areas.	It is recognized in the ROD that achievement of the groundwater and surface water cleanup levels will require a period for natural attenuation to occur after the remedy is completed. Sampling data are required following completion of the Selected Remedy to monitor the effectiveness of source control and progress of surface water and groundwater recovery.
Step 2: Identify the Decision		
Principle Study Question	Do concentrations of indicator parameters exceed action levels in the various environmental media down gradient of the Site during the active phase of the RA construction? The process for establishing the indicator parameters and the calculated action levels is summarized in Attachment Q2-E for surface water and groundwater, and in Attachment Q2-F for sediment. **For surface water and groundwater**, indicator parameters are parameters/constituents that 1) historically are elevated in mine-affected water relative to down gradient surface water and groundwater, and 2) are mobile in the environment. The indicator parameters for surface water and groundwater include pH, specific conductivity, sulfate, uranium, manganese, and radium-226. The full site-wide monitoring analytical suite for surface water and groundwater (see Table Q2-5) also will include constituents of concern (COCs) established in the ROD (e.g., COCs for which cleanup levels were established) and other parameters that may be useful for data evaluation (e.g., cations and anions). The cleanup levels established in the ROD will not be used for action levels during the RA because the cleanup levels are already exceeded at some locations, and because it is recognized in the ROD that achievement of the groundwater and surface water cleanup levels will require a period for natural attenuation to occur after the remedy is completed. Action levels were first developed for select surface water and groundwater sampling locations in the *Quality Assurance Project Plan for the Performance Monitoring Plan Phase I RD/RA: Interim Water Management for the Midnite Mine* (AES, 2011), and have been updated based on more recent pre-RA baseline data (see Attachment Q2-E). These action levels are the upper prediction limits (UPLs) calculated from historical data. At locations where some baseline data are available, but the data set is not sufficient for calculating a UPL, action levels will be qualitative (e.g., spikes in concentrations or increasing concentration trends) until a sufficient data set is available to establish a UPL. At new sampling locations that have no baseline data, qualitative or quantitative action levels or trends cannot be established until sufficient data are available. Analytical results for COCs for which action levels are not established only will be used to support data evaluation if necessary. **For sediment**, indicator parameters will be the COCs listed in the ROD for which cleanup levels were established (Table Q2-4). As with surface water/groundwater, the cleanup levels will not be used as action levels during the RA because the cleanup levels are already exceeded at some locations. As described above, the action levels are the UPLs calculated from historical data. At locations where some baseline data are available, but the data set is not sufficient for calculating a UPL, action levels will be qualitative (e.g., spikes in concentrations or increasing concentration trends) until a sufficient data set is available to establish a UPL. At new sampling locations that have no baseline data, qualitative or quantitative action levels or trends cannot be established until sufficient data are available. Analytical results for COCs for which action levels are not established only will be used to support data evaluation if necessary.	Do the concentrations of constituents of concern (COCs) in the various environmental media exceed the cleanup levels established in the ROD following completion of the RA? If cleanup levels are exceeded in down gradient groundwater or surface water, do monitoring data indicate that that natural attenuation is occurring?
Alternative Actions	If concentrations of indicator parameters remain stable or decrease during RA construction – then maintain the Site's engineering controls/water management system. If concentrations of indicator parameters exceed action levels during RA construction – then evaluate the Site's engineering controls/water management system to confirm they are operating as designed to prevent contaminant migration. Further evaluation will include: (1) confirmation sampling to verify the result, (2) visual inspection of the engineering controls/water management system, and (3) comparison with up gradient data where appropriate. If it is determined that further action is necessary, then evaluate, select, and implement corrective action to prevent further exceedance of action levels. Figure Q2-2 represents the decision process for alternate actions.	**Groundwater and Surface Water** 1) If concentrations are at or below the cleanup levels, no action is required. 2) If concentrations exceed cleanup levels, evaluate long-term (e.g., 5 year) trends: a. If concentrations are trending toward cleanup levels, then continue long-term monitoring and data evaluations. b. If concentrations are stable or are not trending toward the cleanup levels, then evaluate and implement supplemental actions to reduce COC concentrations in the affected media. **Sediment** 1) If concentrations are at or below the cleanup levels, then no action is required. 2) If concentrations exceed cleanup levels, then confirm results and evaluate and implement supplemental actions to reduce COC concentrations or otherwise mitigate risks. *Note that the alternative actions for surface water and groundwater differ from sediment because achievement of the surface water and groundwater cleanup levels will require a period of natural contaminant attenuation following source control, whereas cleanup levels in sediment (other than in Blue Creek) should be met upon completion of the RA.*
Step 3: **Identify the Inputs to the Decision**		
Information Required to Resolve Decision Statement	Required information includes concentration values for indicator parameters in the various environmental media (surface water, groundwater, and sediment) down gradient of the Site. Analytical results of environmental samples collected during the RA will be compared with baseline data (where available) to evaluate if the RA activities might be releasing contaminants to down gradient areas. Flow rate and water level data also will be collected to provide information for interpretation of the analytical results (e.g., to confirm flow directions and to potentially calculate contaminant-mass flux).	Required information includes concentration values for the COCs in the various environmental media near and down gradient of the Site. Analytical results of samples collected following remedy implementation (as well as surface water and groundwater data trends) will be compared to the cleanup levels established in the ROD.

BODR – Basis of Design Report
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – data quality objective
EPA – U.S. Environmental Protection Agency
FSP – Field Sampling Plan
MA – Mined Area
QAPP – Quality Assurance Project Plan
RA – Remedial Action
RD – Remedial Design
ROD – Record of Decision
Site – Midnite Mine Superfund Site
UPL – upper prediction limit

Table Q2-A-1 – Data Quality Objectives for Monitoring Surface Water, Groundwater, and Sediment During and Following Remedy Implementation

DQO Step	During Remedial Action	Post Remedial Action
Sources of Information	**Surface Water and Groundwater** The process for establishing the indicator parameters and the calculated action levels for surface water and groundwater is summarized in Attachment Q2-E. **Sediment** The process for establishing the indicator parameters and the calculated action levels for sediment is summarized in Attachment Q2-F.	Site COCs and associated cleanup levels for surface water, groundwater, and sediment are established in the ROD (EPA, 2006) (See BODR Tables 4-2 through 4-5).
Planned Environmental Measurements	Surface water, groundwater, and sediment samples will be collected from representative locations down gradient of the RA activities and analyzed for the constituents listed on QAPP Tables Q2-4 and Q2-5.	COCs for sediment, surface water, and groundwater are listed on BODR Tables 4-2 through 4-5, respectively.
Basis for Action Levels	**Surface Water, Groundwater, and Sediment** Action levels for several monitoring locations located within the area of mine-affected surface water and groundwater (refer to the site-wide monitoring networks summarized and depicted in the FSP) are based on historic concentrations for indicator parameters in samples collected during operation of the Phase I RD/RA seep collection and pump-back system (between 1998 and 2013). Action levels for other locations will be qualitative and based on professional judgment to identify spikes in concentrations or increasing data trends. These include locations that: • Do not have a sufficient historical data set to generate statistically based action levels. • Are very close to the disturbed mine area (e.g., surface water locations at the toe of the south waste rock pile). Constituent concentrations at these locations are considered too variable to use for indicating a release as a result of the RA activities. However, data from these surface water locations likely will be useful for interpreting data collected at locations further down gradient. Likewise, action levels are not established for up gradient locations.	Cleanup levels are established in the ROD, and are based on calculated risks to human health and the environment.
Step 4: Define Study Boundaries		
Spatial Boundaries	**Groundwater in the main Mine drainages** The geographic area for groundwater monitoring in the main mine drainages includes the Far West, Western, Central, Eastern, and Mine Drainages down gradient of the MA; and includes both alluvial and bedrock groundwater. These monitoring locations are representative of groundwater convergence zones immediately down gradient of the MA (see FSP Figures Q1-3 and Q1-4). **Groundwater in the Blue Creek terrace deposits** The geographic area for monitoring groundwater in the Blue Creek terrace deposits includes two well clusters located down gradient of the confluence of Oyachen and Blue creeks. These monitoring locations are representative of groundwater along the reach of Blue Creek where potentially mine-affected surface water is lost to the alluvial terrace deposits (see FSP Figure Q1-3). **Surface Water in the main Mine drainages and Blue Creek** The geographic area for surface water monitoring in the main mine drainages include the Western, Central, Eastern, and Mine Drainages down gradient of the MA, and the reach of Blue Creek immediately up gradient and down gradient of the Site extending to just before the confluence with Oyachen Creek. These monitoring locations are representative of surface water convergence zones immediately down gradient of the MA, and up- and down-gradient of where the mine drainages discharge to Blue Creek (see FSP Figure Q1-1). **Sediment** For sediment, the geographic area consists of the Western, Central, Eastern, and Mine Drainages down gradient of the MA, and the reach of Blue Creek immediately up gradient and down gradient of the Site extending to the confluence with Oyachen Creek. These monitoring locations are representative of surface water convergence and sediment depositional zones immediately down gradient of the MA, and up- and down-gradient of where the mine drainages discharge to Blue Creek (see FSP Figure Q1-1). Note that evaluations performed during 2013/2014 indicate that mine-affected sediments in the Far West Drainage are confined to the uppermost reach of Whitetail Creek. Surface water and sediment sampling will not be performed in this drainage because Whitetail Creek rarely has flow and the mine affected sediments will be removed during the Early Works phase of the RA.	The post-remedy geographical boundaries for surface water, groundwater, and sediment initially will be similar to the geographical boundaries as defined during RA (see column to the left). These boundaries will be refined based on post-remedy monitoring results and in accordance with the CERCLA 5-year review process.
Temporal Boundaries	Monitoring during the RA will commence upon initiation of the RA earthwork activities. Monitoring will be discontinued when the RA is complete and post-remedy monitoring is initiated. Surface water and groundwater samples will be collected quarterly and semi-annually, respectively, as described in the FSP to account for seasonal variations. In addition, continuous measurement of indicator water-quality parameters (pH, conductivity, and temperature) will be performed at select surface water locations. Sediment sampling will be performed annually because seasonal variations are not anticipated.	Post-remedy monitoring will continue indefinitely, or until the monitoring program is revised based on the CERCLA 5-year review process.
Scale of Decision Making	The scale of decision making will be evaluated by the project team identified in QAPP Section Q2-2.0, and will consider risks posed by the exceedance, and the available technologies, costs, and feasibility to remedy the exceedance.	The scale of decision making will be evaluated by the project team identified in Section Q2-2.0, and will consider risks posed by the exceedance, and available technologies, costs, and feasibility to remedy the exceedance.
Step 5: Develop Decision Rule		
Parameter of Interest	The analytical suites for sediments and water are listed on QAPP Tables Q2-4 and Q2-5, respectively.	COCs identified in the ROD (see BODR Tables 4-2 through 4-5).
Action Level	**Surface Water** Surface water sampling locations with quantitative action levels (see QAPP Attachment Q2-E) include SW-2, SW-5, SW-6, SW-7, SW-11, SW-12, and WDAC. Action levels for all other surface water sampling locations listed on FSP Table Q1-1 are qualitative evaluation of concentration spikes and increasing concentration trends.	Cleanup levels are listed on BODR Tables 4-2 through 4-5.

BODR – Basis of Design Report
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – data quality objective
EPA – U.S. Environmental Protection Agency
FSP – Field Sampling Plan
MA – Mined Area
QAPP – Quality Assurance Project Plan
RA – Remedial Action
RD – Remedial Design
ROD – Record of Decision
Site – Midnite Mine Superfund Site
UPL – upper prediction limit

Table Q2-A-1 – Data Quality Objectives for Monitoring Surface Water, Groundwater, and Sediment During and Following Remedy Implementation
(Page 3 of 3)

DQO Step	During Remedial Action	Post Remedial Action
	Groundwater Groundwater sampling locations with quantitative action levels (see QAPP Attachment Q2-5) include GW-19, GW-35A, GW-36A, GW-50, and GW-51. Action levels for all other groundwater sampling locations listed on FSP Table Q1-1 are qualitative evaluation of concentration spikes and increasing concentration trends. **Sediment** Sediment sampling locations with quantitative action levels (see QAPP Attachment Q2-F) include SW-5, SW-7, SW-11, SW-12, and WDAC. Action levels for all other sediment sampling locations listed on FSP Table Q1-2 are qualitative evaluation of concentration spikes and increasing concentration trends	
Decision Rule	If the action level is exceeded (and confirmed) for any indicator parameter, then the Project Team (see Section Q2-2.0) will decide if Alternative Actions listed above will be evaluated and implemented immediately or if additional, regularly scheduled monitoring will be performed to confirm the data trend prior to implementing the Alternative Action (see Figure Q2-2).	If the cleanup level is exceeded for any constituent, then Alternative Actions described above will be implemented.
Step 6: Specify Tolerance Limits on Decision Errors		
Null Hypothesis	Action levels are exceeded at the sampled location.	Cleanup levels are excceded at the sampled location.
False Acceptance Error	Decide that indicator parameters exceed Action Levels down gradient of the mine area when in fact they do not. Potential consequence: Unnecessary resources are consumed for further evaluation and modifications to the engineering controls employed during the RA.	Decide that cleanup levels are not being met when in fact they are. Potential consequence: Unnecessary resources are consumed for further evaluation and RAs.
False Rejection Error	Decide that indicator parameters do not exceed Action Levels down gradient of the mine area when in fact they do. Potential Consequence: Increased risk to human health and the environment down gradient of the mine area.	Decide that cleanup levels are being met when in fact they are not. Potential Consequence: Increased risk to human health and the environment down gradient of the mine area.
Tolerable Limits on Decision Errors	Quantitative limits on decision errors (e.g., gray region and probability values) have not been established because: 1) Monitoring will be repeated at regularly scheduled intervals throughout the RA; therefore if a decision error occurs it is likely to be identified and corrected after the next sampling event (i.e., it is unlikely that two consecutive sampling events would result in a decision error). As a result, the consequence is limited because the duration of the decision error is relatively short (e.g., the duration between sampling events). 2) Total study error (the combination of sampling design error and measurement error) is minimized by preparing this QAPP in accordance with EPA guidance and by using industry-standard sampling and analysis procedures as described herein.	Quantitative limits on decision errors (e.g., gray region and probability values) have not been established because: 1) Monitoring will be repeated at regularly scheduled intervals following the RA; therefore if a decision error occurs it is likely to be identified and corrected after the next sampling event (i.e., it is unlikely that two consecutive sampling events would result in a decision error). As a result, the consequence is limited because the duration of the decision error is relatively short (e.g., the duration between sampling events). 2) Total study error (the combination of sampling design error and measurement error) is minimized by preparing this QAPP in accordance with EPA guidance and by using industry-standard sampling and analysis procedures as described herein.
Step 7: Optimize the Design for Obtaining Data	The data collection design is described in the FSP.	The post-RA data collection design (e.g., sampling locations and frequencies) will be described in an update to the FSP prior to completion of the RA.

BODR – Basis of Design Report
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – data quality objective
EPA – U.S. Environmental Protection Agency
FSP – Field Sampling Plan
MA – Mined Area
QAPP – Quality Assurance Project Plan
RA – Remedial Action
RD – Remedial Design
ROD – Record of Decision
Site – Midnite Mine Superfund Site
UPL – upper prediction limit

Table Q2-A-2 – Data Quality Objectives for Surface Water Impoundment Sampling

(Page 1 of 2)

DQO Step	Surface Water Impoundment Sampling
Step 1: State the Problem	
Problem Statement	The quality of the water stored in the surface water impoundments needs to be periodically evaluated during the RA to: • Understand the nature of potential contaminant sources to down gradient surface water and groundwater • Confirm that the stored water continues to require treatment prior to discharge • Inform operation of the Water Treatment Plant • Ensure proper health and safety procedures are employed for site workers.
Step 2: Identify the Decision	
Principle Study Questions	What are the concentrations of constituents of concern (COCs) in the water stored in the surface water impoundments during the RA?
Alternative Actions	If COC concentrations exceed surface water cleanup levels, then continue to treat water at the operating WTP. If COC concentrations do not exceed surface water cleanup levels for four consecutive quarterly sampling rounds, then water can be discharged without treatment. Alternative actions for WTP operation are at the discretion of the WTP manager. Alternative actions for health and safety procedures are at the discretion of the Company Site Safety Manager and the Company Radiation Safety Officer.
Step 3: Identify the Inputs to the Decision	
Information Required to Resolve Decision Statement	Water quality data from surface water samples.
Sources of Information	Historical operational data are available from the Interim Water Management System in operation at the start of the RA. However, the configuration of the water management system will change during the three main phases of the RA.
Planned Environmental Measurements	Quarterly sampling and analysis at all active surface water impoundments that report to the WTP.
Basis for Action Levels	Action levels are the cleanup levels established in the ROD. Other parameters that do not have established cleanup levels (e.g., pH) also will be measured to inform WTP operation and health and safety procedures.
Step 4: Define Study Boundaries	
Spatial Boundaries	The geographical study area includes all active surface water impoundments within the MA.
Temporal Boundaries	Data collection will commence upon initiation of the RA activities and continue until the RA is complete.
Scale of Decision Making	The scale of decision is limited to the water contained in the active surface water impoundments.
Step 5: Develop Decision Rule	
Parameter of Interest	COCs and other parameters listed on Table Q2-5.
Action Level	Action levels are the surface water cleanup levels listed on Table 4-3 of the BODR. Action levels for WTP operation is at the discretion of the WTP manager, and action levels for health and safety procedures are at the discretion of the Company Site Safety Manager and the Company Radiation Safety Officer.
Decision Rule	If the COC concentrations exceed cleanup levels, then continue transfer of the water to the WTP. If the COC concentrations do not exceed the cleanup levels for four consecutive quarterly sampling rounds, then water can be discharged untreated.
Step 6: Specify Tolerance Limits on Decision Errors	
Null Hypothesis	COC concentrations in the sampled water exceed surface water cleanup levels.
False Acceptance Error	Decide that COC concentrations exceed cleanup levels when in fact they do not. Potential consequence: Resources and energy are consumed to un-necessarily treat the stored water.
False Rejection Error	Decide that COC concentrations do not exceed cleanup levels when in fact they do. Potential Consequence: Increased risk to human health and the environment down gradient of where the

BODR – Basis of Design Report
COC – constituent of concern
DQO – Data Quality Objective
EPA – US Environmental Protection Agency
FSP – Field Sampling Plan
MA = Mined Area
PSO – Project Safety Officer
QAPP – Quality Assurance Project Plan
RA – Remedial Action
RAC – Remedial Action Contractor
ROD – Record of Decision
SSO – Site Safety Officer
WTP – Water Treatment Plant

Table Q2-A-2 – Data Quality Objectives for Surface Water Impoundment Sampling

(Page 2 of 2)

DQO Step	Surface Water Impoundment Sampling
	untreated water is discharged.
Tolerable Limits on Decision Errors	Quantitative limits on decision errors (e.g., gray region and probability values) have not been established because: 1) Cleanup levels will be achieved for four consecutive sampling rounds before water will be discharged without treatment. 2) Monitoring will be repeated at regularly scheduled intervals throughout the RA; therefore if a decision error occurs it is likely to be identified and corrected after the next sampling event (i.e., it is unlikely that consecutive sampling events would result in a decision error). As a result, the consequence is limited because the duration of the decision error is relatively short (e.g., the duration between sampling events). 3) Total study error (the combination of sampling design error and measurement error) is minimized by preparing this QAPP in accordance with EPA guidance and by using industry-standard sampling and analysis procedures as described herein.
Step 7: Optimize the Design for Obtaining Data	The data collection design is described in the FSP.

BODR – Basis of Design Report
COC – constituent of concern
DQO – Data Quality Objective
EPA – US Environmental Protection Agency
FSP – Field Sampling Plan
MA = Mined Area
PSO – Project Safety Officer
QAPP – Quality Assurance Project Plan
RA – Remedial Action
RAC – Remedial Action Contractor
ROD – Record of Decision
SSO – Site Safety Officer
WTP – Water Treatment Plant

Table Q2-A-3 – Data Quality Objectives for Water Balance Data

(Page 1 of 2)

DQO Step	Water Balance Data
Step 1: State the Problem	
Problem Statement	The volume of potentially mine-affected water that is captured by the water management system needs to be compared with (or balanced against) the volume of water treated at the water treatment plant (WTP) to confirm that the bulk of captured water is being treated and not otherwise lost to the down-gradient hydrologic system.
Step 2: Identify the Decision	
Principle Study Questions	Is the bulk of potentially mine-affected water that is captured during the RA activities being treated?
Alternative Actions	If the water balance indicates that significant volumes of water are being lost prior to treatment, then confirm measurements and proper O&M, investigate conditions and/or consider additional administrative/engineering controls and corrective actions to prevent loss of potentially mine-affected water. If the water balance indicates that the bulk of captured water is being treated, then continue routine O&M of the water management system.
Step 3: Identify the Inputs to the Decision	
Information Required to Resolve Decision Statement	The maximum combined storage of the active surface water impoundments during a defined period of the RA and the cumulative volume of water treated by the WTP during that same time period.
Sources of Information	Historical operational data are available from the Interim Water Management System in operation at the start of the RA. However, the configuration of the water management system will change during the three main phases of the RA.
Planned Environmental Measurements	• Weekly flow rate measurements at the seeps where water is captured and directed to the WTP. • Cumulative pumping rates where water is conveyed from the impoundments to the WTP. • Monthly water level measurements at the active surface water impoundments where water is captured and directed to the WTP. • Daily weather data (precipitation and temperature). • Cumulative pumping rates of WTP effluent.
Basis for Action Levels	Action levels are a qualitative evaluation of positive or negative water balance due to the relatively large uncertainty associated with calculating the water balance.
Step 4: Define Study Boundaries	
Spatial Boundaries	The geographical study area is the un-remediated MA where potentially mine-affected water is being captured. This area will change as the RA progresses.
Temporal Boundaries	Data collection will commence upon initiation of the RA earthwork activities and continue until the RA is complete.
Scale of Decision Making	The scale of decision making will be evaluated by the project team identified in Section Q2-2.0, and will consider risks posed by loss of potentially mine-affected, and the available technologies, costs, and feasibility to capture and treat the lost water.
Step 5: Develop Decision Rule	
Parameter of Interest	Data inputs used to calculate the water balance.
Action Level	Positive water balance, which would indicate that more water is being captured than is being treated.
Decision Rule	If the combined volume of captured and stored water is greater than the volume of water treated by the WTP over a defined period (accounting for water that remains in storage pending treatment), then the Project Team (see Section Q2-2.0) will decide if the Alternative Actions listed above will be evaluated and implemented.
Step 6: Specify Tolerance Limits on Decision Errors	

DQO – Data Quality Objective
FSP – Field Sampling Plan
O&M – operation and maintenance
RA – Remedial Action
WTP – water treatment plant

Table Q2-A-3 – Data Quality Objectives for Water Balance Data

(Page 2 of 2)

DQO Step	Water Balance Data
Null Hypothesis	Water balance calculations indicate that potentially mine-affected water is being lost without being treated.
False Acceptance Error	Decide that mine-affected water is being lost without treatment when in fact it is not. Potential consequence: Unnecessary resources are consumed for further evaluation and modifications to the water management system.
False Rejection Error	Decide that mine-affected water is being captured and treated when in fact it is not. Potential Consequence: Release of untreated water.
Tolerable Limits on Decision Errors	Quantitative limits on decision errors are set at ±25% due to the large degree of measurement error associated with flow meters, and stage-to-surface-area volume relationships in water bodies.
Step 7: Optimize the Design for Obtaining Data	The data collection design is described in the FSP.

DQO – Data Quality Objective
FSP – Field Sampling Plan
O&M – operation and maintenance
RA – Remedial Action
WTP – water treatment plant

Table Q2-A-4 - Data Quality Objectives for Alluvial Groundwater Controls and Hydraulic Containment Water Level Monitoring
(Page 1 of 3)

DQO Step	Water Level Monitoring to Confirm Alluvial Groundwater Controls are Restricting Flow of Mine-Affected Groundwater	Water Level Monitoring to Confirm Hydraulic Containment in the Waste Containment Areas and Backfilled Pit Area
Step 1: State the Problem		
Problem Statement	The performance of the alluvial groundwater controls (intercept trenches and low-permeability barrier walls) installed during the RA in the Western, Central, and Far East Seep drainages needs to be periodically evaluated.	The performance of the dewatering activities in the backfilled and consolidated wastes needs to be periodically evaluated in the: 1) Pit 4 waste containment area (WCA) 2) Pit 3 WCA 3) Backfilled Pits Area (BPA).
Step 2: Identify the Decision		
Principle Study Questions	Do water levels in the monitoring wells located up- and down-gradient of the groundwater controls indicate that the groundwater controls are functioning as designed (i.e., intercepting potentially mine-affected water in the alluvium and shallow weathered bedrock)?	Are the operating water levels in the dewatering wells (or nearby redundant wells) within the established operating ranges? Is drawdown occurring in the nearby redundant well (in Pits 3 and Pit 4) or observation wells (in the BPA) indicating that dewatering is occurring away from the pumping well?
Alternative Actions	If water levels indicate that the groundwater controls are restricting groundwater flow as designed, then no action is required and monitoring should continue as scheduled in the FSP. If water levels indicate that the groundwater controls are not restricting groundwater flow as designed, then review O&M records to confirm sufficient extraction rates are being maintained and evaluate ways to optimize the system (e.g., clean fouled extraction piping, increase extraction rates).	If operating water levels are within the established operating ranges (and sufficient drawdown is observed in the redundant or observation wells), then no further action is required and monitoring should continue as scheduled in the FSP. If operating water levels are outside of the design ranges (or sufficient drawdown is not observed in the redundant or observation wells), then response actions should occur which could include: • Increase pumping rate (if operating water levels are too high) • Decrease pumping rate (if operating water levels are too low) • Perform well maintenance to correct fouling and improve well efficiency.
Step 3: Identify the Inputs to the Decision		
Information Required to Resolve Decision Statement	Required information includes monthly water levels in the wells located up- and down-gradient of the groundwater controls. These water-level data will be used to determine if the groundwater controls are preventing potentially impacted alluvial groundwater from migrating past the extraction trench/low-permeability barrier.	Required information includes continuous water-level data from transducers installed in the dewatering and redundant/observation wells.
Sources of Information	Water level data in the wells located up- and down-gradient of the groundwater controls will be evaluated monthly. (The DQOs for collecting water quality data are included on Table Q2-A-1.)	Operating water levels in the pumping wells were determined in the Remedial Design and will be revised based on as-built well construction details and dewatering activities performed during RA construction. Target drawdown levels in the redundant wells in the WCA sumps will be determined during RA construction by observing the effect that pumping has on water levels in the redundant wells after they are constructed and operated for a period of time. Target drawdown levels in the BPA observation wells were determined in the remedial design (based on long-term pump testing).

amsl – above mean seal level
BPA - Backfilled Pits Area
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – Data Quality Objective
FSP – Field Sampling Plan
ft - feet
O&M – Operation and Maintenance
QAPP = Quality Assurance Project Plan
RA – Remedial Action
TBD – to be determined
WCA – Waste Containment Area

Table Q2-A-4 - Data Quality Objectives for Alluvial Groundwater Controls and Hydraulic Containment Water Level Monitoring
(Page 2 of 3)

DQO Step	Water Level Monitoring to Confirm Alluvial Groundwater Controls are Restricting Flow of Mine-Affected Groundwater	Water Level Monitoring to Confirm Hydraulic Containment in the Waste Containment Areas and Backfilled Pit Area
Planned Environmental Measurements	Water level measurements in the wells listed on FSP Table Q1-3.	Water level measurements in the wells listed on FSP Table Q1-3.
Basis for Action Levels	Action levels are based comparing water levels in the wells closer to the extraction trench and barrier wall with water levels in the wells located further away.	Action levels are based on maintaining water levels that are low enough to provide adequate drawdown in the WCA sumps or BPA, and are high enough to avoid exposing the screened interval in the well to air (which would promote fouling). However, it is anticipated that the Pit 3 and Pit 4 waste rock sumps may be dry after the cover system is constructed.
Step 4: Define Study Boundaries		
Spatial Boundaries	The geographical study areas are the areas between the monitoring wells located up- and down-gradient of the groundwater controls.	The geographical study areas are the locations of the dewatering wells and observation wells.
Temporal Boundaries	Water-level monitoring during the RA will commence upon initiation of the RA earthwork activities. Post-remedy monitoring will continue indefinitely, or until the monitoring program is revised based on the CERCLA 5-year review process.	Water level monitoring in the dewatering wells and observation wells will commence when the dewatering activities begin during the RA, and will continue for as long as the dewatering wells are operational.
Scale of Decision Making	The scale of decision making will be evaluated by the project team identified in QAPP Section Q2-2.0, and will consider risks posed by poor performance of the groundwater controls, and available technologies, costs, and feasibility to remedy the performance of the groundwater controls.	The scale of decision making will be evaluated by the project team identified in QAPP Section Q2-2.0, and will consider risks posed by water levels that are outside of the design ranges, and the available technologies, costs, and feasibility to optimize the dewatering activities.
Step 5: Develop Decision Rule		
Parameter of Interest	Water levels in the wells located up- and down-gradient of the groundwater controls: **Far East Seep Drainage**: MWFESD-14-01, MWFESD-14-02, MWFESD-14-03, MWFESD-14-04 **Western Drainage**: MWWD-14-01, MWWD-14-02, MWWD-14-03, MWWD-14-04 **Central Drainage**: MWCD-14-01, MWCD-14-02, MWCD-14-03, and GW-36a	Water levels in: • Pit 4 underdrain dewatering well and redundant well • Pit 4 waste rock dewatering well and redundant well • Pit 3 underdrain dewatering well and redundant well • Pit 3 waste rock dewatering well and redundant well • BPA dewatering well (GW-54) and observation wells (GW-58, BOM-89-2S, BOM-89-2D, GW-53, GW-56, and GW-57).
Action Level	Action levels are the qualitative comparison of water levels in the wells listed above. The action level is triggered if water levels indicate that groundwater extraction is not depressing the piezometric surface immediately up- and down- gradient of the extraction trench and barrier wall.	Action levels are water levels that are outside of the operating ranges defined in the Remedial Design or target drawdown levels established during RA construction (i.e., in the WCA redundant wells). Water levels that are too low would indicate that the well screens might be exposed to air, which could promote fouling; or that the well is fouled causing the well to be inefficient (large drawdown in well casing but not adjacent to the well). Water levels that are too high would indicate that the desired dewatering of the wastes or underdrain materials is not occurring. Operating Water Elevation Ranges: Pit 4 underdrain dewatering well: 2960 to 2967 ft amsl*. Pit 4 underdrain redundant well: TBD based on dewatering activities performed

amsl – above mean seal level
BPA - Backfilled Pits Area
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – Data Quality Objective
FSP – Field Sampling Plan
ft - feet
O&M – Operation and Maintenance
QAPP = Quality Assurance Project Plan
RA – Remedial Action
TBD – to be determined
WCA – Waste Containment Area

Table Q2-A-4 - Data Quality Objectives for Alluvial Groundwater Controls and Hydraulic Containment Water Level Monitoring
(Page 3 of 3)

DQO Step	Water Level Monitoring to Confirm Alluvial Groundwater Controls are Restricting Flow of Mine-Affected Groundwater	Water Level Monitoring to Confirm Hydraulic Containment in the Waste Containment Areas and Backfilled Pit Area
		during RA construction. Pit 4 waste rock dewatering well: 2999 to 3004 ft amsl*. Pit 4 waste rock redundant well: TBD based on dewatering activities performed during RA construction. Pit 3 underdrain dewatering well: 2516 to 2523 ft amsl*. Pit 3 underdrain redundant well: TBD based on dewatering activities performed during RA construction. Pit 3 waste rock dewatering well: 2544 to 2549 ft amsl*. Pit 3 waste rock redundant well: TBD based on dewatering activities performed during RA construction. BPA dewatering well GW-54: 2660 to 2665 ft amsl*. * Elevations will be established or revised based on as-built surveys and dewatering activities performed during RA construction.
Decision Rule	If water levels indicate that the groundwater controls are not functioning as designed, then review O&M records to confirm sufficient extraction rates are being maintained and evaluate ways to optimize the system (e.g., clean fouled extraction piping, design and implement additional controls).	If water levels are too low, decrease pumping rates until water levels are within the designed operating ranges. When water levels are back in the operating ranges, review water levels in the redundant or observation wells to confirm dewatering is occurring away from the pumping well. If water levels are too high, increase pumping rates until water levels are within the designed operating ranges. When water levels are back in the operating ranges, review water levels in the redundant or observation wells to confirm dewatering is occurring away from the pumping well.
Step 6: Specify Tolerance Limits on Decision Errors		
Null Hypothesis	Groundwater controls are not preventing migration of potentially mine-affected water.	Out of range water levels are caused by fouled well screen (poor well efficiency).
False Acceptance Error	Decide that groundwater controls are not preventing migration of potentially mine-affected water when in fact it is. Potential consequence: Unnecessary resources are consumed for further evaluation and optimizations to the groundwater controls.	Decide that desired dewatering away from the pumping well is not occurring when in fact it is. Potential consequence: Unnecessary resources are consumed to rehabilitate wells that are not fouled.
False Rejection Error	Decide that groundwater controls are preventing migration of potentially mine-affected water when in fact it is not. Potential consequence: Increased risk that potentially mine-affected groundwater is migrating down gradient through the alluvium.	Decide that desired dewatering away from the pumping well is occurring when in fact it is not (e.g., because well fouling is affecting well efficiency). Potential consequence: Backfilled or consolidated wastes are not being dewatered.
Tolerable Limits on Decision Errors	Quantitative limits on decision errors (e.g., gray region and probability values) are considered unnecessary for water level measurements because they are easily obtained and reproduced.	Quantitative limits on decision errors (e.g., gray region and probability values) are considered unnecessary for water level measurements because they are easily obtained and reproduced.
Step 7: Optimize the Design for Obtaining Data	The data collection design is described in the FSP.	The data collection design is described in the FSP.

amsl – above mean seal level
BPA - Backfilled Pits Area
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC – constituent of concern
DQO – Data Quality Objective
FSP – Field Sampling Plan
ft - feet
O&M – Operation and Maintenance
QAPP = Quality Assurance Project Plan
RA – Remedial Action
TBD – to be determined
WCA – Waste Containment Area

Attachment Q2-B

Standard Operating Procedures

Document	Title or Description	Revision
SMP-SOP1	GROUNDWATER SAMPLING	0
SMP-SOP2	SURFACE WATER SAMPLING	0
SMP-SOP3	SEDIMENT SAMPLING	0
SMP-SOP4	GROUNDWATER LEVEL MEASUREMENT	0
SMP-SOP5	DECONTAMINATION OF ENVIRONMENTAL SAMPLING EQUIPMENT	0

SOPs will be added or revised as necessary during and following the Remedial Action.

Table of Contents

1. PURPOSE....3
2. RESPONSIBILITY....3
3. PRECAUTIONS....3
4. EQUIPMENT AND MATERIALS....4
5. PROCEDURE....4
6. RECORDS....10
7. REFERENCES....11
8. ATTACHMENTS....11

1. PURPOSE

Groundwater samples are collected from monitoring wells and analyzed to determine the presence of possible contamination. This operating procedure prescribes the methods for groundwater sample collection and describes the equipment and field procedures to be employed when collecting groundwater samples. Sample handling, labeling, documentation, preservation, shipping and analysis and the quality assurance/quality control QA/QC protocols are addressed in the *Midnite Mine Superfund Site – Site Wide Monitoring Quality Assurance Project Plan* (QAPP). Decontamination of sampling equipment is addressed in SMP-SOP5. The sampling locations and rationale are included in the *Midnite Mine Superfund Site – Site Wide Monitoring Filed Sampling Plan (FSP).*

2. RESPONSIBILITY

The individuals who will be involved and the tasks for which they are responsible are discussed in the QAPP.

3. PRECAUTIONS

3.1. The order of well sampling will be determined by the sampling team based on field conditions, site access, equipment availability, and the most efficient use the sampling team resources and time. All wells will be sampled with dedicated pumps, disposable bailers, and/or decontaminated equipment. Equipment rinsate samples will document the effectiveness of decontamination so sample collection order will not bias sample data. Efforts will be made to sample in a sequence from wells with the lowest historic contaminant concentrations to wells with the highest historic contaminant levels.

3.2. All sample bottles shall be inspected for cleanliness and flaws prior to use. Sample bottles shall not be reused, nor shall they be used if there is any question as to their origin or whether or not they are new. Only those bottle types and preservatives specified in the QAPP shall be used. For samples where preservatives are required, pre-preserved bottles will be provided by the laboratory. When filling pre-preserved bottles, care shall be taken to follow all laboratory instructions provided with the sample set. These include the use of nitrile gloves during sampling, taking care not to overfill the sample bottles, and being aware of the potential for fumes emanating from the pre-preserved sample bottle, particularly during warm weather conditions.

3.3. Hands should be cleaned immediately prior to sample collection and nitrile gloves worn to ensure that samples are not contaminated. Small amounts of foreign material (i.e. dirt, grease, etc.) can contaminate an entire batch of samples.

3.4. Sample collection equipment shall be decontaminated in accordance with SMP-SOP05. Decontamination supplies will be provided such that sampling equipment can be decontaminated in the field.

4. EQUIPMENT AND MATERIALS

The following equipment is required for sampling:

- Sample bottles and preservatives as required by the QAPP
- Collection containers (e.g. plastic or stainless steel buckets, beakers, or extra sample bottles)
- Electronic water level measuring device or measurement tapes
- Portable pH, conductivity, and temperature meters and appropriate calibration solutions
- Electronic equipment operating manuals
- Plastic squeeze bottle with deionized or distilled water
- Kimwipes or equivalent
- Decontamination equipment and supplies (see SMP-SOP5)
- Filtering equipment as required (peristaltic pump, silicon tubing, inline 0.45 micron disposable cartridge filter)
- Ice chests and ice for transport of samples to the laboratory
- Portable Sample pump (currently a Moyno Pump)
- Generator
- PVC, Teflon™, or stainless steel bailers
- Nylon or polypropylene rope or twine
- Clear glass or polyethylene beakers
- Flow measurement equipment as needed (flow meter, calibrated bucket, and stop watch)
- Calculator
- Disposable nitrile gloves
- Personal Protective Equipment as required by the *Midnite Mine Superfund Site Remedial Action Health and Safety Plan* and relevant JSAs.

The following forms and supplies will be available as necessary prior to the start of sampling:

- Calibration Data Sheet (Attachment 1-1)
- Groundwater Sampling Data Sheet (Attachment 1-2)
- Chain-of-Custody forms
- Field log book
- Field Sampling Plan (FSP), QAPP, SMP-SOP5 (Decontamination), and SMP-SOP1 Ground Water Sampling)

5. PROCEDURE

5.1. Decontaminate Equipment

5.1.1. Before any evacuation of water (removal of a specified volume of water from the well prior to sampling) or before sampling begins, all non-dedicated equipment, measurement devices, and sampling devices that will come into contact with the groundwater shall be decontaminated, as described in SMP-SOP5. Single use disposable sampling equipment such as inline filters and tubing are not decontaminated but rinsed with sample water before use.

5.1.2. Dedicated sampling pumps and hoses that are left in the well between sampling events will not be decontaminated.

5.2. Instrument Calibration

5.2.1. Electronic equipment used during sampling and requiring calibration includes a pH meter (that is accurate to 0.1 pH unit) with temperature readout, and a conductivity meter with temperature correction to 25º C.

5.2.2. Before going into the field, the sampling technician shall verify that the electronic equipment is operating properly.

5.2.3. The pH and conductivity meters require calibration at least every day prior to use. Calibration time and readings will be recorded on a Calibration Data Sheet (Attachment 1-1) or in a notebook by the sampling technician. Calibration standards shall bracket the range of measurement values. Calibration check value(s) shall be measured and recorded after the daily calibration and at the end of the day to demonstrate validity of measurements. Calibration of hand-held electronic monitoring devices will be spot-checked if the operator observes unexpected or unusual results during sampling. The equipment will be re-calibrated if the calibration spot check reveals that the meter is out of range.

5.2.4. Specific instruments utilized may change during a sampling event or between sampling events due to breakdown or equipment availability. Specific instructions for calibrating each instrument will be provided in the manuals for each separate instrument. Hach sensION2 pH meter and Hach sensION5 conductivity meter are examples of meters that may be used to measure water field parameters.

5.3. Pre-sampling Inspection

5.3.1. Inspect the well cap and standpipe to ensure that it has not been tampered with or damaged.

5.3.2. Remove the locking and protective cap (if equipped).

5.3.3. Note on the Groundwater Data Sheet (Attachment 1-2) or in the field log book any unusual conditions.

5.4. Water Level Measurement

5.4.1. Decontaminate the water level meter by rinsing the probe and the length of measuring tape that will come into contact with the groundwater with deionized water.

5.4.2. The water level meter should be adjusted to the appropriate sensitivity so that the meter indicates when it comes into contact with the groundwater but such that condensation on the water level tape does not produce false indications. Typically the measurement point is a notch or a mark on the well with an indelible marker; this is the point from which the depth to water

should be measured. If no such measurement point is present, use the north rim of the well casing and note in the field book the location of the measurement point based on direction or other distinguishing features.

5.4.3. Lower the water level meter into the level standpipe, or into the well if no standpipe is available, until water is detected (positive indication on the meter). Measure (to the nearest 0.01 foot) the depth to static water (DTW) in the well from the top of the well casing (measurement point). Record the DTW in the field log book or Groundwater Data Sheet (Attachment 1-2). The well construction details, including the depth to bottom (DTB) of the well, are presented in summary tables contained in the FSP. If the DTB is measured, the water level meter could become entangled with the dedicated pump and increases the amount of cable that will have to be decontaminated. The DTB will be measured if there reason to suspect well damage such as a significant increase in turbidity during evacuation.

5.4.3.1. Calculate Casing Volume (CV) as follows:

$$CV = (\pi)(r^2)(h)(7.48)$$

7.48 = gallons per ft^3
pi = 3.14
r = casing radius (in feet)
h = DTB - DTW (in feet)
CV = gallons

5.4.3.2. Note that casing radius (r) and DTB-DTW (h) are both measured in feet.

5.4.3.3. Record these calculations in the field log book or Groundwater Data Sheet (Attachment 1-2). The casing volume will be calculated prior to purging the well. Previous casing volume calculations will be reviewed by the samplers prior to purging a well.

5.5. Well Casing Evacuation

5.5.1. Well casing evacuation will utilize dedicated submersible pumps, a Moyno positive displacement pump or other suitable pump with dedicated tubing, or bailers. If non-dedicated equipment is used for evacuation either disposable or decontaminated equipment will be used. If a non-dedicated pump is used the pump intake or end of tubing will be placed as close as possible to the midpoint of the screened interval of the well.

5.5.2. Prior to sampling, evacuate at least 3 casing volumes (CV's) of groundwater from the monitoring well using either bailer or pump. The purpose of this procedure is to allow retrieval of groundwater that is representative of formation water rather than water that has been stagnant in the well. Record the initial conductivity and pH readings on the Groundwater Data Sheet (Attachment 1-2) or log book, and take and record on the field form the incremental stabilization readings at least

after every one-half CV removed. Purge volumes will be measured with a totalizing flow meter or a calibrated bucket and stop watch.

5.5.3. Pumping rates should be adjusted as practicable to minimize turbulent flow from the aquifer into the well. The flow-rate is left to the judgment of the sampling technician. Suspended particles (sand) in the bucket could indicate excessive turbulence in the well and should be used to assess the appropriateness of the flow rate. Every effort should be made to adjust the pumping rate to prevent the well from going dry as a result of aggressive pumping.

5.5.4. A sample can be collected after conductivity and pH have stabilized indicated by three subsequent measurements that are within +\- 10 percent for conductivity and temperature and 0.2 pH units for pH and three CVs have been evacuated. Stabilization parameters and calculations will be recorded on the Groundwater Data Sheet (Attachment 1-2).

5.5.5. If the well has been pumped dry and does not recharge sufficiently to continue evacuation, allow the well to recover until there is sufficient volume to collect a sample. Stabilization of parameters and CVs do not apply in this case. Record on the Groundwater Data Sheet (Attachment 1-2) the stabilization parameters at the time of sampling and volume of water purged prior to the well going dry.

5.5.6. Record the final conductivity, pH, temperature, and volume of water purged on the Groundwater Data Sheet (Attachment 1-2)

5.6. Sample Collection

5.6.1. Samples will be collected by capturing an adequate volume of water in a clean decontaminated collection container directly from the pump discharge (or bailer) or by filling the sample bottles directly. Sampling containers and/or bottles shall be rinsed three times with sample water before filling. Pre-preserved bottles will not be rinsed. The estimated sample volume required to rinse, fill sample bottles, and measure field parameters is approximately 1.5 gallons.

5.6.2. Samples requiring dissolved analyte concentration analysis will be filtered as specified in Section 5.9.

5.7. Conductivity Measurement

5.7.1. Verify that the conductivity meter is properly calibrated per the manufacturer's instructions and the calibration data recorded on the Calibration Data Sheet (Attachment 1-1).

5.7.2. Fill the sampling container (a clear glass beaker, polyethylene container or other appropriate container) with an aliquot of the sample water.

5.7.3. Rinse the probe with deionized (DI) water and sample water and then shake off excess water. Insert the probe into the aliquot of the sample water.

5.7.4. Turn the selection switch on the conductivity meter to the appropriate scale (if not automatic). Record the conductivity in the field log book or Groundwater Data Sheet (Attachment 1-2). Turn off the meter, remove the probe from the sample, and rinse the probe with DI water and store as specified by the manufacturer.

5.8. pH and Temperature Measurement

5.8.1. Verify that the pH meter is properly calibrated per the manufacturer's instructions and the calibration data recorded on the Calibration Data Sheet (Attachment 1-1).

5.8.2. Fill the sampling container (a clear glass beaker, polyethylene container or other appropriate container) with an aliquot of the sample water.

5.8.3. Rinse the pH probe with DI water and sample water and shake off excess water. Insert the probe into an aliquot taken from the sample container.

5.8.4. Turn on the pH meter. Allow the reading to stabilize and record the pH and temperature in the field log book or sample collection log sheet.

5.8.5. Rinse the pH probe in DI water and store as specified by the manufacturer.

5.9. Sample Filtration

Samples which require dissolved analyte concentration analysis shall be filtered at the time of sample collection in accordance with the following method:

5.9.1. Filtering with electric well pumps

5.9.1.1. Samples will be filtered using the electric pump an inline filter, and the bottles filled directly.

5.9.1.2. Attach new unused silicon tubing to the electric submersible pump or Moyno Pump discharge (if required) and install a new inline 0.45 micron disposable cartridge filter.

5.9.1.3. Purge approximately 100 ml of sample through the tubing and filter before sample collection.

5.9.1.4. Rinse the sample bottle with filtered sample water three times. Pre-preserved sample containers shall not be rinsed.

5.9.1.5. Fill the sample container with the filtered sample water and preserve as specified in the QAPP.

5.9.2. Filtering with peristaltic pump

5.9.2.1 The sample will be collected in an intermediate collection container (plastic or stainless steel bucket, beaker, or sample bottle) and filtered using a peristaltic pump, silicon tubing, and an inline filter.

5.9.2.2 Attach new unused silicon tubing to the peristaltic pump and install a new inline 0.45 micron disposable cartridge filter.

5.9.2.3 Purge approximately 100 ml of sample through the tubing and filter before sample collection.

5.9.2.4 Rinse the sample bottle with filtered sample water three times. Pre-preserved sample containers shall not be rinsed.

5.9.2.5. Fill the sample container with the filtered sample water and preserve as specified in the QAPP.

5.10. Sample Preparation

Samples should be labeled immediately after (or before) sampling in accordance with the QAPP.

5.10.1 Following sampling, sample bottles that require cooling for preservation shall be stored in an iced cooler (as directed in the QAPP). Coolers should be kept out of the sun, in a relatively cool place during the time the cooler remains in the field. Samples may be stored in a refrigerator or iced cooler until they are shipped to the lab for analysis.

5.10.2 Dedicated pumps and/or tubing shall be left in the well, and wells shall be resealed and locked after sampling.

5.10.3 Samples shall be shipped in accordance with the QAPP.

5.11 Quality Assurance/Quality Control

5.11.1 QA/QC samples will be collected during groundwater sampling as specified in the QAPP. QA/QC samples are collected to help identify potential sources of sample contamination and evaluate potential error introduced during sample collection, handling, and analysis. All QA/QC samples are labeled with QA/QC identification number identified in the QAPP and sent to the laboratory with the other samples for analyses.

5.11.2 A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical techniques. For groundwater samples, a duplicate sample will be collected by alternately filling the primary sample bottle and then the duplicate sample bottle. Different filters will be used for the primary

sample and the duplicate sample. A minimum of one field duplicate will be submitted per 20 samples as specified in the QAPP.

5.11.3 An equipment blank consists of analyte-free reagent water (distilled or deionized water) poured through the sampling device, collected in a clean sampling bottle and preserved as specified I the QAPP. Equipment blanks may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide for representative samples. Equipment blanks are analyzed for the same suite of analytical parameters as the associated samples. Equipment blanks will be collected at a minimum frequency of one per 20 samples as specified in the QAPP.

5.11.4 Sample containers and preservatives are specified in the QAPP - Sample Handling, Documentation, and Analysis.

6. RECORDS

All records and documentation associated with sample collection, including the Groundwater Sampling Data Sheets, Calibration Data Sheet, and field log books shall be maintained in accordance with the Midnite Mine Water Treatment Plant Quality Assurance Project Plan. All information pertinent to field sampling must be recorded in either a field log book, Groundwater Sampling Data Sheet, or Calibration Data Sheet regardless of the type of sample.

6.1. Minimum Field Data

The field log book, Groundwater Sampling Data Sheet, or Calibration Data Sheet shall contain, at a minimum, the following information:

- The sample identification number
- Location of sampling (well name)
- Name of sampling technician
- Depth to water
- Date and time of sampling
- Field analysis results (pH, cond., temp, etc…)
- Method of sampling
- Weather conditions

6.1.1. Field Observations

Sampling situations vary widely, so no general rule can be given for the amount of information required. The best guideline is to record sufficient information necessary on the Groundwater Sampling Data Sheet (Attachment 1-2) or in the field log book, so that the sampling event could be reconstructed if necessary without relying on the sampling technician's memory. The completed field log book(s) shall be maintained and filed chronologically.

6.2. The field log book should be a bound book, preferably with consecutively numbered pages.

6.3 Calibration Data Sheet

An example Calibration Data Sheet is included in this SMP-SOP as Attachment 1-1.

6.4 Groundwater Sampling Data Sheet

An example Groundwater Sampling Data Sheet is included in this SMP-SOP as Attachment 1-2. A separate Groundwater Data Sheet should be completed for each site. Once completed the Groundwater Data Sheet shall be maintained in accordance with the quality assurance plan.

7. REFERENCES

7.1. *Midnite Mine Superfund Site – Site Wide Monitoring Quality Assurance Project Plan* (QAPP).

7.2 *Midnite Mine Superfund Site – Site Wide Monitoring Filed Sampling Plan* (FSP)

7.3 MM-SMP-SOP5 Decontamination of Environmental Sampling Equipment

7.4 *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*

8. ATTACHMENTS

8.1. Attachment 1-1 – Calibration Data Sheet

Attachment 1-2 - Groundwater Sampling Data Sheet

ATTACHMENT 1-1

CALIBRATION DATA SHEET

DATE: _____ **TIME:** _____

CALIBRATION PERFORMED BY: _____

pH Meter Number: _____

Buffer: _____ Measured Value: _____ Temp.: _____°C

Buffer: _____ Measured Value: _____ Temp.: _____°C

Buffer: _____ Measured Value: _____ Temp.: _____°C

Calibration check after calibration

Buffer: _____ Measured Value: _____ Temp.: _____°C

Calibration check at end of day **Time:** _____

Buffer: _____ Measured Value: _____ Temp.: _____°C

Conductivity Meter Number:_____

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Calibration check after calibration

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Calibration check at end of day **Time:** _____

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Notes: _____

_____

Signature: _____

ATTACHMENT 1-2

GROUNDWATER SAMPLING DATA SHEET

IDENTIFICATION

Sample Location_____ _____Page___of_____

Date _____ Start Time _____ Stop time_____

Sample Control Number_____ Samplers _____

WEATHER CONDITIONS

Ambient Air Temperature: _____ °C☐ °F☐ Not Measured ☐ **Wind**: Heavy ☐ Moderate ☐ Light ☐

Precipitation: None ☐ Rain ☐ Snow ☐ Heavy ☐ Moderate ☐ Light ☐ Sunny ☐ Partly Cloudy ☐

INITIAL WELL MEASUREMENTS (Measurements in feet made from top of well casing)

Static Water Level_____ Total Depth_____ Well Casing ID_____ Casing Volume_____ 3X Casing Volume _____

Well purged with: _____

_____

_____

FIELD PARAMETER MEASUREMENTS DURING PURGING

Time	Volume (gallons)	pH	Cond. (µS/cm)	Temp. °C☐ °F☐	Turbidity Visual Est. ☐ Measured☐	Comments

Was a duplicate sample collected (02) ☐ Yes ☐ No Sample Control No._____

Was a rinsate sample collected (04) ☐ Yes ☐ No Sample Control No._____

FINAL SAMPLE PARAMETERS

Sample Date	Sample Time	Discharge cfs☐ gpm☐	pH	Cond. (µS/cm)	Temp. (°C)	Turbidity Visual Est. ☐☐ Measured☐

Notes:_____

_____

_____

_____

Sampler's Signature _____

MIDNITE MINE – SITE WIDE MONITORING PLAN STANDARD OPERATING PROCEDURES	**SMP-SOP2** **REVISION: 0**
SURFACE WATER SAMPLING	**PAGE: 1 of 15** **DATE: April 14, 2014**

Table of Contents

1. PURPOSE....3
2. RESPONSIBILITY....3
3. PRECAUTIONS....3
4. EQUIPMENT AND MATERIALS....4
5. PROCEDURE....5
6. RECORDS....10
7. REFERENCES....11
8. ATTACHMENTS....11

1. PURPOSE

This procedure provides guidance regarding the collection of surface water samples at the Midnite Mine sites and describes the equipment and field procedures to be employed when collecting surface water samples. Sample handling, labeling, documentation, preservation, shipping and analysis and the quality assurance/quality control QA/QC protocols are addressed in the *Midnite Mine Superfund Site - Site Wide Monitoring Quality Assurance Project Plan* (QAPP). Decontamination of sampling equipment is addressed in MM-SMP-SOP5. The sampling locations and rationale are included in the *Midnite Mine Superfund Site – Site Wide Monitoring Filed Sampling Plan (FSP).*

2. RESPONSIBILITY

The individuals who will be involved and the tasks for which they are responsible are discussed in the QAPP.

3. PRECAUTIONS

3.1. Hands should be cleaned immediately prior to sample collection and latex or nitrile gloves worn to ensure that samples are not contaminated. Small amounts of foreign material (i.e. dirt, grease, etc.) can contaminate an entire batch of samples.

3.2. The sampling schedule should be checked prior to sampling to ensure that all required samples are collected.

3.3. Sample collection equipment shall be decontaminated in accordance with SMP-SOP5. Decontamination supplies will be provided such that sampling equipment can be decontaminated in the field.

3.4. Sample collection shall be conducted in the order of downstream to upstream on the same stream. For samples not collected on the same stream, the order of surface water sampling will be determined by the sampling team based on field conditions, site access, equipment availability, and the most efficient use of the sampling team resources and time.

3.5. If flow from a cross section of a stream is measured, surface water samples should be collected from the same cross section of the stream, being careful not to disturb bottom sediments and/or collecting floating materials. Sampling should be performed prior to determining flow measurements.

3.6. Attempts may be made to break through ice in the event that a sampling location is covered with ice. If the ice cannot be broken, no surface water sample will be collected at that time and this will be documented on the Surface Water Sampling Data Sheet (Attachment 2-1). An attempt shall be made to sample the location within the required sampling time period. In the event that the ice can be broken, the following criteria must be satisfied in order to obtain a surface water sample:

- Collection of the surface water sample will not place sampling personnel in any danger.
- Surface water located beneath the ice is not stagnant.
- Broken and residual ice is removed via surface water flowing beneath the ice.
- Sufficient water is available to collect the surface water sample.

4. EQUIPMENT AND MATERIALS

The following Personnel and Sampling Equipment should be available as necessary prior to the start of sampling:

- Sample bottles and preservative as required by the laboratory (see QAPP)
- Collection containers (e.g. plastic or stainless steel buckets, beakers, or extra sample bottles)
- pH/temperature/conductivity meters and appropriate calibration solutions
- Electronic equipment operating manuals
- Plastic squeeze bottle with deionized or distilled water
- Kimwipes or equivalent
- Coolers and ice packs
- Decontamination equipment and supplies (see SMP-SOP5)
- Filtering and sample collection equipment as required (peristaltic pump, silicon tubing, inline 0.45 micron disposable canister filter)
- Tools to break ice (e.g., sledge hammer, pry bar, ice chipper, and/or pick axe)
- Cutthroat flume with assorted throat widths (if needed), bubble level
- Shovel
- Volumetric flow measurement equipment (calibrated containers of various sizes and stop watch)
- PVC pipe for flow measurement (if needed)
- Clear glass or polyethylene beakers
- Cup/pole sampler
- 2 liter glass bottle and 14 foot PVC pipe/pole
- Boat, oars or electric trolling motor, floatation device as appropriate
- Disposable latex or nitrile gloves
- Personal Protective Equipment as required by the *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*, relevant JSAs, and other.

The following forms and supplies will be available as necessary prior to the start of sampling:

- Surface Water Sampling Data Sheet (Attachment 2-1)
- Calibration Data Sheet (Attachment 2-2)
- Chain-of-Custody forms
- Field log book
- FSP, QAPP, SMP-SOP5 (Decontamination), and SMP-SOP2 (Surface Water Sampling)

5. PROCEDURE

5.1. Decontaminate Equipment

5.1.1. Before sampling of water or before sampling begins, all non-disposable equipment, shall be decontaminated prior to sample collection as described in SMP-SOP5. Single use disposable sampling equipment such as inline filters and tubing are not decontaminated but rinsed with sample water before use.

5.2. Instrument Calibration

5.2.1. Electronic equipment used during sampling includes a pH meter (that is accurate to 0.1 pH unit) with temperature readout and a conductivity meter with temperature correction to 25º C.

5.2.2. Before going into the field, the sampling technician shall verify that the electronic equipment is operating properly.

5.2.3. The pH and conductivity meters require calibration at least every day prior to use. Calibration time and readings will be recorded on a Calibration Data Sheet (Attachment 2-2) or in a notebook by the sampling technician. Calibration standards shall bracket the range of measurement values. Calibration check value(s) shall be measured and recorded after the daily calibration and at the end of the day to demonstrate validity of measurements. Calibration of hand-held electronic monitoring devices will be spot-checked if the operator observes unexpected or unusual results during sampling. The equipment will be re-calibrated if the calibration spot check reveals that the meter is out of range.

5.2.4. Specific instruments utilized may change during a sampling event or between sampling events due to breakdown or equipment availability. Specific instructions for calibrating each instrument will be provided in the instrument manual. Hach sensION2 pH meter and Hach sensION5 conductivity meter are examples of meters that may be used to measure water field parameters.

5.3. Pre Sample Inspection

5.3.1. Prior to each water sample collected, an inspection of the water source shall be made that includes abnormal colors, odors or other unusual condition. Record any abnormalities in the field log book or on the Surface Water Sampling Data Sheet. Sample locations will be marked in the field with stakes and flagging or described in sufficient detail so that they are easily located.

5.4. Flow or Level Measurement

5.4.1. A flow or level measurement shall be made for sample locations designated in the work plan. The flow measurement should be in the same location after the sample is collected.

5.4.2. For moving water sources, the flow rate shall be determined when required by an industry approved method (e.g. weir, gauging station, stand pipes, current velocity meters, volumetric, etc.). Attachment 2-3 presents various discharge measurement procedures.

5.4.3. For stagnant water sources, (lakes, ponds, pools, etc.), a staff gage height will be recorded. Temporary staff gages are installed at pits/ponds. The staff gages will be moved as necessary due to the fluctuating water levels in the pits/ponds. Staff gages are surveyed to equate staff gage measurements to elevation.

5.5. Obtaining Water Samples

5.5.1. Prior to sample collection, all surface water sampling equipment will be decontaminated in accordance with SMP-SOP5.

5.5.2 Make sure that no activities are occurring or have recently occurred immediately upstream that would affect the integrity of the sample. Wade upstream to the sample collection point (midstream) from a downstream location. To avoid disturbing stream sediments or otherwise contaminating samples, stand downstream of the location from which the sample is collected. When collecting samples at successive locations, always proceed from downstream to upstream locations.

5.5.3 Sample collection point should be mid stream and mid depth if possible. Where adequate flow depth is available, the intake for the sample tubing shall be moved across the cross section of the stream to ensure a representative sample. Care should be taken not to allow the intake tubing to encroach on the floor of the steam, as the intake of sediments can compromise sample integrity if sediments are disturbed during sample collection.

5.5.4 The open end of the peristaltic tubing shall face upstream during stream sample collection.

5.5.5 Triple rinse the water collection device (e.g., beaker, dipper) with sample water and pump 100 to 200 mL of sample water through tubing/filter to rinse. If not enough sample water is available to perform the triple rinse, then at a minimum, a single rinse will be performed and will be recorded in the field logbook and/or data sheet. If bottles are sterile and pre-preserved, no rinse shall be performed.

5.5.6 Triple rinse and fill the unfiltered sample bottles directly by immersion in the stream or seep flow if possible. If not enough sample water is available to perform the triple rinse, then at a minimum, a single rinse will be performed and will be recorded in the field logbook and/or data sheet, unless sample bottles are pre-preserved. If unfiltered bottles cannot be filled due to low water depth, use the peristaltic pump and silicon tubing to pump sample water into an intermediate container or use a sterile or decontaminated beaker to fill the unfiltered sample bottles or intermediate container, being careful to minimize sediment. Pre-preserved sample bottles will not be rinsed.

5.5.7 Filtered sample bottles will be filled by pumping the sample through silicon tubing and a 0.45 micron filter with a peristaltic pump as specified in Section 5.8. The sample will be pumped directly from the stream, seep, or, if a lack of flow depth necessitates an intermediate sediment settling container, from an intermediate container (i.e., a decontaminated beaker, plastic bucket, or intermediate sample bottle). The intermediate container can be filled with a peristaltic pump or beaker.

5.5.8 Portable batteries shall be used to power the peristaltic pump at sites which are not readily accessible

5.5.9 Pit/pond samples will be collected from a boat and will be a composite from five random locations. Tubing will be attached to the end of a pole, and will be lowered at a continuous and constant rate to the appropriate depth for the specific sampling location. Samples, both filtered and unfiltered, will be collected directly from the tubing. The sampling procedure will be repeated at random locations until 5 sample aliquots are obtained. The tubing will not be replaced for each aliquot, but new tubing will be used between each sampling location.

5.5.10 Wear clean, disposable latex gloves at all times when collecting samples.

5.5.11. The sample should immediately be preserved and placed in an ice-filled cooler, if required.

5.5.12. Sample bottles for the same analysis should be filled immediately after one another.

5.5.13. Sample bottles for samples that do not require filtration should be filled prior to sample containers requiring filtration.

5.6. pH and Temperature Measurement

5.6.1. Verify that the pH meter is properly calibrated per the manufacturer's instructions and the calibration data recorded on the Calibration Data Sheet (Attachment 2-2) or in the field log book.

5.6.2. Fill the sampling container (a clear glass beaker polyethylene container or other suitable container) with an aliquot of sample water.

5.6.3. Rinse the pH probe with de-ionized (DI) water and sample water and then shake off excess water. Insert the probe into the aliquot of the sample water

5.6.4. Turn on the pH meter. Allow the reading to stabilize and record the pH and temperature in the field log book and sample collection log sheet.

5.6.5. Rinse the pH probe in DI water and store as specified by the manufacturer.

5.7. Conductivity Measurement

5.7.1. Verify that the conductivity meter is properly calibrated per the manufacturer's instructions and the calibration data recorded on the Calibration Data Sheet (Attachment 2-2) or in the field log book.

5.7.2. Fill the sampling container (a clear glass beaker polyethylene container or other suitable container) with an aliquot of sample water.

5.7.3. Rinse the probe with DI water and sample water and then shake off excess water. Insert the probe into an aliquot of the sample water.

5.7.4. Turn the selection switch on the conductivity meter to the appropriate scale (if not automatic). Record the conductivity in the field log book or the Surface Water Sample Data Sheet (Attachment 2-1). Turn off the meter, remove the probe from the sample, and rinse the probe with DI water and store as specified by the manufacturer.

5.8. Sample Filtration

Samples which require dissolved analyte concentration analysis shall be filtered at the time of sample collection in accordance with the following method:

5.8.1. Inline Cartridge Filtration

5.8.1.1. The sample will be pumped directly from the stream/seep or, if a lack of flow depth necessitates an intermediate sediment settling vessel, collected in an intermediate collection container (plastic or stainless steel bucket, beaker, or sample bottle) and then filtered by pumping with a peristaltic pump though silicon tubing and an inline filter.

5.8.1.2. Attach new unused silicon tubing to the peristaltic pump and

install a new inline 0.45 micron disposable cartridge filter.

5.8.1.3. After installation of the filter, start the pump and purge approximately 100 ml of sample through the tubing and filter before sample collection.

5.8.1.4. Rinse the sample bottle with filtered sample water three times. Pre-preserved sample containers shall not be rinsed.

5.8.1.5. Fill the sample container with the filtered sample water and preserve/ice as specified in the QAPP.

5.9. Sample Preparation

5.9.1. Samples should be labeled immediately after (or before) sampling in accordance with the QAPP.

5.9.2. Following sampling, sample bottles that require cooling for preservation shall be stored in an iced cooler (as directed in the QAPP). Coolers should be kept out of the sun, in a relatively cool place during the time the cooler remains in the field. Samples may be stored in a refrigerator or iced cooler until they are shipped to the lab for analysis.

5.9.3. Samples shall be shipped in accordance with the QAPP.

5.10. Quality Assurance/Quality Control

5.10.1. QA/QC samples collected during surface water sampling activities are specified in the QAPP.

5.10.2. A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical techniques. For surface water samples, a duplicate sample will be collected by alternately filling the primary sample bottle and then the duplicate sample bottle. Different filters will be used for the primary sample and the duplicate sample. A minimum of one field duplicate will be submitted per 20 samples as specified in the QAPP.

5.10.3. An equipment blank consists of analyte-free reagent water (distilled or de-ionized water) poured through the sampling device, collected in a clean sampling bottle and preserved as necessary. Equipment blanks may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide for representative samples. Equipment blanks are analyzed for the same suite of analytical parameters as the associated samples. Equipment blanks will be collected at a minimum frequency of one per 20 samples as specified in the QAPP.

5.10.4. QA/QC of field measuring equipment involves the review of calibration procedures and the use of standards. QA/QC of field sampling documentation involves the routine verification of field log-books and/or

forms and the required sign-off on the Chain-of-Custody (COC) forms.

5.10.5. Each QA/QC sample should be labeled with the correct QA/QC identification number and sent along with the other samples to the independent laboratory for analysis.

5.10.6. The number and frequency of QA/QC samples to be collected is specified in the QAPP

5.10.7. Sample containers and preservatives for QA/QC samples should be prepared in the same manner as all other sample containers.

6. RECORDS

All records and documentation associated with sample collection, including the Surface Water Sampling Data Sheets, Calibration Data Sheet, and field log books shall be maintained in accordance with the *Midnite Mine Water Treatment Plant Quality Assurance Project Plan*. All information pertinent to field sampling must be recorded in either a field log book, Surface Water Sampling Data Sheet, or Calibration Data Sheet regardless of the type of sample.

6.1. Minimum Field Data

6.1.1. The field log book, Surface Water Sampling Data Sheet, or Calibration Data Sheet shall contain, at a minimum, the following information:

- The sample identification number
- Location of sampling
- Name of sampling technician
- Date and time of sampling
- Field analysis results (pH, cond., temp, etc)
- Number and volume of sample containers and corresponding analyses to be performed
- Method of sampling
- Discharge or staff gage measurement
- Weather conditions

6.1.2. Field Observations

Sampling situations vary widely, so no general rule can be given for the amount of information required. The best guideline is to record sufficient information necessary to complete the Surface Water Sampling Data Sheets (Attachment 2-1), field log book, or Calibration Data Sheet (Attachment 2-2), so that the sampling event could be reconstructed if necessary without relying on the sampling technician's memory. The completed field log book(s) shall be maintained and filed chronologically.

6.2. Field Log Book

The field log book should be a bound book, preferably with consecutively numbered pages.

6.3. Calibration Data Sheet

An example Calibration Data Sheet is included in this SMP-SOP as Attachment 2-2.

6.4. Surface Water Sampling Data Sheet

The Surface Water Sampling Data Sheets is included in this SMP-SOP as Attachment 2-1. A separate Surface Water Sampling Data Sheet should be completed for each sampling location. Once completed the Surface Water Sampling Data Sheets shall be maintained in accordance with the Quality Assurance Project Plan.

7. REFERENCES

7.1 *Midnite Mine Superfund Site – Site Wide Monitoring Quality Assurance Project Plan* (QAPP).

7.2 *Midnite Mine Superfund Site – Site Wide Monitoring Filed Sampling Plan* (FSP)

7.2 MM-SMP-SOP5 Decontamination of Environmental Sampling Equipment

7.3 *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*

8. ATTACHMENTS

8.1 Attachment 2-1 - Surface Water Sampling Data Sheet

Attachment 2-2 - Calibration Data Sheet

Attachment 2-3 - Discharge Measurement Procedures

ATTACHMENT 2-1

SURFACE WATER SAMPLING DATA SHEET

IDENTIFICATION

Sample Location_____ Page___of___

Date _____ Start Time _____ Stop time_____

Sample Control Number_____ Samplers _____

WEATHER CONDITIONS

Ambient Air Temperature: _____ °C ☐ °F ☐ Not Measured ☐ **Wind**: Heavy ☐ Moderate ☐ Light ☐

Precipitation: None ☐ Rain ☐ Snow ☐ Heavy ☐ Moderate ☐ Light ☐ Sunny ☐ Partly Cloudy ☐

SAMPLE LOCATION DESCRIPTION

Notes: _____

SAMPLE COLLECTION PROCEDURE Fill bottles directly in stream ☐ Fill bottles with beaker ☐ Fill with peristaltic pump ☐

Collect composite at _____ locations with dipper ☐ peristaltic pump ☐

Filter with peristaltic pump: Directly from stream ☐ From intermediate sample container ☐

Decontamination Procedure: _____

Notes: _____

_____

DISCHARGE MEASUREMENT

Cutthroat Flume: 1"☐ 2"☐ 4"☐ 8"☐ Marsh McBirney ☐ Volume/Time ☐ Estimate ☐

Volume_____ x Time _____ = Discharge

Volume_____ x Time _____ = Discharge

Volume_____ x Time _____ = Discharge

Discharge _____ cfs ☐ gpm ☐ Initial staff gauge _____ Final staff gauge (after 5 minutes) _____

Notes: _____

_____

_____

_____

FINAL SAMPLE PARAMETERS

Sample Date	Sample Time	Discharge cfs☐ gpm☐	pH	Cond. (µS/cm)	Temp. ☐(°C)

Was a duplicate sample collected (02) ☐ Yes ☐ No Sample Control No._____

Was a rinsate sample collected (04) ☐ Yes ☐ No Sample Control No._____

Notes:_____

_____

Sampler's Signature _____

ATTACHMENT 2-2

CALIBRATION DATA SHEET

DATE: _____ **TIME:**_____

CALIBRATION PERFORMED BY: _____

pH Meter Number: _____

Buffer: _____ Measured Value: _____ Temp.: _____°C

Buffer: _____ Measured Value: _____ Temp.: _____°C

Buffer: _____ Measured Value: _____ Temp.: _____°C

Calibration check after calibration

Buffer: _____ Measured Value: _____ Temp.: _____°C

Calibration check at end of day **Time:** _____

Buffer: _____ Measured Value: _____ Temp.: _____°C

Conductivity Meter Number:_____

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Calibration check after calibration

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Calibration check at end of day **Time:** _____

Standard: _____µS/cm Measured Value: _____µS/cm Temp.: _____°C

Notes: _____

_____

Signature: _____

ATTACHMENT 2-3

Discharge Measurement Procedures

ATTACHMENT 2-3

1.0 DISCHARGE MEASUREMENT PROCEDURES

Depending on the magnitude of the discharge and the physical conditions at the measurement site, discharge shall be measured with one of the following: (1) flow meter, (2) portable cutthroat flume, (3) permanent flume, (4) permanent V-notch weir, (5) time and volume (stopwatch and a bucket or tank), or (6) time and distance (stopwatch and a measuring tape).

If none of these six methods can be used to measure discharge at a particular sample location, then: (1) other methods may be selected and added as addenda, (2) the measurement point may be relocated so that discharge can be measured, or (3) the point may be eliminated.

Because of the dynamic nature of surface water, flow measurement by the methods described in this document may, on occasion, be impossible at some sites. If unmeasurable flow conditions exist at any of the surface water measuring sites, an attempt shall be made to measure flow at a point upstream or downstream of the measuring site and this point will be noted relative to the marked data collection point. Whether or not a measurement is made, the sampling technician shall note the conditions that inhibited accurate flow measurement.

1.1 Location of Stream Measurement Points

The selection of the precise point at which to measure stream discharge at each measurement site specified in the Site Wide Monitoring Plan (SMP) depends on a number of factors, including data acquisition requirements, accessibility, and stream flow characteristics. After selecting the point, all subsequent stream flow measurements shall be taken at the same point. When flow is measured in conjunction with water-quality sampling, take flow measurements as close as possible to the sample collection point. To avoid disturbing the sediments or otherwise contaminating samples, measure the flow after collecting water-quality samples and sediment samples and immediately downstream of the sample collection point. Streamflow characteristics shall be used to determine the exact point where the discharge measurements will be made and the method used for measuring discharge; these characteristics include ease of measurement, channel alignment, flow regime, flow depth, and velocity. Consider the following factors when selecting a point:

1. Ease of measurement. The point should be accessible to wading, and flow should be confined to a definable channel. Because flow measurement will require wading in the stream to measure the flow, be sure that the flow depth and velocity are sufficiently low to permit safe crossing.
2. Flow regime. Stream flow should be steady and uniform, the stream-bed gradient in the vicinity should be relatively constant, and flow-lines should be as close to parallel as possible.
3. Backwater effects. The measurement site should be free from backwater caused by downstream obstructions or by the confluence of the stream with a major tributary or other body of water.
4. Depth and velocity limitations. Certain types of flow meters must have a sufficient depth and velocity of water (e.g., Marsh-McBirney flow meter) to function properly. The meter used should be evaluated to ensure it will perform properly at the selected point.

1.2 Flow Meters

1.2.1 Theoretical Considerations

The volume rate of flow of water, which is commonly called discharge (Q), is calculated as follows:

$$Q = VA$$

where:

V = the average stream velocity for the entire cross section
A = the total cross-sectional area.

The current meter measures velocity at a point. The velocity-area method of making discharge measurements at a cross section requires measurement of the mean velocity in multiple portions of the cross section at each of the selected vertical locations. These are taken at subsections of the cross section. A complete discussion of velocity observation methods is found in “Measurement of Stage and Discharge,” United States Geological Survey (USGS) Water-Supply Paper 2175, Measurement and Computation of Stream Flow, Volume 1, Chapter 5.

By dividing the steam width into subsections, total discharge becomes the sum of the discharges measured in each subsection. Table 1 provides guidelines for the number of subsections that should be used for varying stream widths. An individual point velocity (v) is measured at each subsection, and the total discharge is the sum of the products of each point velocity and cross-sectional area of each subsection, as follows:

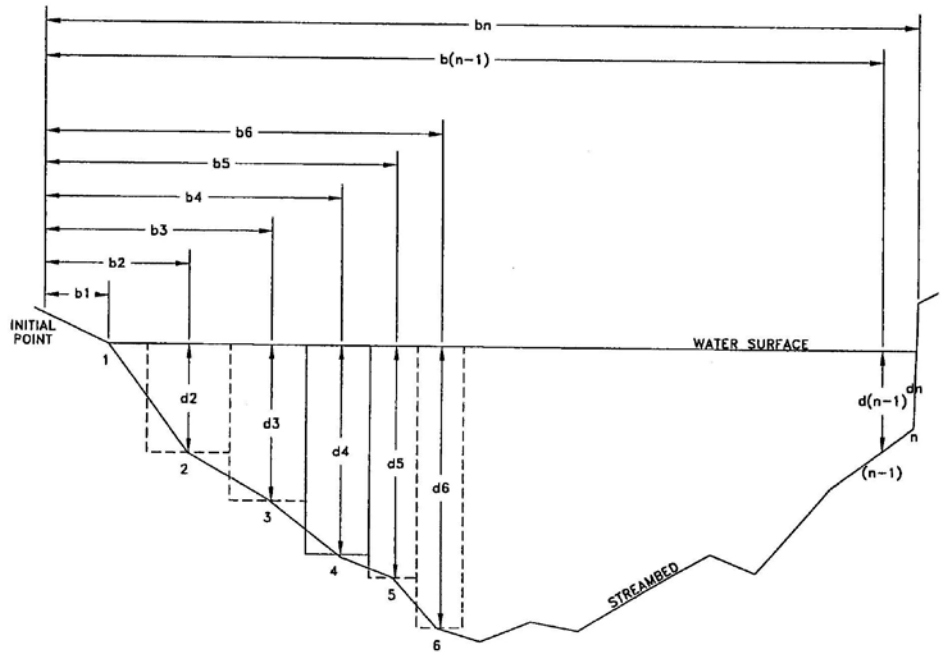
Error! Bookmark not defined.

$$Q = \sum_{1}^{n} va$$

where:

n = the number of subsections in the cross section
v = point velocity
a = the area of each subsection.

A cross section is defined by depths at vertical locations 1 through n (see Figure 1). At each vertical location, the point velocity is measured by a current meter.



EXPLANATION

1,2,3,.....,n	Observation verticals
b1,b2,b3,...,bn	Distance, in feet or meters, from the initial point to the observation vertical
d1,d2,d3,...,dn	Depth of water, in feet or meters, at the observation vertical
DASHED LINES	Boundaries of subsections; one heavily outlined is discussed in text

Figure 1. Definition Sketch of Midsection Method of Computing Cross-Sectional Area for Discharge Measurements

1.2.2 Flow Meter Measurement

A Marsh-McBirney magnetic current meter is the recommended flow meter for measuring water velocity. The Marsh-McBirney meter provides a direct velocity reading in feet per second, is durable, and is rugged for field use. If another flow meter is used, refer to the instrument's operation manuals for directions on using the meter.

Equipment that is required to measure streamflow using a Marsh-McBirney meter includes a top-setting wading rod, water-velocity meter, and a fiberglass measuring tape long enough to span the stream. Use the top-setting wading rod to measure the depth of water and adjust the position of the velocity flow meter. Attach the velocity flow meter to the top-setting wading rod on a movable mount so that the sensor on the meter can be set at the appropriate depth for velocity measurements. The wading rod should be made of stainless steel and marked with permanent grooves at intervals of 0.1 foot.

The Marsh-McBirney meters measure flow velocity using the Faraday principle, which states that as a conductor moves through and cuts lines of magnetic flux, a voltage is produced. The magnitude of the generated voltage is directly proportional to the velocity at which the conductor moves through the magnetic field.

The selector switch of the Model 201D has five positions; these positions are OFF, CAL, FT/SEC, M/SEC, and KNOTS. To check for electronics failure or discharged batteries, switch the selector to the CAL position and the time constant switch to the A2 setting. The meter should count down and turn itself off. If this does not happen, change the batteries and repeat the above check. The time constant switch is used to help stabilize the velocity readings. Generally, begin with the smallest time constant setting and increase the setting until the readout velocity stabilizes.

The sensor on the Marsh-McBirney meter can be connected to the universal sensor mount on the top-setting wading rod and used to determine flows using either the six-tenths depth method or the two-tenths and eight-tenths depths method. The minimum flow depth at which an average velocity can be measured with the Marsh-McBirney meter set at six-tenths of total depth is approximately 0.18 feet. Velocities can be estimated in flows as shallow as 0.1 feet. The meter is capable of measuring velocities ranging from 0 to 20 feet per second (fps).

1.2.3 Required Measurement Conditions

In order to make a velocity-area discharge measurement, the following conditions are required:

1. The stream must be channelized; that is, observable banks must channel the stream flow
2. The depth must be greater than 0.2 foot across most of the cross section being measured
3. The stream must have a measurable velocity of at least 0.1 fps in most of the cross section.

Conditions No. 2 and 3 can often be met in streams of very low discharge by conservatively modifying the stream channel to produce a narrower and slightly deeper cross section in order to meet measurement requirements. These modifications may include removal of aquatic growth or ice, moving large stones which impact velocity upstream or downstream of the cross section, and narrowing or deepening the cross section. When such modifications are made, great care shall be exercised to avoid unnecessary movement of sediments. After clearing the cross section, allow the flow to stabilize before measuring the flow.

Current meter measurements are best made by wading, if conditions permit. Wading measurements have a distinct advantage over measurements made from cableways or bridges in that it is usually possible to select the best of several available cross sections for the measurement.

Table 1 Number of Subsections Based on Stream Width

Approximate Width (ft)	Approximate Number of Subsections	Approximate Distance between Subsections (ft)
<2	8 - 10	0.2 - 0.3
2 - 4	10 - 12	0.3 - 0.4
4 - 10	12 - 15	0.4 - 0.7
10 - 20	15 - 20	0.7 - 1.0
>20	20 - 25	1.0 - 2.0

1.3 Flumes

Flumes are specially shaped open-channel flow devices that constrict channel area and change the slope to force the flow through critical depth. Typical flumes consist of three sections:

- A converging section to accelerate the approaching flow
- A throat section, whose width is used to designate flume size
- A diverging section, designed to ensure that the level downstream is lower than the level in the converging section.

The hydraulic theory behind flumes is based on a calibrated constriction placed to change the level of the water in or near the constriction. By knowing the dimensions of the constriction, the discharge though the constriction will be a function of the water level. A simple depth determination near the constriction provides a discharge measurement. Flumes are constructed so that a restriction in the channel causes the water to accelerate, producing a corresponding change (drop) in the water level that can then be related to the discharge.

The flow rate through a flume is determined by measuring the gage (flow depth) at a single point upstream from the throat. The gage height measurement determines the discharge only if critical flow is achieved in the throat of the flume. By definition, critical flow occurs when the ratio of the force due to inertia to the force due to gravity (Froude number) is unity. Supercritical flow occurs when the Froude number exceeds unity. If the Froude number is less than one, subcritical flow occurs, commonly due to a condition referred to as submergence. If submergence exists, a second depth reading must be taken in the throat section to determine the flow rate. Additional information concerning the use of flumes under all flow conditions, including submergence, is located in USGS Water-Supply Paper 2175, Volume 2, Chapter 10.

1.3.1 Parshall Flume

- The Parshall flume consists of a permanently installed flume that has a converging section with a level floor, a throat section with a downward-sloping floor, and a diverging section with an upward-sloping floor. The principal feature of the Parshall flume (developed by R. Parshall in 1922) is an approach reach having converging sidewalls and a level floor of which the downstream end is a critical-depth section. Critical flow is established at the throat due to a sharp downward break in the slope of the flume. The flow downstream from the level approach section is therefore supercritical. The primary gage height measurement is made in the approach reach at a standard distance upstream from the critical-depth cross section. Table 1 presents free-flow discharge through 6-inch Parshall measuring flume in ft3/sec.

The following steps shall be performed when measuring discharge from a permanent flume:

- Remove any material that may have accumulated in the flume
- Remove any material that may have accumulated downstream of the flume and is causing water to backup in the flume
- Note any deterioration of the flume
- Measure and record the throat width to the nearest 0.01 of a foot
- Record the time and date of flow measurement
- Use the staff gage to measure and record the gage height to the nearest 0.02 of a foot
- Calculate discharge using appropriate tables or equations
- Record the calculated discharge (should any leakage occur around the flume, the amount of leakage is estimated as a percentage of the total measured flow and is added to the calculated flow value).

1.3.2 Portable Cutthroat Flumes

A portable cutthroat flume with interchangeable throat widths, typically ranging from 1 to 8 inches, can be used to measure most discharges. Set-up and measurement with the cutthroat flume are significantly easier and faster than with a flow meter, and the flume is more accurate when installed properly. Place a portable cutthroat flume in a section of the stream channel with a bed slope of less than approximately 1 percent for a distance of 4 to 6 feet upstream of the flume. When the proper throat width is used, a pool of water with a width at least twice the front width of the flume should form upstream of the flume.

The following steps shall be performed when installing and measuring discharge from a portable cutthroat flume:

- Assemble, install, level, plumb, and square the flume
- Install the flume so that free-flow discharge occurs (flow through the flume discharges freely without backup)
- Divert all stream flow through the flume inlet, being careful to seal the sides and bottom of the flume so that flow does not run around or underneath the flume
- Remove any material that may have accumulated in the flume
- Record the time and date of flow measurement
- After the flow has equilibrated, use the staff gage to measure and record the gage height to the nearest 0.02 of a foot
- Take and record two identical staff gage measurements 5 minutes apart to demonstrate that flow has equilibrated
- Calculate discharge using appropriate tables or equations
- Record the calculated discharge (should any leakage occur around the flume, the amount of leakage is estimated as a percentage of the total measured flow and is added to the calculated flow value)

1.4 V-Notch Weirs

A V-notch weir is an obstruction or dam built across an open channel over which surface water flows through a V-shaped notch. Generally, the edge of the V-notch is beveled with a sharp upstream corner so that water shoots past the downstream portion of the weir structure without contacting it.

The angle between the legs in the "V" is typically 90 degrees but can be less. As the angle decreases, the accuracy of the measured discharge also decreases. All weirs used will have a 90-degree-angle notch.

In order to obtain accurate discharge measurements, the following conditions must be met when using a 90-degree-angle V-notch weir:

- The flow must be greater than 0.05 cfs and less than 10 cfs.
- The head on the notch (the distance from the bottom of the "V" to the top of water) must be greater than 0.2 feet but less than 2 feet.
- The height of the bottom of the "V" above the stream channel must be at least two times the expected maximum head (see Figure 2).

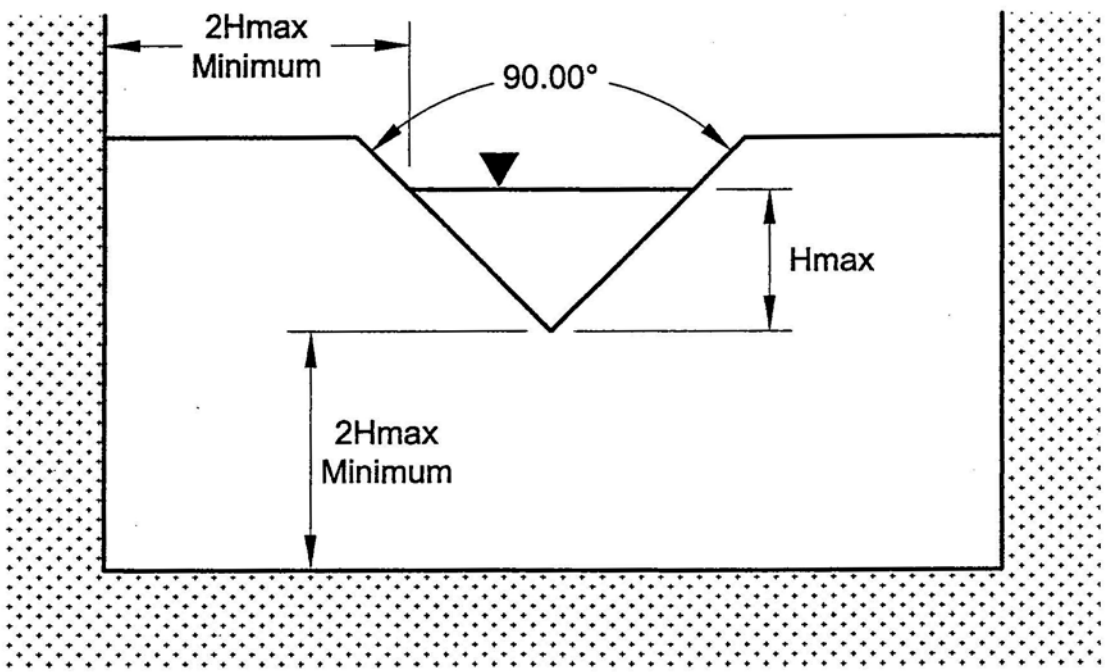


Figure 2. V-Notch Weir

For a V-notch weir with a 90-degree-angle notch, the discharge is calculated using the equation:

$$Q = 2.5H^{2.5}$$

where: Q = discharge (cfs)
H = distance from bottom of the "V" to the top of the water (feet)

The following steps shall be performed when measuring discharge from a V-notch weir:

- Remove any material that may have accumulated in the weir
- Remove any material that may have accumulated downstream of the weir and is causing water to backup in the weir
- Note any deterioration of the weir
- Record the time and date of flow measurement
- Measure and record the distance from the bottom of the "V" to the top of the water to the nearest 0.02 of a foot
- Calculate the discharge using the equation above
- Record the calculated discharge (should any leakage occur around the weir, the amount of leakage is estimated as a percentage of the total measured flow and is added to the calculated flow value)

1.5 Time and Volume

The time and volume method consists of capturing flow in a container and measuring the time required to fill the container. When using this method, divert the flow through a culvert or pipe and measure the discharge at the point of outflow. Alternatively, a small earthen dike can be built to divert spring flow through a pipe into a container with a known volume. Record the time required to fill the container with a stopwatch.

If practical, repeat the measurement at least three times and average the resulting values. If the variance between the time measurements exceeds 10 percent, repeat the measurement procedure. If any leakage occurs through or around the dike, estimate the amount of leakage as a percentage of the total measured flow and add the estimated leakage to the measured flow in order to calculate the total flow.

1.6 Time and Distance

In extreme cases where other measurement procedures fail or are not available, stream discharge may be estimated by measuring the time a floating object takes to travel a known distance through a stream cross section of known (or estimated if not known) area. In this method, measure or estimate the area of an average cross section with the procedures described in Section 4.2.1. Measure the time required for a floating object to travel a measured distance (e.g., 10 feet) of a uniform stream section. If possible, select an object that floats immediately below the water surface because such an object will travel at approximately 90 percent of the actual water velocity. Given the time, distance, cross-sectional area, and the 90 percent correction factor, calculate the estimated discharge.

2.0 DOCUMENTATION

All information pertaining to stream flow measurements shall be recorded in a bound field logbook with consecutively numbered pages or on a Surface Water Sample Data Sheet. Corrections shall be made by line-out deletions that are initialed and dated. The information recorded shall include the following, as appropriate:

- Location
- Date and time
- Method of flow measurement
- Flow measurement (or data, such as gauge measurement, such that flow can be calculated)
- Unusual conditions at measurement location or conditions that prevented measurement
- Name of person(s) performing observations.

Table 2. Free-flow discharge through 6-inch Parshall measuring flume in ft^3/sec.

Upper Head h_a, ft	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.10	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14	0.15
.20	.16	.17	.19	.20	.22	.23	.25	.26	.28	.29
.30	.31	.32	.34	.36	.37	.39	.41	.43	.45	.47
.40	.48	.50	.52	.54	.56	.58	.60	.62	.65	.67
.50	.69	.71	.73	.76	.78	.80	.82	.85	.87	.89
.60	.92	.94	.97	.99	1.02	1.04	1.07	1.09	1.12	1.15
.70	1.17	1.20	1.23	1.25	1.28	1.31	1.34	1.36	1.39	1.42
.80	1.45	1.48	1.51	1.53	1.56	1.59	1.62	1.65	1.68	1.71
.90	1.74	1.77	1.81	1.84	1.87	1.90	1.93	1.96	2.00	2.03
1.00	2.06	2.09	2.13	2.16	2.19	2.23	2.26	2.29	2.33	2.36
1.10	2.39	2.43	2.46	2.50	2.53	2.57	2.60	2.64	2.68	2.71
1.20	2.75	2.78	2.82	2.86	2.89	2.93	2.97	3.01	3.04	3.08

Computed from the formula $Q=2.06h_a^{1.58}$

Table of Contents

1. PURPOSE....3
2. RESPONSIBILITY....3
3. PRECAUTIONS....3
4. EQUIPMENT AND MATERIALS....3
5. PROCEDURE....3
6. RECORDS....5
7. REFERENCES....6
8. ATTACHMENTS....6

1. PURPOSE

Sediment samples are collected from the surface water collection points and analyzed to determine the presence of possible contamination. This operating procedure prescribes the methods for sediment sample collection. Sample handling, labeling, documentation, preservation, shipping and analysis and the quality assurance/quality control QA/QC protocols are addressed in the *Midnite Mine Superfund Site - Site Wide Monitoring Quality Assurance Project Plan* (QAPP). Decontamination of sampling equipment is addressed in SMP-SOP5. The sampling locations and rationale are included in the *Midnite Mine Superfund Site – Site Wide Monitoring Filed Sampling Plan (FSP).*

2. RESPONSIBILITY

The individuals who will be involved and the tasks for which they are responsible are discussed in the QAPP

3. PRECAUTIONS

3.1. All sample containers shall be inspected for cleanliness and flaws prior to use. Only those container types specified by the laboratory for use shall be used.

3.2. Hands should be cleaned immediately prior to sample collection and latex or nitrile gloves shall be worn to ensure that samples are not contaminated.

4. EQUIPMENT AND MATERIALS

The following equipment is required for sampling:

- Sample containers (e.g. plastic or stainless steel buckets, spoons, trawls, cups, and beakers)
- Scoop or shovel
- Field log book
- Decontamination equipment and supplies
- Clear glass or polyethylene beaker, plastic bags or other sample container
- Disposable latex/nitrile gloves
- Personal Protective Equipment as required by the *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*
- Sediment Sampling Data Sheet (Attachment 3-1) or equivalent

5. PROCEDURE

5.1. Equipment Decontamination

5.1.1. Before any sediment sampling with non-dedicated equipment, clean all of the equipment as specified in SMP-SOP5.

5.1.2. If dedicated equipment (equipment that will only be used at one site) is used, it should be rinsed with distilled or de-ionized water prior to coming into contact with the soil or sediment.

5.2. Pre-sampling Inspection

5.2.1. Inspect the sampling site and ensure that it has not been tampered with or disturbed.

5.2.2. Note on the Sediment Sampling Data Sheet or in the field log book any unusual conditions. If the sampling location changes significantly from the previous location and cannot be adequately described in writing in the sample collection notes then photographs will be taken.

5.3. Sample Collection

5.3.1. Sediment Samples

5.3.1.1. Sediment sample will consist of a single grab sample from 0 to 4-inches deep located in the middle of the stream. Collect enough sample to fill the required sample containers from the sediment layer at the sample point by a gloved (latex or nitrile) hand, or with a stainless steel or plastic spoon, scoop, cup or beaker. The sediment layer is usually composed of well sorted material, which is relatively fine. No screen is necessary because of the abundance of this material. Vegetation and rocks greater than one-half inch in diameter will be excluded from the sample. A stainless steel bowl may be used as an intermediate container. There may also be a layer that is composed of decaying biological matter that has a foul smell, which should not be collected.

5.3.1.2. Place sample in appropriately marked container.

5.4. Sample Preparation

5.4.1. Samples should be labeled immediately after (or before) sampling in accordance with the QAPP.

5.4.2. Samples shall be shipped in accordance with the QAPP.

5.5. Quality Assurance/Quality Control

5.5.1. QA/QC samples will be collected during sediment sampling as specified in the QAPP. QA/QC samples are collected to help identify potential sources of sample contamination and evaluate potential error introduced during sample collection, handling, and analysis. All QA/QC samples will be labeled with QA/QC identification numbers (identified in the QAPP) and sent to the laboratory with the other samples for analyses.

5.5.2. A field duplicate is defined as a second sample (or measurement) from the same location, collected in immediate succession, using identical

techniques. For sediment samples, a sample will be chosen and split by homogenizing the sediment sample in a bowl or plastic bag and splitting the sample into two similar samples. A minimum of one field duplicate will be submitted per 20 samples for each sediment sampling event.

5.5.3. An equipment blank consists of analyte-free reagent water (distilled or de-ionized water) poured through the sampling device, collected in a clean sampling bottle and preserved as necessary. Equipment blanks may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide for representative samples. Equipment blanks are analyzed for the same suite of analytical parameters as the associated samples. Equipment blanks will be collected at a minimum frequency of one per 20 samples as specified in the QAPP.

5.5.4. Sample containers and preservatives are specified in the QAPP.

6. RECORDS

6.1. Field Log Book

6.1.1. All information pertinent to field sampling must be recorded in a log book or on the Sediment Sampling Data Sheet (Attachment 3-1), regardless of the type of sample. The field log book should be a bound book, preferably with consecutively numbered pages. A log entry shall contain at a minimum of the following information:

- The sample identification number
- Location of sampling
- Name of sampling technician
- Date and time of sampling
- Method of sampling
- Weather conditions

6.1.2. Field observations

Sampling situations vary widely, so no general rule can be given for the amount of information required. The best guideline is to record sufficient information necessary in a field log book or on the Sediment Sampling Data Sheet (Attachment 3-1), so that the sampling event could be reconstructed if necessary without relying on the sampling technician's memory. The completed field log book(s) and Sediment Sampling Data Sheet shall be maintained and filed chronologically.

6.2. Sediment Sampling Data Sheet

An example Sediment Sample Sampling Data Sheet is included in this SMP-SOP as Attachment 3-1. A separate Sediment Sampling Data Sheet should be completed in its entirety for each location. Once completed the Soil and Sediment Data Sheet shall be maintained in accordance with the Quality Assurance Project Plan.

7. REFERENCES

7.1. *Midnite Mine Superfund Site – Site Wide Monitoring Quality Assurance Project Plan (QAPP)*.

7.2. *Midnite Mine Superfund Site – Site Wide Monitoring Field Sampling Plan* (FSP).

7.3 SMP-SOP5 Decontamination of Environmental Sampling Equipment

7.4 *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*

8. ATTACHMENTS

8.1 Attachment 3-1 - Sediment Sampling Data Sheet

ATTACHMENT 3-1
SEDIMENT SAMPLE DATA SHEET

DATE _____ SAMPLE SUITE_____ TECHNICIAN_____

Sample ID	Time Sampled	Comments

MIDNITE MINE SITE WIDE MONITORING PLAN STANDARD OPERATING PROCEDURES	**SMP-SOP4** **REVISION: 0**
GROUNDWATER LEVEL MEASUREMENT	**PAGE 1 of 7** **DATE: April 14, 2014**

Table of Contents

1. SCOPE AND APPLICABILITY....3
2. RESPONSIBILITIES....3
3. DEFINITIONS....3
4. REQUIRED MATERIALS....3
5. PROCEDURES....4
6. QUALITY ASSURANCE/QUALITY CONTROL....7
7. RECORDS....7
8. REFERENCES....7

1. SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) describes the procedures for field acquisition and documentation of monitor well water level data, measured as the depth-to-water, at the Midnite Mine (Site). Groundwater levels may be monitored continuously using electronic data loggers and pressure- sensitive transducers, or obtained manually, with a water level indicator, at a prescribed frequency (e.g., weekly, monthly, or quarterly).

During a field investigation, groundwater levels may be obtained in association with monitor well development, purging and sampling, or aquifer testing. Successive measurements of groundwater levels over time in association with a long-term monitoring program may be used to assess seasonal and/or diurnal fluctuations, as well as the effects of any pumping wells on groundwater flow direction and gradient.

2. RESPONSIBILITIES

The Project Manager is responsible for ensuring that groundwater measurements are implemented in accordance with this SOP and any other site-specific or project specific planning documents.

The Field Personnel are responsible for understanding and implementing this SOP during all field activities, as well as obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

The Site Safety Officer (SSO), typically the supervising field manager, is responsible for overseeing the health and safety of employees and for stopping work if necessary to fix unsafe conditions observed in the field.

3. DEFINITIONS

Hydrograph - A plot of monitor well water level elevation versus time.

Potentiometric surface - The level to which water will rise in a cased well under atmospheric pressure conditions.

Reference Point - The top of the well casing, or other selected point, at which a water level is to be measured from.

4. REQUIRED MATERIALS

The basic types of equipment and supplies used for the measurement of water levels are listed in the following subsections.

4.1 Manual Measurement

The following materials are needed for performing manual groundwater measurements.

- Water-level indicator (two-wire electrical sounder or conductivity meter), equipped with a sufficient length of cable to reach the deepest

anticipated water level; the cable should be graduated into 0.01-foot intervals.

- Extra batteries for the water level indicator.
- Decontamination supplies (e.g., Alconox or other nonphosphate detergent, deionized or distilled water, brush, plastic bucket, clean spray bottles, paper towels, clean plastic sheeting) used for decontamination of the water level indicator, interface probe and cable, and measuring tape.
- Keys for locked protective casings.
- Tools (e.g., wrenches), as needed, to enter well vault boxes.
- Health and safety monitoring equipment.

4.2 Continuous Measurement

The following materials are needed for conducting continuous measurements of groundwater levels.

- Laptop or field computer that can communicate with the electronic data logger (with the appropriate number of channels, if a number of wells are to be monitored with one data logger).
- Water level indicator, (as described above).
- Pressure-sensitive transducers, including one barometric pressure transducer, that are compatible with both water quality and anticipated pressure-sensitivity range in the wells to be measured. A barometric pressure transducer is needed if total pressure measurements are to be made using unvented pressure transducers. Alternatively, vented pressure-sensitive transducers can be used and would eliminate the need for a barometric pressure transducer. Depending on study objectives, vented transducers may or may not be applicable.
- Decontamination supplies (as described above).
- Keys for locked protective casings.
- Tools, as needed, to enter well vault boxes.
- Health and safety monitoring equipment.

5. PROCEDURES

Groundwater level measurements in monitoring wells shall be obtained manually using a two- conductor, battery-powered water level indicator (e.g., electrical sounder or conductivity meter). Continuous water level measurements shall be obtained using an electronic data logger and pressure transducers (e.g., an INW Aquistar PT2X transducer with a designated data logger at each well-head or an transducer(s) coupled to an In Situ Inc. Hermit or similar multichannel data logger).

5.1 Preparation for Groundwater Level Measurement

In preparation for a monitoring event, the field personnel shall review the site-specific planning documents to obtain the following information:

- The identification number(s) of the well or wells to be monitored
- The locations of the wells as shown on a site map
- Records listing the most recent water level measurements for the well(s) (if available)

- Reference point information (e.g., elevation of casing, location of reference point)
- The types of equipment needed to perform the scheduled monitoring activity
- Calibration requirements for the equipment (if applicable)
- Health and safety considerations, as appropriate

A well monitoring form or similar form, shall be used to record manual groundwater level measurements and supporting information. In addition, manual level measurements should be recorded in a bound field notebook.

5.2 Review of Existing Data

The field personnel may elect to prepare a hydrograph with the groundwater level data available for each well (or update an existing hydrograph) prior to going to the field. A hydrograph provides a visual record of groundwater level fluctuations over time. A hydrograph can be useful to identify any water level measurements that appear anomalous due to changes in conditions (e.g., a groundwater level rise due to a rainfall event or events, or a drop in water level due to initiation of pumping at a nearby well).

5.3 Well Inspection

An inspection of the condition of the well shall be performed prior to obtaining a water level in a given well. Any signs of vandalism, unauthorized entry, or settlement and/or ponding around the well surface completion shall be noted in the same bound field notebook used for recording manual water level measurements.

5.4 Manual Water Level Measurement

Prior to making manual water level measurements, the well cover shall be removed and left off for at least three minutes prior to conducting measurements. Indications of air movement in or out of the well should be noted.

The probe of the electric water level indicator shall be lowered into the riser casing until water is encountered, as indicated by the instrument signal. The water level is then measured with respect to the “top-of-casing” reference point and entered on the field log. Two additional water level measurements shall be made to verify the initial reading obtained. It is good practice to visually inspect the measuring tape/probe to insure that it is not missing sections and the numbers are accurate. A periodic measurement of electric water level indicators using a measuring tape also is good practice.

The water level measurement shall be compared to the most recent water level obtained for the well (if any). If the measurements differ by more than 0.5-foot, the depth to water shall be measured a second time for verification purposes. A remark shall be made on the field log if a probable cause for the discrepancy is known (e.g., tidal fluctuation, rainfall event, or start-up of a nearby pumping well).

As indicated in Section 7, field measurements of water levels for a given well

shall be recorded on the field form including the following information:

- The type of measurement device used
- Date and time of the measurement
- Any relevant remarks concerning the well condition, instrument malfunction, variation of the sounded depth versus the installed depth of the well, etc.

A weighted measuring tape can be used to sound the total depth of the well. Any discrepancy between the total well depth as compared to the constructed well depth shall be noted as a remark on the form. Such a discrepancy may indicate the presence of a possible obstruction or break in the casing or sedimentation at the bottom of the monitor well. Use of an interface probe or electronic water level meter to sound the total depth of a monitor well should be avoided because of the difficulty in decontaminating the instrument cable.

5.5 Continuous Water Level Measurement

Continuous water level data may be required for certain field investigation activities such as aquifer testing. Electronic data loggers and transducers are typically used for continuous water level measurement.

5.5.1 Equipment Installation

A designated electronic data logger may be installed in one well with one transducer cable or a single data logger may be connected to multiple transducer cables that simultaneously monitor a number of nearby wells. If the data logger is not equipped with an internal barometer or vented pressure transducers are not being used, one of the transducers shall be a barometric pressure transducer.

The electronic data logger and transducer cables shall be installed by the field personnel in accordance with the manufacturer's instructions. A transducer cable shall be lowered into each well to be monitored and stress relief cables attached as recommended by the manufacturer. The cable shall be positioned such that it does not interfere with closing and locking of the wells protective casing; and in such a manner that it is not pinched. If transducer cables are extended over areas that are heavily trafficked, they should be buried in a 6-inch-deep trench or strung through small-diameter, polyvinyl chloride (PVC) casing for protection. If cables are buried, their respective locations shall be flagged with survey laths and colored surveyor tape.

5.5.2 Equipment Calibration

Most pressure transducers currently available for groundwater level measurement require no field calibration (e.g., INW Aquistar PT2X). If fluctuations in water level are anticipated over a range of less than 23 feet, a transducer rated at 10 pounds per square inch (psi) is appropriate. If a greater range of water level fluctuation is anticipated, a transducer with a greater operating pressure range will be required. Periodic manual measurement of water levels shall be performed as a check on the water level data recorded by a data logger.

6. QUALITY ASSURANCE/QUALITY CONTROL

To promote consistency of data, water level measurements in a given well should be obtained with the same measuring device as used during previous monitoring events.

As a Quality Assurance/Quality Control (QA/QC) check on the accuracy of water level indicator measurements, the water level in a well may be obtained using a steel tape and carpenter's chalk. Measuring water levels with a steel tape graduated to 0.01-foot is considered the most accurate method for obtaining water levels. Verification of data obtained with an electronic data logger shall be obtained by periodic (e.g. weekly) manual water level measurement.

7. RECORDS

The field personnel shall submit copies of water and/or water/product levels forms to the Project Manager or designate immediately following the monitoring event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

8. REFERENCES

ASTM D 4750-87. 2001. Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well).

MIDNITE MINE SITE WIDE MONITORING PLAN STANDARD OPERATING PROCEDURES	**SMP-SOP 5** **REVISION: 0**
DECONTAMINATION OF ENVIRONMENTAL SAMPLING EQUIPMENT	**PAGE: 1 of 5** **DATE: April 14, 2014**

Table of Contents

1. PURPOSE.....3
2. REQUIRED EQUIPMENT 3
3. DECONTAMINATION OF ENVIRONMENTAL SAMPLING EQUIPMENT.....3
4. DECONTAMINATION OF OTHER EQUIPMENT.....4
5. REFERENCES.....5

1. PURPOSE

This procedure describes the standard methods for decontamination specific to environmental sampling tools and equipment during site-wide monitoring activities at the Midnite Mine Superfund Site as described in the *Midnite Mine Superfund Site Site-wide Monitoring Plan* (SMP). The ultimate selection of decontamination methods is dependent upon As Low as is Reasonably Achievable (ALARA) principles, economic considerations, and waste minimization.

2. REQUIRED EQUIPMENT

The following is a list of equipment that may be necessary to perform decontamination activities:

- Source-approved potable tap water
- ASTM Type II, or equivalent, reagent deionized water
- Laboratory-grade detergent (i.e., Liquinox, Alconox, or equivalent)
- 5-gallon buckets
- Scrub brushes
- Plastic sheeting
- Garden and hand sprayers (plastic)
- Large plastic wash tub
- Scrub brushes
- Hand sprayers
- High-pressure washer
- Disposable nitrile gloves
- Personal Protective Equipment as required by the *Midnite Mine Superfund Site Remedial Action Health and Safety Plan*.

3. DECONTAMINATION OF ENVIRONMENTAL SAMPLING EQUIPMENT

All equipment that will contact a sampled medium will be decontaminated prior to use. An exception is for new supplies, such as disposable filters and tubing, that are certified clean by the manufacturer. General decontamination procedures that apply to most equipment are listed below.

- Wash hands thoroughly prior to decontamination activities and handling decontaminated equipment (or wear new nitrile gloves).
- Decontaminate all wash/rinse tubs before initial use and between sampling sites, as specified below.
- Replace rinse and detergent waters used for decontamination procedures, unless in garden sprayers, with new solutions between sampling sites. In some cases, new solutions may be needed between the collection of samples at the same location.
- Following decontamination, place equipment in a clean area or on clean plastic sheeting to prevent contact with soil. If the equipment will not be used immediately, cover or wrap the equipment with plastic sheeting or heavy duty trash bags to minimize potential airborne contamination.

Procedures for decontaminating sampling equipment are listed below.

3.1. 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.

3.2. 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.

3.3. 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.

3.4. Rinse equipment with distilled or de-ionized water three times and pump distilled or de-ionized water through submersible pumps

3.5. Place the equipment in a clean location or use appropriate controls to ensure it will not be contaminated while drying.

3.6. Allow equipment to air dry, if practical, or dry with a clean, lint-free towel.

4. DECONTAMINATION OF OTHER EQUIPMENT

Decontamination of heavy equipment used for sampling, such as drilling equipment, backhoes and boats, shall take place at a designated decontamination area as described in the Remedial Action Work Plan.

4.1. 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.

4.2. 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.

4.3. 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.

4.4. 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 facility, as applicable.

4.5. Move materials to a clean area or establish controls to ensure that the equipment will remain clean for future use.

4.6. Vehicles used for non-intrusive activities shall be cleaned on an as-needed basis. Cleaning shall be required for dirty vehicles that will be leaving the Site.

5. REFERENCES

5.1. *Midnite Mine Superfund Site Site-wide Monitoring Plan* (Appendix Q of the Midnite Mine Superfund Site Basis of Design Report [BODR]).

5.2 *Midnite Mine Superfund Site Remedial Action Health and Safety Plan* (Appendix L of the Midnite Mine Superfund Site Basis of Design Report [BODR])

Attachment Q2-C

Laboratory Quality Assurance Plans and NELAP Certifications

Provided electronically only.

ACZ Laboratories, Inc.

QUALITY ASSURANCE PLAN
v.17

Effective Date: May 22, 2014

Last Review: May, 2014

APPROVAL AUTHORITIES[1]:

Christopher Wakefield, President/CEO
Reserve Technical Director – Organic Chemistry

Billy Grimes, Production Manager
Reserve Technical Director – Metals, WetChemistry Manual, WetChemistry Instrument

Matt Sowards, QA Officer
Reserve Technical Director – Radiochemistry

TECHNICAL DIRECTORS & SIGNATORIES

Scott Habermehl, Senior Project Manager

Max Janicek, Project Manager

Sue Webber, Project Manager

Isaac Klaus, Technical Director – Organic Chemistry

Steve Pulford, Technical Director – Metals

Alyssa Dybala, Technical Director –WetChemistry Manual

Jennifer Fox, Technical Director – WetChemistry, Instrument

Brett Dalke, Technical Director – Geochemistry

Mark McNeal, Technical Director – Radiochemistry

[1] Emails & read receipt constitute approval signatures.

UNCONTROLLED

TABLE OF CONTENTS

1 INTRODUCTION 3
2 QUALITY SYSTEM OBJECTIVES & COMPONENTS 4
3 ETHICAL AND LEGAL RESPONSIBILITY 14
4 PERSONNEL AND RESPONSIBILITIES 15
5 TECHNICAL TRAINING 24
6 SAMPLE COLLECTION & HOLDING TIMES 26
7 SAMPLE CUSTODY & SAMPLE HANDLING 27
8 PROCUREMENT, INVENTORY & TRACEABILITY OF SUPPLIES 29
9 MAINTENANCE & CALIBRATION OF INSTRUMENTATION & EQUIPMENT 32
10 CONTROL & STORAGE OF RECORDS & DOCUMENTS 34
11 ELEMENTS OF QUALITY CONTROL 41
12 EVALUATING QUALITY CONTROL SAMPLES 48
13 VALIDATION & REVIEW OF ANALYTICAL DATA 52
14 DETECTION LEVELS 55
15 SAMPLE DILUTIONS 56
16 ERROR CORRECTION PROTOCOL 56
17 COMPUTER / AUTOMATED PROCESSES 57
18 CLIENT SERVICES 58
19 FACILITIES 61
20 RADIOCHEMISTRY 64
21 CLINICAL LABORATORY IMPROVEMENT AMENDMENTS (CLIA) 67
22 CERTIFICATIONS 67
APPENDIX A REQUIRED CONTAINER TYPE, PRESERVATION TECHNIQUES, AND HOLDING TIMES 68
APPENDIX B – FORMS FOR MANAGEMENT REVIEW OF THE QUALITY SYSTEM 70
APPENDIX C REFERENCES UTILIZED BY ACZ 74
APPENDIX D DEFINITIONS OF TERMS 75
APPENDIX E TECHNICAL DIRECTORS 82

UNCONTROLLED

1 INTRODUCTION

ACZ Laboratories, Inc. is an environmental testing laboratory that provides data to clients primarily for regulatory purposes. Samples are analyzed for compliance with federal programs including the Resource Conservation Recovery Act (RCRA), Safe Drinking Water Act (SDWA), and Clean Water Act (CWA). Environmental compliance and management decisions are based on the analytical data provided, which are critical to the expenditure of large amounts of money; are important to public health safety; are important in evaluating, monitoring, and protecting the environment; and are often essential in litigation. To this effect, analytical data must always be technically sound, accurate, and legally defensible or it is useless to the end user.

An effective Quality Assurance and Quality Control program is the cornerstone of the generation of reliable analytical data. ACZ's Quality Assurance Plan (QAP) outlines the quality assurance and quality control objectives, policies, and procedures determined to be necessary to meet the requirements of the EPA, federal government entities, state agencies, other regulatory authorities, and our clients. This document provides the necessary guidelines to ensure all ACZ employees have sufficient knowledge and training to perform their job responsibilities in a manner that guarantees all data reported to ACZ's clients is accurate, reliable, technically sound, legally defensible, and impartial.

For data to be accurate, it must be of known and documented quality. The word "quality" has many different meanings, but for the purposes of environmental testing activities can be stated simply as "conformance to requirements." Conforming to requirements allows objective measurements to be applied, rather than subjective opinions, to determine when work is of good quality. *Quality control* refers to all activities that ensure accuracy (i.e. good quality) of the data. It requires action(s) to be taken and is typically included as part of the procedure. *Quality assurance* provides the records of the results obtained from the required action(s) and refers to the ability of the laboratory to demonstrate or prove to an outside party that the quality of the data is what the laboratory states it is. Quality assurance relies heavily on documentation, and to be effective, the documentation must: (1) assure the quality control procedures are being implemented as required; (2) assure the reported data reflect the sample as it was received, meaning sample mix-up was avoided, the sample was properly preserved prior to analysis, etc.; (3) facilitate traceability of an analytical result; and (4) be subjected to reasonable precautions to protect data from loss, damage, theft, and internal or external tampering.

Quality Policy Statement: To maintain an effective QA program, continually improve the quality of our environmental testing services, and consistently provide clients with technically sound and legally defensible data in a timely manner, the management of ACZ recognizes the importance of its commitment to:

- Ensuring good professional practice by well-trained and qualified employees with the necessary experience and skills to carry out their organizational functions and to meet or exceed ACZ's standards for the quality and reliability of its testing services.
- Ensuring the data provided to our clients is of known and documented quality, and is accurate and impartial.
- Ensuring that all quality assurance and quality control policies and procedures are communicated to and understood by all employees, and that they are implemented by all employees in their work.
- Ensuring that all aspects of the business operations are conducted in a manner that adheres to the TNI Standards and all of ACZ's policies and procedures documented in the QAP, SOPs, emails, memos, etc.
- Upholding the spirit and intent of ACZ's Data Integrity Program and implementing the requirements of the program.

UNCONTROLLED

2 QUALITY SYSTEM OBJECTIVES & COMPONENTS

ACZ's QAP provides a framework that guides all technical staff and administrative personnel. The information presented is necessary to ensure all employees perform their duties in a manner that allows the company to achieve its objectives, thereby ensuring the precision, accuracy, completeness, and consistency of the analytical data reported to our clients. This framework is referred to as the Quality System. The Quality System encompasses every documented quality assurance (QA) and quality control (QC) policy and procedure and guides all business functions and laboratory operations by specifying standardized protocols to control both the short-term and long-term activities that influence the quality and defensibility of our testing services.

The Quality System is designed to be appropriate to the type, range, and volume of the environmental testing undertaken. The Quality System is not a static entity and must function in a manner that allows for continuous evolution of all aspects of ACZ's business when improvements have been identified and have been determined to be necessary or beneficial. ACZ management recognizes that the staff is comprised of people who possess varied experience and knowledge and can contribute valuable insight and suggestions regarding these improvements. All employees are encouraged to be involved in this process. The following six (6) key elements form the foundation of ACZ's Quality System:

- Documents & Records
- SOPs
- Training
- Audits
- Corrective Actions
- Management Review of the Quality System

2.1 Documents & Records

The entire history of any sample must be readily understood through the associated documentation. To this extent, a formal and systematic control of documents and records is necessary for accurately reconstructing all events pertaining to any sample and for guaranteeing the quality and defensibility of the data. All information relating to the laboratory facility's equipment, analytical test methods, and related laboratory activities (such as sample receipt, sample preparation, data verification and data reporting) must be documented, and all records, including those pertaining to calibration and test equipment, certificates and reports, must be maintained. Documents and records must be safely stored (protected against fire, theft, loss, deterioration, and vermin), and must be held secure and in confidence to the client for a minimum of 10 years. Refer to §10 for details regarding the storage and control of ACZ's documents and records.

2.1.1 Documents

All controlled documents are reviewed for accuracy, approved for release by authorized personnel, and properly distributed. A document control system subsequently ensures that employees use only the correct and effective version of any form, Standard Operating Procedure (SOP), or other document, which are maintained through ACZ's LabWeb intranet. LabWeb is a computerized document control system based in HTML that can be accessed from any network computer within the facility. Documents can be queried by department and then organized in several ways by clicking the appropriate header. Click on the title of the document to view it as an Adobe Acrobat (*.pdf) file. The PDF has a "read only" qualifier and does not allow changes. Users may view SOPs but the documents may not be saved to another network drive and may not be printed. Forms may be viewed and printed but may not be saved to another network drive.

All documents are categorized by department and are assigned a unique document ID that is displayed in either the header or footer section. The ID nomenclature starts with either SOP (procedure) or FRM (form), followed by the 2-letter department code, the unique document number, the month and year of issue, and the revision. The effective date for any SOP or other document is included on the title page and header section of each subsequent page and indicates the implementation date.

The QA Officer has full responsibility of the Document Control System. Documents can be changed, overwritten, or saved as a different document only by employees with the appropriate computer access (primarily IS and QA

UNCONTROLLED

staff). A new or revised document is reviewed, and following approval, the document control number is updated and the SOP or form is uploaded to Labweb. When a new version of an SOP is added to Labweb, the previous version is removed from the active list, date-stamped and electronically archived in a designated location on the network. This automatic process guarantees that ACZ can retrieve the version that was in effect at any given time.

2.1.2 Records

A record is any information or data on a particular subject that is collected and preserved. Records are produced on a daily basis and contain original, factual information from an activity or study. For ACZ's purpose, this information may be recorded by the following means: LIMS database, logbooks, raw instrument data, worksheets, and notes (or exact copies thereof) that are necessary for the reconstruction and evaluation of the report of the activity or study. The record management system provides control of records for data reduction, validation, reporting and storage, and also provides control of all laboratory notebooks and logbooks. The system must allow for historical reconstruction of all laboratory activities that produced analytical data, must document the identity of personnel involved in sample receipt, preparation, calibration, and testing; and must facilitate the retrieval of all working files and archived records for inspection and verification purposes. At a minimum, the following criteria for records must be met:

1) Instrument logbooks must be kept up-to-date on a daily basis. In general, document all relevant activities when the event occurs.

2) Dilution factors and observations must be recorded at the time they are made, and notes regarding the sample(s) or analysis must be identifiable to the specific task.

3) A detailed description of any departure from a documented procedure, and the reason for the departure, must be provided at the time it is performed.

4) All generated data must be recorded either by an automated data collection system or must be recorded directly, promptly and legibly in permanent ink (blue or black is preferred).

5) Erroneous entries (hard copy or electronic) cannot be destroyed by methods such as erasures, overwritten files or markings. Refer to §16 for ACZ's error correction protocol.

6) Any change(s) to hard copy records must be clearly initialed and dated by the responsible staff. Changes to electronic records must also be traceable to the individual who made the change, and the reason for the change must be provided.

7) Records generated by computers must have hard copy or write-protected backup copies.

2.2 Standard Operating Procedures

A documented procedure is required for all phases of ACZ's business operations, from sample log-in through sample disposal. A Standard Operating Procedure (SOP) is a written document that details the manner in which an operation, analysis, or action is performed and thoroughly prescribes the techniques and procedures, which are the accepted process for performing certain routine or repetitive tasks. Analytical SOPs must be written with adequate detail to allow someone similarly qualified, other than the analyst(s) who routinely performs the procedure, to reproduce the procedure used to generate the test result. To the extent possible, administrative SOPs [non-technical] must include specific requirements pertaining to the process; however, the procedure itself may be a more general description so as to lend a degree of necessary flexibility to account for client requests and other circumstances which may be outside of ACZ's control.

Proposed revisions to any test SOP shall be submitted by the pertinent department supervisor (exceptions may be granted on a case by case basis) and be reviewed and approved by QA prior to implementation. Changes to provide additional clarification, correct typographical errors, etc. do not require formal approval and/or training. Analytical SOPs must be reviewed annually using the SOP Review Form (FRMQA035), and Administrative SOPs must be reviewed regularly and revised if necessary to ensure the information is accurate and reflects current practice. Documenting changes in the controlled copy of any SOP is prohibited. Refer to §10.5.1 for additional information on SOPs.

UNCONTROLLED

SOPs are proprietary documents and ACZ does not distribute them freely. Any copy sent electronically or otherwise to an outside party is considered uncontrolled, and the recipient understands that additional changes can be made without prior notification. The use of uncontrolled copies of SOPs is not permitted on site unless approved by QA, and such documents will be initialed and dated by QA personnel when issued.

Unless the reference method is followed exactly and contains sufficient detail to ensure consistent application, an SOP must be developed before a new procedure, application, or instrument can be implemented. The introduction of a new method must be a planned activity directed by the Production Manager, assigned to the appropriate technical director(s), and overseen by QA staff. Exceptions may be made when the client provides specific procedural instructions. In this event, the client's instructions must be followed exactly and appended to ACZ's test report package. Exceptions are primarily related to the preparation of solid materials for analytical testing (refer to SOPAD043 for additional details). An SOP template (SOPAD025) may be obtained from QA. If a client requests a procedure for which there is no published method or existing SOP, ACZ will utilize the process described in the SOP *Client Service Policies and Procedures* (SOPAD043). Analytical SOPs are written in accordance with the TNI Standards and must include or reference the following items, where applicable:

1) identification of the test method
2) summary, scope & application of the test method, including matrices & parameters to be analyzed
3) references, including documents provided by instrument / equipment manufacturer
4) sample collection, preservation, & storage
5) equipment & supplies
6) reagents & standards, including storage conditions & shelf-life for each
7) safety
8) interferences
9) complete procedure, including details and acceptance criteria for initial & continuing calibration
10) data review & assessment, including protocols for handling out-of-control or unacceptable data
11) quality control, including acceptance criteria & corrective action for handling failed quality control
12) calculation equations (dilution factors, RPD, % recovery, etc.) & calibration formulas
13) method detection limit & reporting limit
14) method performance, including Demonstration of Capability and Method Detection Limit procedures
15) pollution prevention & waste management
16) definitions
17) tables, diagrams, flowcharts

2.3 Training

It is the responsibility of ACZ's management to ensure the competence of all employees who perform environmental tests and other specific duties, operate equipment or instrumentation, give opinions and interpretations, evaluate results, and sign test reports. Additionally, ACZ management is responsible for formulating the goals and policies with respect to the necessary education, training, and skills of all personnel and for providing training that is relevant to the company's present and anticipated tasks.

Employees must possess the appropriate combination of education, experience, and skills to adequately demonstrate a specific knowledge of their particular functions and to carry out those functions in a manner that meets ACZ's standards and expectations. Additionally, each staff member must demonstrate an understanding of laboratory operations, test methods, related quality assurance and quality control procedures, and management of records and documents to the extent necessary to successfully perform their job duties.

All full-time and part-time personnel must complete a formal training process for Safety, Ethics, Quality Assurance / Quality Control, Quarantined Materials, and Sexual Harassment on the first day of hire and are subsequently responsible for complying with all requirements that pertain to their organizational functions. For all technical staff, training for analytical procedures must be completed prior to independent generation of client data, including Proficiency Testing samples. In general, any staff member who is undergoing training must be provided with appropriate supervision. It is the responsibility of each supervisor or manager to ensure personnel within his or her department are supervised, competent, and working in accordance with ACZ's Quality System.

UNCONTROLLED

2.3.1 Safety Training

Safety training is scheduled with ACZ's Chemical Hygiene Officer (CHO) and includes viewing a video of general laboratory safety, a complete review of ACZ's Chemical Hygiene Plan, and a building tour to identify the location of Safety Data Sheets, emergency showers, eye wash stations, and emergency exits. Following completion of the training, the employee takes an exam, which allows the CHO to evaluate their understanding of the material covered.

2.3.2 Data Integrity Training

ACZ is committed to fostering and enforcing an ethically sound work environment that encourages the conscientious production of accurate, technically sound, and legally defensible data. Data integrity training is required for all full-time and part-time employees (permanent or temporary) as described in ACZ's SOP *Data Integrity Principles & Policies* (SOPAD039). Initial training provides an orientation of ACZ's Ethics program, ACZ's Code of Conduct, Code of Ethics, and zero-tolerance policy. Each new employee is introduced to the company's Ombudsman. Data integrity training is provided for all current employees on an annual basis. At a minimum, employees must review ACZ's Data Integrity Principles & Policies (SOPAD039) and sign form FRMQA023 to indicate they have read, understood, & agree to adhere to them.

2.3.3 QA Training

All full-time and part-time employees attend an initial orientation session which is based on the most current version of ACZ's Quality Assurance Plan [QAP] and focuses on the relationship between quality control, quality assurance, environmental testing, and environmental monitoring.

2.3.4 Sexual Harassment Training

Sexual Harassment training is required for each new employee and includes viewing a video that demonstrates the identification, reporting, and remediation of harassment issues in the work place. Any complaints of sexual harassment must be brought to the attention of ACZ's CEO as soon as possible.

2.3.5 Technical personnel must be thoroughly trained in the analytical techniques and operating principles for all pertinent method procedures. Under no circumstances may any analyst independently generate or review client data for a test procedure before completing the required training and receiving the explicit approval of the QA department. §5 provides details of ACZ's technical training program.

2.3.6 An employee performing only data AREV or SREV functions must be appropriately trained regarding QC requirements, corrective action(s), and data qualification criteria stated in the effective version of the test SOP. The trainee must first read the SOP, and then review all pertinent information with the department supervisor. Items covered during training must be documented using the appropriate form, and both the supervisor and the trainee must sign the form. Thereafter, the effective version of the test SOP must always be used for data review.

2.3.7 Continuing training must be documented and, at a minimum, the documentation must certify that the employee has read, understands, and agrees to follow the effective version of the applicable SOP and any associated revision(s) or other in-house document. Training is documented using either FRMQA023, FRMQA012, or through email, whichever is most appropriate.

2.3.8 Training is required for all employees whose activities are affected by any procedural change(s) to an SOP and is considered to be complete once each employee has submitted documentation attesting they have read, understand, and agree to follow the revised policy.

2.3.9 ACZ recognizes the benefit of continuing education and encourages employee participation in advanced training courses, seminars, and professional organizations and meetings.

2.4 Audits

UNCONTROLLED

The purpose of an audit is to verify performance and compliance to documented Quality Assurance and Quality Control policies and procedures, and to identify discrepancies when they exist. In the latter case, any problems shall be addressed and resolved in an appropriate manner to assure the Quality System is continuously improved on all levels.

2.4.1 External Audits

External audits are conducted to ascertain compliance with rules, regulations, and additional criteria for certification, and will have a higher degree of formality than internal audits. Where records are required, compliance will be critically evaluated. Issues of non-compliance identified in previous audits are usually reviewed to verify the laboratory has remediated them effectively. The ease with which important records and information can be retrieved is a criterion for judgment of the management practices of a laboratory and may dictate the depth of the audit. Individual state agencies, laboratory Accrediting Bodies, and current and potential clients routinely audit ACZ.

The on-site assessment is generally a two to four day process during which the regulating agency conducts an entrance interview and tours the facility before performing an in-depth review of documents, workgroups, reports, electronic data files, etc. A critical aspect of the on-site assessment is review and verification of bench-level documentation and analyst interviews to determine actual laboratory practices. ACZ's policy is to always have QA personnel present during an interview. If necessary, the President, Executive Director or Production Manager may attend the interview. An exit interview is conducted upon completion of all on-site assessments, during which observations and findings are reviewed. The agency will submit a final report to ACZ, generally within 30 days, detailing all pertinent findings and recommendations.

Upon receipt and review of the agency's report, the QA department will meet with department managers to develop a corrective action plan, which must be submitted to the agency by the date indicated in their report. Each finding or group of similar findings is addressed as a major corrective action as described in §2.5.2. Employees may not make changes to any laboratory or other practice based on comments or opinions expressed by the regulating agency during an interview or any other stage of the on-site assessment without first obtaining approval from QA. ACZ will revise policies and procedures as necessary as part of the major corrective action process.

2.4.2 Internal Audits

ACZ is responsible for the quality of its data and must take reasonable efforts to assure itself and all interested parties confidence can be placed in it. ACZ shall conduct internal audits of its activities to verify compliance with the Quality System. It is the responsibility of the QA Officer (QAO) to plan, direct, and organize internal audits; however, a trained and qualified individual, independent from the area or system being audited, may be designated by the QAO to conduct an internal audit. The area of activity audited, the audit findings, and subsequent corrective actions shall be documented.

The internal audit program shall address all elements of the management system. At least one test method shall be audited annually for each analytical laboratory division. Method audits encompass both qualitative evaluation of the operational details of the QA program and quantitative evaluation of the accuracy of data generated by the laboratory staff. Test method audits include step by step witnessing of the procedure. Laboratory Divisions:

- Wet Chemistry Manual
- Wet Chemistry Instrument (Prep and Analytical)
- Metals (Instrument & Prep)
- Soils
- Radiochemistry (Prep and Analytical)
- Organics (Prep and Analytical)

When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test or calibration results, the laboratory shall take timely corrective action, and shall notify customers in writing if investigations show that the laboratory results may have been meaningfully affected. Client contact should normally be initiated within two months of discovering the error(s). If data impact assessment

UNCONTROLLED

cannot be completed in this timeframe management shall set a deadline commensurate to the demands of the assessment.

More frequent internal audits may be scheduled depending on the following criteria:

- Number and type of corrective actions filed for a method or activity
- Client complaints
- Continued failure to achieve acceptable results for a Proficiency Testing sample
- Findings from an external audit
- Request from management

All findings from internal audits are directed through ACZ's corrective action system. Each finding is assigned a corrective action number (similar findings may be combined). A general description of the process is as follows:

1) Findings and observations are summarized in a report.

2) The report is distributed to the department supervisor, Production Manager, and President or Executive Director.

3) The supervisor reviews the report and composes a plan of corrective action (POC) and projected completion dates for each finding. The POC should be proportional to the finding and the projected completion date commensurate with the demands of the tasks required for the corrective action.

4) The supervisor submits the plan of corrective action to the QAO or designee for review and approval.

5) The QAO or designee reviews the plan of corrective action for each internal audit finding. Once the plan of corrective action is accepted, a major corrective action number is assigned to each planned corrective action or group of similar corrective actions.

6) The supervisor negotiates the corrective action and submits a Corrective Action Report (FRMQA001) for each major corrective action number to the QA department for final review.

7) Once all corrective actions associated with the internal audit have been completed and approved, the internal audit process is complete.

An in-depth review will be conducted if there is any evidence of inappropriate actions or vulnerabilities related to data integrity. This review shall be handled in a confidential manner until a follow up evaluation, full investigation, or other appropriate actions have been completed and the issue(s) clarified. Refer to ACZ's SOP *Data Integrity Policies & Procedures* (SOPAD039).

2.4.3 Proficiency Testing (PT) Program

ACZ is required to participate in a formal Proficiency Testing Program at the frequency stipulated by regulating agencies. These "performance evaluations" are facilitated through the introduction of blind samples, purchased from approved vendors. ACZ analyzes PT samples for most accredited parameters twice in a calendar year, with each study being approximately six (6) months apart. These tests are matrix, technology, and analyte specific, and provide useful information regarding the accuracy of the analytical data being produced. At a minimum, ACZ participates in the Water Supply (WS) study for SDWA, the Water Pollution (WP) study for CWA, a Soil study for RCRA, and a Radiochemistry PT study for Drinking Water. Refer to SOPAD011 for additional details.

2.5 Corrective Action

Corrective action shall be performed when any aspect of ACZ's testing and/or calibration work, or the results of this work, do not conform to established procedures or the agreed requirements of the customer. Corrective actions are a fundamental element of ACZ's QA Program, as a successful Quality System requires the identification of deficiencies and depends on the

UNCONTROLLED

development, implementation, and documentation of effective contingency plans and resolutions to effectively remediate the deficiencies. Corrective actions are classified as minor, major, or technical.

2.5.1 Minor Corrective Action

Minor corrective actions address problems or issues isolated to a specific data set or group of data sets that do not meaningfully impact reports *already* issued to clients. The minor corrective action report (FRMQA001) allows for complete documentation of any temporary deviation from the SOP or other protocol. The employee who initiates the corrective action will complete Section 1 of the report. Documentation must be accurate and must provide a complete detailed explanation of the situation for future reference. The need to qualify data shall be critically assessed and appropriately addressed. The department supervisor should always be informed of the need for a minor corrective action and may provide additional information in the appropriate section. The project manager may also provide additional information in the appropriate section if necessary. QA does not need to close a minor corrective action; however, the employee may review the report with QA personnel and request their signature in the appropriate section. Minor corrective actions do not require follow-up.

Complete documentation may be provided either on the workgroup bench sheet or on the data review checklist in lieu of using FRMQA001. Use FRMQA001 if the deviation applies to many workgroups and attach a copy of the completed form to each workgroup before the workgroup is scanned. If the report is generated after the workgroups have been scanned, then the workgroup must be retrieved and rescanned with the report included as part of the data package. In this case, a note is made on the front page of the workgroup package indicating the reason the workgroup was rescanned (i.e. “CAR attached, WG rescanned”).

2.5.2 Major Corrective Action

Major corrective actions address problems which are systematic or meaningfully impact reports which have been issued to clients. It is the responsibility of the QAO to notify laboratory management in writing of departures from the Quality System, and it is the responsibility of the laboratory management to ensure remediation is completed by the assigned due date or to negotiate an extended deadline.

A major corrective action is initiated whenever a system failure has been identified or whenever an audit finding or other circumstance casts doubt on the correctness or validity of the analysis result(s). The client must be notified in writing if their work is significantly affected. The QA department will work with the Project Manager to determine if a revised report must be issued to the client. See ACZ’s SOP *Client Service Policies and Procedure* (SOPAD043) for details. A major corrective action may also be initiated when the need for preventive action has been identified (refer to §2.5.4).

Only QA department personnel may open and close a major corrective action. When opened, the corrective action shall be assigned a unique tracking number (referred to as the CAR number) to ensure that ACZ maintains a complete and accessible record of all Quality System deviations or failures, root cause determinations and subsequent resolutions, and preventive actions. A remediation deadline shall be assigned for all major corrective actions.

Examples of circumstances requiring a major corrective action include, but are not limited to:

- Contamination trends as indicated by blanks routinely above acceptable levels
- Spikes, surrogates and lab control samples continually outside acceptance limits
- Change to the MDL and/or PQL for a procedure
- “Not Acceptable” Proficiency Testing results
- Findings from internal or external audits
- Discrepancies between what was reported to clients and what should have been reported to clients due to equation errors or incorrect LIMS configuration.
- Hold times or deadlines routinely missed

UNCONTROLLED

- Evidence of insufficient or inadequate training

Following initiation, the procedure for a major corrective action proceeds to an investigation by the assigned individual to determine the root cause of the problem and identify possible resolutions to rectify the problem. The action(s) most likely to eliminate the problem and prevent recurrence of the problem must be selected, documented and implemented, and pertinent staff members must be trained, if necessary. Changes resulting from the corrective action will be monitored, if necessary, to ensure the resolution(s) are effective. A general outline of the procedure is as follows:

1) Initiation: Any employee may initiate a corrective action by notifying QA. The department manager should be notified first so that they can assess the need for a major corrective action. If determined to be necessary, QA personnel will open a corrective action, assign a unique tracking number, and a deadline for remediation. Deadlines shall be assigned based on the anticipated demands of remediation and potential threat posed to data integrity.

2) Assignment: QA assigns the corrective action to the person(s) responsible for problem characterization, Root Cause Analysis (RCA), Data Impact Assessment (DIA), corrective (including preventive) actions. Sections 1 and 2 of FRMQA001 shall be completed by the assignee(s).

3) Immediate action shall be taken to eliminate propagation of errors. Stopgap measures may be employed, including but not limited to: subcontracting analyses, imposing a moratorium on data reporting, manual data transformation. Immediate action shall be to a degree commensurate with the magnitude and risk of the problem.

4) Investigation and Action: Must be completed by the assigned deadline. Deadline extensions shall be negotiated with the QA department.

   a. The assigned individual(s) launch an investigation of the problem. There are three major components of the investigation
      1) Characterization of the problem: A thorough, but succinct, description of the problem must be composed. Whenever possible, this includes determination of the exact timeframe during which the error was present and what workgroups and samples were affected.
      2) Root Cause Analysis (RCA): Focuses on establishing the sequence of events or causal chain leading up to the problem, identifying contributing factors and elucidating relationships between them, and determining where intervention could be reasonably implemented to change performance and prevent an undesirable outcome. The depth of the RCA shall be commensurate with the risk and magnitude of the problem.
      3) Data Impact Assessment (DIA): Once the problem has been fully characterized, it shall be evaluated to determine whether client data may have been significantly impacted by the error. The DIA shall be commensurate with the risk and magnitude of the problem.

   b. A resolution to correct the problem and prevent its recurrence must be determined & implemented. Resolution may be done solely by the person(s) who investigated the root cause or it may require input from one or more additional departments.

      1) Conduct additional training if necessary. Training must be documented using the appropriate form and must include a description provided by the person who conducts the training. All trainees are required to sign and date the form to acknowledge he/she has received training, understands the change(s) and agrees to adhere to any change(s) in a policy or procedure.
      2) Revise SOP(s) as necessary. Proposed revisions must be approved by QA prior to implementation.
      3) Configure or enhance automated systems (e.g. LIMS) to correct problems or support preventive measures.
      4) Correct data in ACZ's LIMS as deemed necessary by Technical Directors, QA Staff, & Project Managers.

UNCONTROLLED

5) Perform additional measures (e.g. instrument or support equipment purchase, etc.) as necessary.
6) Document implementation dates for each corrective action.
7) Attach or reference all supporting documentation in the corrective action report.

5) Project Manager Review: If necessary, the PM will determine whether affected data will be accepted or rejected, contact the client, and issue revised reports accordingly. Project Manager review may not be required for every major corrective action.

6) QA reviews the corrective action. If satisfactory, the corrective action is approved and closed.

7) If deemed necessary, QA conducts follow-up. Follow-up is scheduled after sufficient time has elapsed to observe the efficacy of the corrective action and may need to be done multiple times. If the corrective action is determined to be ineffective, a new major corrective action will be initiated and the process repeated. QA follow-up may be documented on the corrective action report or the CAR spreadsheet located on ACZ's network.

2.5.3 Technical Corrective Actions

Technical corrective actions apply to departures or deviations from the quality control parameters stated in individual test SOPs. Each test SOP must include all required quality control that applies to the procedure (as stipulated by the method and other regulatory agencies) as well as the performance frequency, acceptance criteria and corrective action for handling failed quality control measurements. Each SOP must describe the procedures to be followed for reviewing and assessing data, including corrective action for handling out-of-control or unacceptable data. The required protocol for technical corrective actions is summarized below. ACZ's protocols are included within the [ ].

1) Identify the individual responsible for assessing each nonconformance and initiating or recommending corrective action [analyst who performs AREV]

2) Define how the analyst must treat data if associated quality control measurements are unacceptable [section 12 of SOP]

3) Specify how non-conformance and subsequent corrective actions are to be documented [data review checklist]

4) Specify how management reviews the corrective actions [reviewed during SREV]

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control then the corrective action described in the SOP must be performed. Alternatively, report data with the appropriate qualifier if reprocessing and reanalysis is not possible. The qualifier must be assigned to any sample associated with the failed quality control measure. A current list of all extended qualifiers is available in the LIMS database and may be accessed by all employees.

2.5.4 Preventive Action

Preventive action is a pro-active process to identify opportunities for improvement rather than reacting to the identification of problems or complaints. Needed improvements and potential source(s) of any nonconformance, either technical or concerning the Quality System, must be identified and addressed. Examples of preventive action include but are not limited to: maintaining a cross-trained staff; maintaining a supply of spare consumable parts; monitoring the performance of support equipment; performing routine maintenance on instruments; maintaining an adequate supply of standards/reagents; ordering supplies before running out; completing log-in review in a timely manner; ensuring ACZ can perform work before samples are accepted; correcting quotes before samples are logged in; and analyzing samples by the appropriate method.

2.6 Management Review of the Quality System

UNCONTROLLED

At least once per calendar year, ACZ's management conducts a review of its Quality System and all activities related to its environmental testing services to ensure their continuing suitability and effectiveness, and to introduce necessary changes or improvements. At a minimum, the review must take the following into account:

- Status, review, and discussion of major corrective actions
- Results of recent PT studies and corrective actions initiated / completed
- Review of recent external audits
- Review of internal audits
- Presentation of ideas to improve efficiency and productivity
- Presentation of ideas to improve service and data quality
- Status of state certifications
- Feedback from clients
- Feedback from employees
- Ethics Program
- Ombudsman
- Changes in the volume and type of work undertaken
- Customer feedback from annual client survey
- Other pertinent issues
- Suitability of policies and procedures.
- The effectiveness of training.

2.6.1 Department Reports

Each department manager completes a Department Report (FRMQA041) prior to the Management Review meeting. Each item on the report is to be evaluated as it pertains to the individual department. FRMQA041 is provided in APPENDIX B – Forms for Management Review of the Quality System
.

2.6.2 Management Review Report

The completed department reports are submitted to ACZ's President or Executive Director by the specified due date, and the information from each report is reviewed and compiled to complete the Management Review Report (FRMQA042). A copy of the completed report is issued to each manager in advance of the Management Review meeting. At a time specified by the President or Executive Director, the CEO, CFO, QAO, Production Manager, IS Manager, Senior Project Manager, and Business Development Manger meet as a group to discuss the report. Other formats may be utilized at the President or Executive Director's discretion. All reviews will be appropriately documented. FRMQA042 is provided in APPENDIX B – Forms for Management Review of the Quality System

2.6.3 Customer Feedback

ACZ solicits customer feedback on an annual basis through the use of a client survey distributed and received via email. The survey asks for feedback regarding customer service, data quality, staff, value, timeliness, and laboratory standing compared to other labs. Feedback is compiled by the CEO and discussed during management review of the quality system.

2.6.4 When a systemic failure is identified through the management review process ACZ's corrective action protocol shall be initiated.

UNCONTROLLED

3 ETHICAL AND LEGAL RESPONSIBILITY

All ACZ employees have an ethical and legal responsibility to produce data that is accurate, reliable, and legally defensible. ACZ's proactive program for the prevention and detection of improper, unethical, or illegal actions includes an Ombudsman who acts as a neutral party and serves as a confidential liaison between ACZ employees and upper management regarding questions, problems, complaints, suggestions, or ethical dilemmas.

Initial employee orientation includes ACZ's Code of Conduct, Code of Ethics, and zero-tolerance policy. Employees are informed of the processes in place to ensure employees are free from undue internal or external commercial, financial, or other pressures that may adversely affect the quality of an employee's work, endanger the trust in the independence of ACZ's judgment, or compromise the integrity of ACZ's environmental testing activities. A more detailed description of all aspects of the ethics program is provided in ACZ's SOP *Data Integrity Principles & Policies* (SOPAD039).

ACZ will not tolerate unethical or improper activities or behavior. Violation of company policies may lead to repercussions ranging from a warning to termination and possible criminal prosecution if warranted by the situation. ACZ has access to many resources that may be utilized at any time to help clarify any situation determined to be a "gray area." Employees are strongly encouraged to seek further guidance from a supervisor, ACZ's Ombudsman, President, Executive Director, or QA staff whenever doubt is raised. Activities that will not be tolerated include, but are not limited to:

- **Misrepresentation of a procedure or documentation** – Intentionally performing a job duty in a manner that does not comply with a documented procedure, including but not limited to a test SOP or method used for sample analysis; providing inaccurate and misleading documentation associated with a data package or failing to provide the necessary documentation as part of a data package.

- **Falsifying Records** – Providing false information on personal credentials, resumes or educational transcripts, logbooks, raw data and client reports, or creating data without performing the procedure (also known as dry labbing).

- **Improper peak integration** – Intentionally performing improper integration of data chromatograms so quality control samples meet acceptance criteria. This is also known as peak shaving or peak enhancing.

- **Improper clock setting** – Readjusting the computer clock so that it appears samples were analyzed within hold times. Also referred to as time traveling.

- **Improper representation of Quality Control samples** – Failing to treat batch quality control samples in the same manner as client samples (including Proficiency Testing samples) or misrepresenting any type of quality control sample associated with the preparation batch and/or analytical batch.

- **Improper calibration** – Intentionally performing improper manipulation of calibration data or forging tune data so that it meets acceptance criteria.

- **File Substitution** – Replacing invalid data with valid data from a different time so the analysis appears to be successful.

UNCONTROLLED

4 PERSONNEL AND RESPONSIBILITIES

ACZ Laboratories, Inc. is a Sub chapter S corporation with a single owner.

Due to the nature of regulatory oversight and the increasing demands of the environmental lab industry, QA issues permeate all aspects of our business, the largest and most critical of which are operations (production). On a daily basis, QA and Production must efficiently function together to consistently provide clients with technically sound and legally defensible data, and to ensure the Quality System remains an integral part of all areas within ACZ. The President or Executive Director must rely on regular input and feedback from ACZ's QAO and Production Manager, and to this effect, upper management is defined as ACZ's President or Executive Director, QAO, and Production Manager. It is the responsibility of upper management to document company policies, objectives, systems, programs, procedures, and instructions to the extent necessary to assure the quality and defensibility of all data.

ACZ is organized such that the President or Executive Director also works directly with and relies on input and feedback from the Senior Project Manager, Business Development Manager, Production Supervisors, Log-In Supervisor, Document Control Supervisor, IS Manager, Chief Financial Officer, Chemical Hygiene Officer, Radiation Safety Officer, and Hazardous Waste Coordinator. These individuals are responsible for managing both the day-to-day operations and long-term goals within their respective areas. It is the responsibility of all managers to ensure that all documented ACZ policies and procedures, including those in the QAP and associated SOPs, are communicated to, understood by, made available to, and implemented by ACZ personnel.

ACZ only uses personnel who are employed by or under contract to the laboratory.

Refer to FRMAD072 for ACZ's current organizational chart.

UNCONTROLLED

4.1 President/CEO/Executive Director[2]

The President or Executive Director is ultimately responsible for all analytical and operational activities of the laboratory and must ensure that 1) the laboratory carries out all environmental activities in such a way as to meet the requirements of the TNI Standards and 2) the laboratory satisfies the needs of the client and the regulatory authorities. General duties involve budgeting for all departments, making decisions on capital equipment and automation; developing company policies and benefits; addressing personnel issues such as hiring, firing, and promotions; and working with clients on various matters. Day-to-day responsibilities include providing direction to all laboratory departments including laboratory operations, accounting, marketing, QA, and client services. Additional responsibilities are as follows:

- Work directly with ACZ's Ombudsman to provide and maintain a mechanism for confidential reporting of ethical/data integrity issues as well as issues that may directly affect current ACZ policies.
- Define the minimal level of qualification, experience, and skills necessary for all laboratory positions.
- Provide the QA Officer with defined responsibility and authority for ensuring the successful development, implementation, and management of ACZ's Quality System.
- Provide the Production Manager with defined responsibility and authority for ensuring the technical operations and provision of resources needed to maintain the required quality of laboratory operations.
- Provide adequate supervision of environmental staff by persons familiar with methods and procedures, purpose of each test, and assessment of the test results.
- Ensure all technical staff has demonstrated capability in the activities for which they are responsible and ensure that the training of each member of the technical staff is kept up-to-date.
- Ensure the QA Officer has access to the highest level of management at which decisions are made on laboratory policy or resources.
- Provide managerial staff the authority and resources needed to discharge their duties.
- Provide technical personnel the resources needed to discharge their duties.
- Specify and document the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests.
- Implement appropriate and current guidelines for all lab methods and procedures to ensure data quality and efficiency of analyses. Ensure all method protocols utilized by ACZ meet the QC requirements as established by EPA or other governing agency.
- Document all policies and procedures related to the analytical and operational activities of the laboratory.
- Provide support to technical staff to ensure timely completion of all laboratory work, and develop contingency plans to ensure workflow progresses as planned.
- Meet quarterly (or more often) with the QA Officer and Production Manager.

[2] If more than one Executive Director is appointed, the duties described in this section will be performed jointly by these individuals.

UNCONTROLLED

4.2 QA Officer (QAO)

The QA Officer reports directly to the President or Executive Director; however, the QA department is considered a separate entity from operations in order to ensure data is evaluated objectively. The QA Officer has direct access to the President or Executive Director, and is therefore able to discuss and/or resolve all concerns, policies, etc. related to quality assurance or quality control. The primary responsibility of the QAO is to develop, implement, and manage all aspects of ACZ's Quality System, and he/she may take any action necessary to ensure all ACZ employees adhere to all policies, procedures, and objectives documented in ACZ's QAP, SOPs, memorandums, emails, etc. If warranted, the QAO has the authority to halt the performance of a single method or the production of a department, and if necessary, the operations of the entire laboratory, and will grant permission to resume when satisfied that the issue(s) have been resolved. Additional responsibilities include but are not limited to those stated in FRMAD060 and the following:

- Review and revise ACZ's QAP and provide training for all employees following approval of a new version.
- Provide QA orientation to new employees.
- Meet quarterly (or more often) with the President or Executive Director and Production Manager.
- Work with department managers to develop and improve training protocols.
- Conduct department training sessions as needed to address specific problems and questions.
- Arrange for or conduct internal audits; notify management of deficiencies; and track corrective actions.
- Organize all external audits; notify management of deficiencies; and assign and track corrective actions.
- Review and approve SOPs.
- Meet at least quarterly with Production Supervisors to provide information, respond to questions, etc.
- Manage Proficiency Testing (PT) program.
- Coordinate and maintain all regulatory and client certification programs.
- Review and validate a determined percentage of all data packages from Log-in to Reporting.
- Work with marketing/client service representatives on QA aspects of proposals.
- Work with Project Managers and the Production Manager to resolve client feedback regarding data quality.
- Review and maintain records and documentation for audits, certifications and all other QA issues.

  Qualifications:

  - General knowledge of the analytical test methods
  - Documented training and/or experience in QA procedures
  - Knowledge of the Quality System as defined under TNI

UNCONTROLLED

4.3 QA Coordinator

The QA Coordinator reports directly to the QAO and assists with the development, implementation, and management of the Quality System. Primary job responsibilities are as follows:

- Review and maintain records/documentation for employee training including DOCs, MDLs, etc.
- Provide initial QA orientation to new employees.
- Coordinate annual data integrity training.
- Schedule analyses and compile and report data for Proficiency Testing (PT) program, including DMRQA.
- Initiate and track corrective actions related to PT samples and manage all documentation associated with analyses.
- Review and approve SOPs.
- Conduct internal audits, notify management of deficiencies; and track corrective actions.
- Conduct department training sessions as needed to address specific problems and questions.
- Update control chart-generated QC limits in the LIMS database as needed.
- Monitor control & calibration of support equipment
- Assist QAO with management of certifications.
- Manage ACZ's resume compilation.
- Update ACZ organizational chart as necessary.

Qualifications:

- General knowledge of the analytical test methods
- Documented training and/or experience in QA procedures
- Knowledge of the Quality System as defined under TNI

UNCONTROLLED

4.4 Production Manager

The Production Manager reports directly to the President or Executive Director. General duties involve working with analytical department supervisors on a daily basis to prioritize client projects and QA deadlines and to track sample analyses in order to maintain acceptable turn-around-times for project completion. The Production Manager also addresses personnel, instrumentation, and reagent/supply issues that may affect the completion of the scheduled work and works directly with the QA department to ensure all Quality System requirements pertaining to production are successfully completed in a timely manner. Additional responsibilities are described in FRMAD060.

- Conduct weekly meeting with Production Supervisors to discuss current and upcoming workload, scheduling, priority projects, QC requirements, instrument / equipment issues, personnel, etc.
- Schedule QA work (MDL studies, DOCs, PT sample analysis, SOP revisions, etc.) with department supervisors in order to ensure QA requirements are kept up-to-date.
- Meet at least quarterly with the President or Executive Director and QA Officer.
- Communicate with Project Managers regarding project/instrument status. Notify PMs if problems exist that may affect the project completion date.
- Work with marketing/client service representatives on production aspects of proposals.
- Work with Project Managers and the QA Officer to resolve client feedback regarding data quality.
- Perform checks of sample status using LIMS database to help the laboratory staff meet all established hold times and to determine that analyses can proceed as scheduled to meet required turnaround times.
- Provide hands-on support to analysts when necessary to ensure timely completion of all laboratory work, and develop contingency plans to ensure workflow progresses as planned.
- Work with QA Officer to develop and improve training protocols, conduct department work sessions to address specific problems and questions.

  Qualifications:

  - General knowledge of the analytical test methods
  - Minimum four (4) years of laboratory experience
  - Minimum two (2) years of supervisory experience
  - General knowledge of lab-wide systems (including but not limited to log-in and reporting)

UNCONTROLLED

4.5 Production Supervisor

Each Production Supervisor is a full-time employee who reports to the Production Manager and exercises day-to-day oversight of laboratory operations for their specific area(s) of expertise. Each supervisor must be familiar with the test methods and related theory and instrumentation, as well as the assessment of results. In addition to monitoring the standards of performance, validity of all analyses, and quality of all data generated in their respective department(s), each supervisor is also responsible for ensuring that a new analyst has successfully completed all training requirements and is adequately prepared to commence work on client samples. Additional responsibilities are described in FRMAD060. If any supervisor is absent for more than 15 consecutive calendar days then another full-time staff member meeting the required qualifications will be assigned to perform the supervisor's duties.

Required Qualifications for a Production Supervisor:

1) Chemical analyses (Organics & Metals): BS or BA in chemical, environmental, biological sciences, physical sciences or engineering, with a minimum of 24 college semester credit hours in chemistry and at least two (2) years of experience in the environmental analysis of representative inorganic and organic analytes for the which the laboratory seeks or maintains accreditation. A masters or doctoral degree in one of the above disciplines may be substituted for one (1) year of experience.

2) Inorganic Chemical analyses (other than Metals): At least an earned associate's degree in the chemical, physical, or environmental sciences, or two (2) years of equivalent and successful college education, with a minimum of 16 college semester credit hours in chemistry and at least two (2) years of experience performing such analyses.

3) Radiological analyses: BS or BA in chemistry, environmental, biological sciences, physical sciences, or engineering, with at least 24 college semester credit hours in chemistry and at least two (2) years of experience in the radiological analyses of environmental samples. A masters or doctoral degree may be substituted for one (1) year of experience.

4.6 Business Development Manager

ACZ's Business Development Manager reports directly to the President or Executive Director and supervises all Client Service Representatives, each of who conducts marketing and sales efforts on behalf of ACZ with potential, new and existing clientele, and develops and maintains long-term relationships with customers by working with Project Managers when necessary. Additional responsibilities of the Business Development Manager are described in FRMAD060. ACZ's Client Service staff is authorized to review all contractual agreements with clients, review all proposals and develop price quotations for routine and non-routine analytical projects.

4.7 Senior Project Manager (PM)

The Senior Project Manager reports directly to the President or Executive Director and is responsible for overseeing the PM department. Additional responsibilities of the Senior PM are described in FRMAD060. Each Project Manager serves as the primary laboratory contact for each ACZ client, handles all client service requests, and investigates and resolves any problem brought to ACZ's attention by the customer. In order to provide consistency, each PM is assigned a list of clients, and it is the primary responsibility of each PM to ensure all of their client project needs are managed on a day-to-day basis and met in a timely manner and that all data submitted to the client is of high quality. All PMs work directly with the Production Manager and Production Supervisors regarding client data issues (due dates, hold times, retests, data quality, etc.), with Document Control regarding client reports and with the QA department regarding data quality questions or concerns.

UNCONTROLLED

4.8 Instrument Operator

Instrument operators report directly to the respective Production Supervisor. The position involves the analysis of various matrices for trace level contaminants using specialized and technical instrumentation. Each operator must be capable of performing all job duties in an accurate and proficient manner. Education will be verified by providing a copy of a college transcript or diploma, which is maintained in the employee's personnel file. Experience is verified by ACZ's CFO prior to completing the hiring process (verbal or documented verification provided by each reference listed on a resume or application is acceptable). The operator must demonstrate understanding of related theory, mathematics, analytical instrumentation, and data interpretation. This work is predominantly intellectual and involves the continuous use of professional and sound judgment. The employee must meet or exceed all requirements for generation of litigation-quality data and must also continue to demonstrate increased proficiency regarding the interpretation of the data as well as the operation and troubleshooting of the assigned instrument(s). These improvements should be attainable through ongoing efforts in-house as well as through specialized instruction at off-site locations. Prerequisites regarding education and experience, as well as job responsibilities and performance expectations are described in FRMAD059. Exceptions pertaining to experience or education will be made on a case-by-case basis.

Qualifications:

- BA or BS in Chemistry or related science or a minimum of 3 years of relevant experience in lieu of degree
- Prior laboratory experience is preferred but is not required.
- Successful completion of training by supervisor or proficient instrument operator

4.9 Laboratory Analyst [Technician]

The laboratory technician reports directly to the respective Production Supervisor. The position involves analysis of various matrices using appropriate analytical techniques and support equipment as well as preparation of samples for instrument analyses. Each technician must be capable of performing all job duties in an accurate and proficient manner. Education will be verified by providing a copy of a college transcript or diploma, which is maintained in the employee's personnel file. Experience is verified by ACZ's CFO prior to completing the hiring process (verbal or documented verification provided by each reference listed on a resume or application is acceptable). The technician must demonstrate understanding of related principles and mathematics, must possess common sense and mechanical skills, and must seek professional judgment from the supervisor as necessary. The employee must meet or exceed all requirements for generation of litigation-quality data as well as sample preparation tasks and routine analyses, and must also continue to demonstrate continuous improvements. These improvements should be attainable through ongoing training efforts in-house as well as through training opportunities at off-site locations. Prerequisites regarding education and experience, as well as job responsibilities and performance expectations, are described in FRMAD058. Exceptions pertaining to experience or education will be made on a case-by-case basis.

Qualifications:

- BA or BS in Chemistry or related science is preferred but is not required
- Prior laboratory experience is preferred but is not required
- Successful completion of training period by supervisor or proficient technician

4.10 Information Services (IS) Manager

The Information Technology Manager reports directly to the President or Executive Director and is responsible for the oversight of the IS department regarding the installation and maintenance of ACZ's computer network and all hardware and software and related equipment deployed on the premise. Additional responsibilities are described in FRMAD060. The department is also responsible for developing, maintaining, and improving custom written applications for laboratory automation and efficiency as well as for ACZ's LIMS, Intranet (Labweb), Internet and electronic data deliverables (EDDs).

UNCONTROLLED

4.11 Log-In Supervisor

The Log-In Supervisor reports directly to the President or Executive Director and is responsible for the oversight and management of all department personnel and operations. Primary responsibilities include fulfillment and shipment of bottle orders to the client's destination in a timely manner, receipt of all incoming samples, evaluation of all incoming samples against ACZ's Sample Acceptance Policy, entering samples into the LIMS database, and performing timely review of all logged samples. Additional responsibilities are described in FRMAD060.

4.12 Document Control Supervisor

The Document Control Supervisor reports directly to the President or Executive Director and is responsible for the oversight of the Document Control department. Primary responsibilities include the generation of client reports and EDDs and the maintenance, organization and control of all hard copy data and records, including workgroup data, client reports, CCOCs, and QA records and documents. Additional responsibilities are described in FRMAD060.

4.13 Chemical Hygiene Officer (CHO)

The Chemical Hygiene Officer is primarily responsibilities for oversight of ACZ's documented Chemical Hygiene Plan, conducting initial and refresher safety training for all employees, monitoring exposures, and maintaining records for Safety Data Sheets, injury reports, chemical exposure reports, etc. Additional responsibilities include working with management to develop and implement policies to improve the program. The person designated as CHO must have completed at least one basic laboratory safety course and have one year of experience performing laboratory work, preferably with responsibility for at least one area of laboratory safety.

4.14 Hazardous Waste Coordinator (HWC)

The HWC is responsible for managing and, with the collaboration of management, enforcing all aspects of ACZ's Hazardous Waste Management Plan (SOPAD007). The HWC must insure the HWP is compliant with relevant requirements in the US Code of Federal Regulations as well as any additional state regulations. Additional duties include bulking and labeling hazardous materials, filling out required documentation, and arranging for disposal; these activities may be delegated to qualified individuals under the supervision of the HWC. The HWC must know and understand the specific waste streams that ACZ uses and be able to determine how to dispose of unknown chemicals. This is best done by attending a training course on "Laboratory Waste Management." The individual responsible for hazardous waste disposal and signing the waste manifest must maintain HAZWOPER and DOT hazmat certification.

4.15 Radiation Safety Officer (RSO)

ACZ's Radioactive Materials License (RML) requires the laboratory have an RSO. The President or Executive Director appoints a Radiation Safety Officer to act as his/her representative in implementing the Radiation Safety Program. The RSO's responsibilities include developing radiation safety guidelines in accordance with Nuclear Regulatory Commission (NRC) and Colorado state rules and regulations, and for assuring compliance with those guidelines by ACZ personnel. The RSO will work with ACZ's administration to implement policies and seek ways to improve the safety program. The person designated as RSO must have completed a Radiation Safety Course or have at least 3 years of experience prior to being officially designated as the RSO. The RSO reports directly to the President or Executive Director of ACZ.

4.16 Chief Financial Officer (CFO)

ACZ's Chief Financial Officer is primarily responsible for all financial matters including payroll, accounts receivable, accounts payable and financial statements; monthly and annual balance and profit and loss statements; and assisting with annual budget preparation. In addition, the CFO maintains and monitors the security system and electronic time clock; invoices client projects from the database; updates customer account information; acts as the administrator for 401k/Profit Sharing Plan; maintains and executes the Employee Benefits Manual; and assists in hiring process by posting job openings, scheduling qualified candidates for interviews, checking references, and ensuring a new employee provides proof of education.

UNCONTROLLED

4.17 Purchasing Agent

Primary responsibilities include final review and approval of requisitions and submitting and tracking all subsequent purchase orders.

UNCONTROLLED

5 TECHNICAL TRAINING

Prior to the independent generation or review of data for client samples (including PT samples), all analysts must undergo a formal, documented training process. Technical personnel must be thoroughly trained in the analytical techniques and operating principles and procedures for the methods utilized by ACZ. This process includes but is not limited to: reading the associated published method, reading all related SOPs, improving laboratory skills, learning troubleshooting, maintenance, calibration and operating procedures for pertinent equipment and instruments, and creating workgroups and reviewing data through the LIMS database.

It is the responsibility of the department supervisor to determine that a new analyst is properly trained, has successfully completed all initial training requirements and is prepared to commence work on client samples. Under no circumstances may an analyst independently generate client data before receiving the explicit approval of the QA department.

5.1 The effective version of the test SOP provides the training framework for all sample preparation and analysis. The SOP is typically based on published approved methodologies (EPA or other) and incorporates any necessary activities and protocols not included in the published method(s) as well as requirements stipulated by other regulatory agencies.

5.2 Training for data AREV or SREV only must be documented as specified in §2.3.6. For analysts, approval to perform a procedure includes approval to perform AREV for the procedure. For supervisors and technical directors, approval to perform a procedure includes both AREV and SREV approval. SREV-specific training documentation is required for analysts.

5.3 Each employee must be trained either by the department supervisor or by an analyst within the department who is proficient in the area of testing and has been designated by the supervisor. Whenever possible, anyone performing training must meet the following requirements:

1) Documentation of training on the effective version of the test SOP.
2) Documented approval for the analysis.
3) A current IDOC or CDOC.

Exceptions may be granted on a case-by-case basis as approved by the QAO.

5.4 Initial training is documented using the Initial Method Training form (FRMQA004). The General Lab Practice Training Form (FRMQA047) is also required for an analyst's first procedure. Once training has been completed, the trainee and the instructor fill out the form together to ensure all pertinent information has been addressed and to ensure the trainee comprehends the material and is provided an opportunity to ask questions or request additional training. The trainee's signature is an attestation that he/she has read, understands, and agrees to follow the effective version of the SOP.

5.5 To demonstrate an aptitude for the procedure, the analyst must perform a successful Initial Demonstration of Capability (IDOC) prior to independent preparation and/or analysis of client samples. Performance is documented using FRMAD023. The data is reviewed initially by the department supervisor and the analyst (AREV), and both individuals must initial and date the review checklist. A new IDOC is required if an analyst does not perform the method within 12 months.

5.6 SREV for any preparation workgroup is performed by the department supervisor or a qualified analyst, and SREV for any analytical workgroup is performed by QA.

5.7 Prior to performing an IDOC, a new analyst should be provided sufficient opportunity to practice the procedure. This confirms the analyst understands the procedure and feels comfortable performing the procedure independently. Data associated with any practice is not submitted to QA.

5.8 It is not necessary for the first IDOC attempt to pass; however, the supervisor needs to review the analyst's techniques if multiple attempts do not pass.

UNCONTROLLED

5.9 A thorough review of the raw data is performed as part of initial method training and should include particular attention to details not presented in LIMS or on the final report, such as generating final sample concentration from the instrument response provided in the raw data (if applicable), verifying correct standard and reagent traceability.

5.10 Where specified by the method or a regulating entity, and as stated in the test SOP, successful demonstration of performance such as Linear Calibration Range determination (LCR) or Method Detection Limit (MDL) study must be completed prior to independent analysis of client samples.

5.11 All initial training documentation must be submitted to the QA department as a complete package. At a minimum, the package must include:

1) Initial Method Training form (FRMQA004), signed by the trainee and instructor (or department supervisor).

2) IDOC documentation:

   - ✓ Completed and signed certification statement (FRMAD023)
   - ✓ Workgroup bench sheet, raw data, and all supporting documentation

3) If applicable, an MDL study. Complete FRMAD031 and attach all related raw data and supporting documentation.

4) If applicable, calibration range study. Complete FRMQA029 and attach all related raw data and supporting documentation.

5) For all determinative methods utilizing a calibration curve or average response factor, the Method Calibration Form (FRMQA050).

5.12 Following review of all pertinent training documentation, QA will issue procedure-specific clearance for the trainee to independently generate and review data for client samples. This permission is tracked and may be viewed on a designated location on the public network drive.

1) Approval for preparation procedures is granted after the instrument data has been reviewed and approved.

2) An unapproved analyst who is “shadowing” the trainer (observing, learning the organization of the lab, reagent room, etc.) may not assist with the procedure, and the workgroup documentation must bear only the initials of the trainer, who is fully responsible for the data.

3) If the analyst has successfully completed training for a procedure and generates client data or reviews client data prior to QA approval, then any workgroup(s) or data review checklist must also bear the initials of a proficient analyst, with current approval for the method, who oversees the analyst’s work for the procedure and assumes full responsibility for the data. The primary analyst must always be aware that he/she is responsible for the workgroup. The use of another employee’s initials without their explicit approval is expressly prohibited.

5.13 The supervisor is responsible for ensuring the training of each analyst is kept up-to-date. Each analyst must read, understand, and agree to follow the effective version of the SOP and continued proficiency must be demonstrated and documented annually for each analyst. A one month grace period is allowed for submitting CDOC documentation. Thereafter, the analyst is prohibited from performing the procedure until a successful CDOC or IDOC is submitted to QA.

5.14 Each production supervisor routinely conducts department meetings to discuss procedures, work schedules, resources, questions and concerns, problems, QA, etc.

UNCONTROLLED

6 SAMPLE COLLECTION AND HOLDING TIMES

Sample collection procedures are well documented by the EPA and other agencies. ACZ's clients are instructed to provide representative samples whenever possible. ACZ supplies its clients with the containers and other materials necessary to maintain sample integrity (to the extent possible) from the time of collection through analysis. Although ACZ does not perform sample collection activities, each project manager or client service representative will assist a client with specific sampling requirements as needed. When necessary, will direct a client to other resources. The following sections include general information on sample containers, preservatives. and holding times. These are essential components in preserving the chemical and physical properties possessed by the sample at the time of collection.

6.1 Sampling Containers and Preservatives

The EPA outlines the requirements for sample container types, sample volume, and preservation. ACZ's inventory includes various sizes of plastic and glass containers that range from pre-sterilized to certified-clean by the supplier. Amber bottles are used when specified by the method. Glass containers are obtained from vendors that specialize in the sales of environmental sample containers, and all non-certified bottles are purchased from reputable lab/industry vendors. Refer to FRMAD045 and FRMAD046 for bottles types and preservation techniques for specific analyses. Refer also to APPENDIX A Required Container Type, Preservation Techniques, and Holding Times for additional information regarding EPA requirements for container types and preservation.

All sample containers shipped to our clients are new, contain the appropriate preservative(s), and are color-coded to identify preservation and storage. Out-going containers are packed in clean coolers with a copy of ACZ's Sample Acceptance Policy, general directions for sample collection, bottle labels, ice packs, sampling information, blank chain of custody, return shipping labels, and custody seals. Trip blanks and rinsette water are included when requested by the client or when mandated by a specific analytical method. After samples have been collected they are cooled to a temperature ≥ 0 °C and ≤ 6.0 °C. Samples that require thermal preservation must be maintained within this temperature range until all analyses have been completed.

6.2 Holding Times

The EPA has conducted lengthy studies of sample degradation versus time to establish a maximum holding time for each parameter, and the results of these studies are compiled into holding-time tables to provide guidelines for litigation purposes. Data for a sample prepared / analyzed outside of the established holding time may be rejected by regulators as unusable. Holding times will vary slightly from regulation to regulation, thus further emphasizing the need for a client to consult with their Project Manager prior to sample collection. The holding time typically begins at the time or date of collection in the field. APPENDIX A Required Container Type, Preservation Techniques, and Holding Times outlines holding times (a hold time stated in 40 CFR supersedes the published method).

If ACZ Laboratories, Inc. receives samples past holding times or near the expiration of the holding time, sample analysis will proceed unless the client has indicated on the CCOC that an attempt to contact the client must first be made. Analyses performed outside of holding time will be appropriately qualified on the final report. Holding times $\leq$ 72 hours are calculated based on the <u>hour</u> of the sample date/time. Holding times > 72 hours are calculated based on the <u>day</u> of the sample date/time.

In general, and unless otherwise noted in the test SOP, sample preparation and analysis must be completed within the stated holding time. For analyses that extend beyond the intended scope of the method for an analyte or matrix, the hold time stated in the SOP must be met or the samples must be appropriately qualified.

UNCONTROLLED

7 SAMPLE CUSTODY & SAMPLE HANDLING

Sample custody begins with receipt of sample containers from the client and continues beyond preparation and analysis to the proper disposal of primary and secondary sub-samples. Complete and accurate documentation must be provided at all stages of custody. There are many key elements to sample custody including laboratory security, chain of custody records, sample storage, internal custody logs, sample tracking within the laboratory, control of subcontracted work, and sample disposal. Unless otherwise specified, ACZ is contractually committed to retain samples for a minimum of 30 days after the invoice of a project[3].

7.1 Sample Receipt and Log-in

Refer to SOPAD045, *Sample Receipt & Log-In Procedure / Maintenance of Sample Integrity*, for the details of ACZ's sample receipt and log-in procedures. Upon delivery of samples to ACZ, Log-In personnel evaluate the condition of the cooler and custody seals. The custody seals are then broken to retrieve the Chain of Custody (COC), which must be signed by the sample custodian to document transfer of sample possession to ACZ.

Sample conditions are evaluated and any problems, such as expired hold times, lack of preservative or improper cooler temperature, are noted. Clients are notified of problems as soon as possible so that a contingency plan can be initiated if necessary. Samples are logged-in and are delivered to the assigned storage areas. Samples (including subsamples, extracts, etc.) must be stored away from standards, reagents, food, and other potential contaminants. Following log-in, every project is reviewed by the assigned PM. Upon completion of the review, the client receives an electronic summary, referred to as the "Login Review Report" that details the project information. This summary allows the client an opportunity to make changes to the project before samples are analyzed. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043) for additional information.

7.2 Internal Custody Logs

Some clients may specify additional custody tracking of the samples once they have been logged in. Internal custody may require that samples are stored in a manner that ensures limited access. The internal custody log (FRMQA015) shall accompany the samples from log-in through completed analysis. The person responsible for the work signs and dates each entry and/or page in the logbook. When all data from a sample set is compiled, copies of all logbook entries shall be included in the final report package. For projects requiring internal custody, ACZ will adhere to the procedure described in the SOP *Client Service Policies and Procedures* (SOPAD043).

7.3 Sample Tracking

Sample flow through the laboratory is facilitated by the use of an Oracle-based LIMS database (Laboratory Information Management System). Every product (requested analysis) logged into the LIMS for a sample has a specific, pre-determined department path. All products have default paths of at least Login Review and Reporting. Between these two departments, a product may go through, for example, Soil Prep and Metal Analysis or Soil Prep, Organic Prep and GC Analysis. At each department step in a product's path, the status can be updated and viewed at any time. Analytical product statuses are defined below. Additional information regarding sample tracking is available in the SOP *Client Service Policies and Procedures* (SOPAD043).

NEED	Prep or Analysis has not been started
WIP	Prep or Analysis has been started (Work In Progress)
PREP	Sample preparation is complete and sample is ready for analysis
UPLD	Analytical data has been uploaded into LIMS
AREV	Analyst has reviewed and accepted analytical data
SREV	Supervisor has reviewed and accepted analytical data
DONE	Analysis or task has been completed

[3] Currently, samples scheduled for any radiochemistry parameters are held for a minimum of 90 days to facilitate radioactive material inventory monitoring. This policy is subject to change at any time in harmony with ACZ's Radiation Safety Plan.

UNCONTROLLED

REDO	Sample requires reanalysis
REDX	Sample requires re-digestion/extraction
CANT	Sample preparation or analysis cannot be performed
NREV	Project requires PM review before work can begin
HOLD	Prep or analysis postponed
SENT	A final report has been issued to the client

UNCONTROLLED

8 PROCUREMENT, INVENTORY AND TRACEABILITY OF SUPPLIES

8.1 Procurement / Inventory

All consumable supplies are purchased from reputable vendors that have been evaluated for service, quality, and price. To the extent possible, materials traceable to national or international standards of measurement are purchased for use in technical operations. Supplies are purchased using ACZ's purchase order (PO), remote inventory management system (RIMS), and the Aestiva ordering system. The Purchasing Agent is not permitted to make a substitution for any material specifically requested unless the department supervisor approves the substitution. Upon receipt, reagents, chemicals, standards, and other laboratory consumables are stored in the Chemical & Supply Room, which has limited access, or are delivered to the laboratory. Refer to ACZ's SOP *Purchase, Receipt, and Storage of Consumable Materials for Technical Operations* (SOPAD037) for additional information.

8.2 Glassware

ACZ uses only laboratory grade glassware. Prior to use, glassware is cleaned to meet the sensitivity of the method. Refer to individual test SOPs for detailed cleaning procedures.

8.3 Other Supplies

Routine consumables (centrifuge tubes, autosampler tubes, pipette tips, etc.) are purchased through an automatic system managed by Fisher (RIMS). All other supplies are purchased on an as-needed basis through ACZ's Purchase Order and the Aestiva ordering system. Refer to SOPAD037 for additional information.

8.4 Traceability of Standards and Reagents

To provide complete traceability, each data package must reference every standard and reagent used for sample preparation or analysis, including but not limited to acids, bases, preservatives, color reagents, pH indicators, buffers, and instrument reagents. Each PCN and/or SCN must be documented either on the workgroup bench sheet, data review checklist, or a current standard/reagent form. The open date for all original containers is not tracked in LIMS; however, good laboratory practice dictates the open date be noted on the sample container.

8.4.1 Primary Control Number (PCN)

Upon receipt, all stock chemicals, standards, and reagents are assigned a unique PCN in LIMS for tracking and traceability purposes. A label with the PCN and the expiration date is affixed to both the container and the Certificate of Analysis (if applicable). Document Control enters the data for each PCN using the certified value(s) supplied by the vendor, as indicated on the Certificate of Analysis. Because the certified value is entered, the final concentrations for prepared standards may vary slightly from the theoretical value indicated in the test SOP. Certified values shall be used for standards when available. If certified values are not available, informational values may be used. Document Control maintains certificates of Analysis, and a copy of the PCN report is generated and maintained. If the certified reference values for any PCN are changed after the PCN has been used in the laboratory, then complete documentation must be provided as a major corrective action (FRMQA001).

NOTE: Only Document Control and QA personnel are authorized to enter or edit PCN data.

8.4.2 Secondary Control Number (SCN)

To ensure complete traceability, a unique SCN must be created when any intermediate or working standard is prepared from one or more stock solutions, stock chemicals, or intermediate solutions. A standardized format is used for creating the SCN: a two-letter code indicates the lab section and is followed by the prep date and then by a daily sequential number. For example, the SCN **II051128-2** denotes the second standard prepared on November 28, 2005 in the Inorganic Instrument lab. An acceptable alternative is to let LIMS assign a unique number when prompted.

UNCONTROLLED

An SCN for any working standard subjected to a LIMS calculation must be created electronically in LIMS. The initial volume and concentration of each constituent and the final volume of the prepared solution are entered in the SCN Wizard program to calculate the final concentration(s) of each analyte using the formula $C_1V_1 = C_2V_2$. The preparation date, expiration date, and preparer's initials are included as part of this electronic record. A hard copy of the SCN report may be affixed to the standard/reagent logbook, depending on individual department practice; however, it is not required.

Prepared reagents do not require an SCN be created electronically in LIMS; however, preparation must be recorded in the department's designated logbook. At a minimum, the logbook entry must clearly identify what reagent was prepared, its subcomponents, the preparer's initials, the preparation date, and the expiration date. This information is sufficient for color reagents, buffer solutions, instrument reagents, etc. because details of the preparation are stated in the test SOP.

8.5 Preparation and Expiration of Standards and Reagents

8.5.1 Preparation of Standards and Reagents

Refer to individual test SOPs for detailed information regarding standard and reagent preparation.
In general, either Class A pipettes or mechanical pipettes are used to measure and dispense aliquots of any solution used to prepare a standard or reagent. Accurate delivery of mechanical pipettes must first be verified as described in ACZ's SOP *Control, Calibration, and Maintenance of Measuring and Test Equipment* (SOPAD013).

All containers of prepared reagents and standards stored for more than one day must be properly labeled with the SCN (or other unique identifier), name/description, preparation date, and expiration date. Preparation of reagents and standards must be documented as described in §8.4.2.

8.5.2 Expiration of Purchased Standards and Chemicals (PCNs)

When provided, the manufacturer's expiration date will be assigned. If the manufacturer does not provide an expiration date, an expiration date of 5 years from receipt is assigned.

An expired stock material may continue to be used only if its reliability can be verified. For the purpose of ensuring transparency, the rationale for extending the expiration date must be documented on FRMQA051 and submitted to the QA department for approval. If the extension is granted, FRMQA051 is filed with the certificate of analysis. Unusable materials must be replaced and the standard or reagent remade as soon as possible. Remove the container from the lab or the supply room and dispose of properly. Contact ACZ's HWC for assistance.

8.5.3 Expiration of Prepared Standards

Storage conditions and shelf life for prepared standards are provided in the individual test SOPs. The following guidelines may be used to determine the shelf life for a prepared standard if the method does not prescribe a shelf life:

1) A standard that has been prepared in-house may continue to be used after its assigned expiration date for as long as its reliability can been verified. Whenever possible, reliability should be verified by comparison to another, unexpired standard containing the same constituents. For applicable procedures, instrument response may be considered when determining whether or not a solution is still reliable.

    - In cases where reliability has been verified, the expiration date of the SCN must be updated in LIMS and/or the standard/reagent logbook. The rationale for extending the expiration must be documented on FRMQA051 and submitted to the QA department for approval.

    - In the event the solution was used prior to updating the SCN then documentation must be provided as part of the workgroup to indicate the solution was used past the shelf life stated in the SOP (a minor corrective action or FRMQA051 may be used if more than one workgroup is affected). The expired standard must be remade as soon as its reliability becomes questionable – it is the responsibility of the analyst to use their best judgment.

UNCONTROLLED

2) The shelf life of any prepared standard with any analyte concentration < 10 mg/L is 90 days from the preparation date. This is a general guideline – if any constituent does not remain in solution for 90 days, then the standard must be prepared more often. If the manufacturer's expiration date for any stock standard is sooner, then the expiration date of the SCN is the manufacturer's expiration date for a single analyte solution or the earliest manufacturer's expiration date for a multiple analyte solution.

3) The shelf life of a prepared standard with analyte concentration ≥ 10 mg/L is one year from the preparation date. This is a general guideline – if any constituent does not remain in solution for one year, then the standard must be prepared more often. If the manufacturer's expiration date for any stock standard is sooner, then the expiration date of the SCN is the manufacturer's expiration date for a single analyte solution or the earliest manufacturer's expiration date for a multiple analyte solution.

4) In general, prepared Radiochemistry standards expire one year from the preparation date. The solution may be re-evaluated using control charts, efficiency checks, or other criteria and the expiration date extended by year intervals if the solution is still deemed usable. Refer to the specific test SOP for details.

8.5.4 Expiration of Reagents

In general, a reagent is a solution, which does not contain the target analyte(s). Storage conditions and shelf life are stated in the individual test SOPs. The expiration date can be extended for a prepared reagent provided its reliability can be verified. LCS/LFB performance (QC criteria met) may be used to verify reagent stability if the control standard is a valid indication of the reagent's continued functionality/stability. Reagents used to treat samples for interference may not be verified this way. Reagents used to dissociate complexed target analytes may not be verified this way unless the LCS is an appropriate complex. FRMQA051 must be submitted to QA for approval whenever an expiration extension is requested.

UNCONTROLLED

9 MAINTENANCE AND CALIBRATION OF INSTRUMENTATION & EQUIPMENT

9.1 Maintenance of Instruments and Support Equipment

The best protocol for producing quality work is to prevent errors and non-conformances rather than react to and correct problems after they occur. An essential part of this protocol is ensuring that all laboratory instrumentation and equipment used for the generation of data have been optimized and are functioning properly before commencing work on client samples. Performing routine maintenance and optimizing instrument-operating conditions prior to sample analysis minimizes instrument downtime, thereby improving productivity and ensuring quality of the data. It is the responsibility of the designated analyst(s) to perform and properly document daily and routine maintenance, instrument optimization, troubleshooting, instrument service or repair, and repair or replacement of parts.

All manufacturer-prescribed inspection and maintenance shall be performed according to the schedule indicated in the operator's manual (or similar) provided by the manufacturer and must be documented in the instrument logbook, a separate maintenance logbook, or on the instrument maintenance checklist (available in LabWeb). ACZ management recognizes that performing all maintenance procedures at the frequency indicated by the manufacturer may not be necessary to sustain instrument optimization. Therefore, at a minimum, instrument part(s) and optimization shall be inspected according to the schedule. The analyst must use their professional judgment to determine if maintenance or replacement is necessary at that time. Decisions to deviate from the manufacturer's schedule shall be documented.

All support equipment (any device that may not be the actual test instrument, but is necessary to support laboratory operations) must be monitored regularly to confirm proper functioning. The temperature of all drying ovens, refrigerators, freezers, and incubators must be checked each day the equipment is in use and each check recorded on the associated Temperature Logsheet. Refer to SOPAD013 for more detail.

Equipment that does not meet performance specifications must be taken out of service and FRMAD029 attached to indicate the instrument or equipment is waiting for repair and cannot be used. During this downtime the department supervisor, Production Manager, and Project Manager may collectively determine it is necessary to sub-contract samples until correct performance of the repaired instrument or equipment has been demonstrated by a successful calibration or other suitable test. Document all contact with the manufacturer, as well as all repairs and other services, in the instrument or maintenance logbook to be used as a reference for solving future instrument problems. Transport and storage of measuring equipment shall be done in accordance with manufacturer recommendations. Additionally, when instrumentation or equipment goes outside of the direct control of the laboratory, the functioning and calibration status must be checked and shown to be satisfactory before it is returned to service. Refer to SOPAD013 for additional information.

To minimize downtime and prevent analytical delays, each laboratory should maintain an adequate inventory of reagents, stock standards, glassware, etc. and should keep a sufficient supply of extra "critical" parts in-house. Instrument redundancy should be established for all analyses and Instrument Qualification (IQ) should be maintained on backup instruments.

9.2 Instrument Calibration

The accuracy of all instrument-generated data relies on proper calibration. In general, calibration or standardization involves defining the relationship between instrument response and the amount or concentration of analyte introduced into the instrument. The graphical depiction of this relationship is referred to as the calibration curve.

Calibration frequency must be performed in accordance with the manufacturer's guidelines, test method or other regulatory requirements, or client contract stipulations, whichever is most stringent. Every calibration or standardization must meet the acceptance criteria stated in the SOP and shall be subsequently verified by analyzing an initial calibration verification standard (ICV) or other control standard (if specified in the SOP) that contains all target analytes and has been prepared or obtained from a different source than the one used to prepare the calibration standards.[4] Calibration standards and the second-source

[4] If a second source standard is not available calibration shall be verified using a standard from a different lot. If a different lot is not available, an analyst who did not prepare the calibration standards may prepare the calibration verification standard. For some standards, it is important to consider whether manufacturer's have obtained their material from the same lot.

UNCONTROLLED

verification standard should be prepared on different days. If they are prepared concurrently, then another qualified analyst should prepare the second-source verification standard. This minimizes the risk of both solutions being prepared consistently incorrectly.

A continuing calibration verification standard (CCV) containing all analytes of interest must be analyzed at the frequency stated in the test SOP to ensure the stability of the initial calibration curve has not varied over time due to any change in the analytical instrument and its detection system, such as instability of standards, instrument cleanliness, column performance, matrix effects, flow changes, and changes within the laboratory environment.

For applicable methods, all initial and continuing calibration steps must be clearly detailed in the test SOP. Additionally, each test SOP must specify the frequency and acceptance limits for the calibration and subsequent verification (ICV and CCV). In general, acceptance criteria are method-specific; however, the SOP may also include requirements of other regulatory agencies. Prior to resuming sample analysis, immediate corrective action must be taken if the calibration, ICV, or CCV is outside of the acceptance criteria. Technical corrective actions are described in the individual test SOPs. Refer also to §11.2 for additional information.

General calibration guidelines are listed below. Additional information is provided in the individual test SOP's and ACZ's SOP *Control of Measuring & Test Equipment* (SOPAD013).

- Understand the method requirements for calibration (minimum number of standards, etc.)
- Use the correct calibration model (linear, second-order, etc.)
- Include all target analytes in the calibration standards and second-source standard
- Analyze a calibration standard with a concentration less than or equal to the reporting limit.[5]
- Do not remove points from the middle of the calibration (only high or low standards may be dropped).
- Calibration is a single-event process. A retest of a calibration standard must be performed immediately.
- Documentation and resolution of calibration abnormalities is critical

[5] In general, the concentration of the low calibration standard is equal to the reporting limit, because lesser values are qualified as estimated; however, actual lab practice may differ and must be stated in the test SOP.

UNCONTROLLED

10 CONTROL AND STORAGE OF RECORDS AND DOCUMENTS

A formal and systematic control of records and documents is necessary to accurately reconstruct the entire history of any sample and guarantee the quality and defensibility of the data. All information pertaining to instrumentation and equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, data verification, audits, corrective actions, method validation, and data reporting must be documented, must identify all personnel involved, and must be readily understood. All records, including those pertaining to calibration and test equipment, certificates and reports, must be maintained, and the management system must facilitate the retrieval of all working files and archived records for inspection and validation purposes. Documents and records must be safely stored (protected against fire, theft, loss, environmental deterioration, and vermin) and must be held secure and in confidence to the client for a minimum of 10 years. The hard copy of all records and documents must be maintained in a designated storage area with limited access. To the extent possible, hard copies for the most recent two (2) years are stored on-site, and if necessary, may be moved to off-site storage after two years. Off-site storage conditions must meet the same criteria that apply to on-site storage.

10.1 Workgroups

10.1.1 Changes made to any workgroup record (hardcopy or electronic) must be documented.

1) If a workgroup is “dissolved” or its data deleted from LIMS, the analyst is prompted in LIMS to provide an explanation of why he/she is performing the task.

2) Changes to upload files must be documented on the hard copy of the workgroup.

10.1.2 Workgroup data that is re-uploaded *for any reason* must first be deleted. If any of the data changes, the Run Approval report shall be corrected. The workgroup shall be rescanned if necessary.

10.1.3 Document Control or other administrative personnel use a multi-page scanner with its own PDF scanning software to scan all hardcopy portions of workgroups.

1) Before the workgroup is scanned, the top page is reviewed to make sure it has both the AREV and SREV initials and dates.

2) The person scanning the workgroup must initial in the lower right hand corner of the front page of the workgroup. This provides an indication the document has been scanned.

3) The workgroup is scanned to the designated network directory and is then moved through an automated process to the appropriate read-only LabWeb directory. This directory is accessible to all employees. When a workgroup is rescanned, the previous file is maintained. A copy will be automatically created so as not to overwrite any files and will have a letter appended; starting with “A” the first time the workgroup is rescanned. <u>The most current file will not have a letter appended</u>.

10.1.4 The hard copy is filed by workgroup number in a file cabinet in the locked supply room by the front office. When capacity is reached, the workgroups are boxed and prepared for long-term storage. The front of the full storage box is labeled with the year and the workgroups contained in the box. The first box of each new calendar year is “1.” Full boxes are consecutively numbered, transferred to a designated location and stored in numerical order. The storage room is locked at all times and access is limited to authorized staff.

10.1.5 When workgroups moved to storage are accessed a checkout card must hold the place of the workgroup in the file and must indicate who removed the workgroup, the workgroup number, and the date the workgroup was removed. The checkout card is removed when the workgroup is returned.

10.2 Electronic File Retention & Storage

All electronic records, stored either on instrument computers or on the network, are systematically backed up to

UNCONTROLLED

both fixed and removable media. These records include Oracle data, instrument raw data, workgroups, client reports, instrument upload files, SOPs and other controlled documents, voice mails, and department data.

10.2.1 Critical system data is protected by Microsoft's Data Protection Manager. The Data Protection Manager is configured to maintain data for a period of 10 years.

10.2.2 All archived data is moved to a secondary machine on a weekly basis. From there, it is backed up to removable media to provide additional data redundancy.

10.2.3 The removable media from the first week of the month is pulled from service and moved to ACZ's safe deposit box at a local bank. The most recent 6 months of tapes are kept in the bank safe deposit box. Months 7 through 12 are placed in a secure, data rated, 4-hour fireproof safe that is located in the CFO's office. Note that this removable media only contains data from December 1st of the previous year to the present date.

10.2.4 At the conclusion of the calendar year, a master copy is made that comprises all of the data from December 1st of the previous year through January 31st of the following (current) year. This 14-month span of data is then moved to ACZ's safe deposit box at a local bank. At that time, the removable media that has aged 10 years is removed from the safe deposit box and its contents are destroyed. All data on the secondary machine from prior to December 1st of the previous year is removed from the system so that it is no longer included on the weekly backup.

10.2.5 Data that has aged 5 years is deleted from the Oracle Database on a monthly basis.

10.3 Instrument Data Files

Instrument raw data files are backed up by ACZ's Instrument Data Backup Application (IDBA). IDBA is a program that accesses local directories from instrument computers. Each morning the program retrieves and backs up individual data files from the specified directory on each instrument computer. Refer to ACZ's SOP *Backup and Archive of Instrument Data Files* (SOPAD044) for details.

10.4 Client Reports

10.4.1 Client reports are generated and signed electronically and are automatically stored as a PDF at a designated location on the network that has limited access. If a copy of any report exists on the network, and a new report is generated, then the existing copy will be renamed so that it is not overwritten. This way ACZ maintains a copy of all reports generated for a client.

10.4.2 Hardcopy documentation associated with a client project (CCOC, invoice, Login Review Form, etc) is filed by project number and stored in the document storage location.

10.4.3 Electronic Data Deliverables (EDD) are stored on the network at a designated location.

10.4.4 Once a project has been invoiced, the working directory is moved to the designated storage network location as a read-only PDF. If a project is un-invoiced, the project folder is copied back to the working directory where changes may take place. If an invoice is altered, a revised invoice is included with the project hardcopy.

10.4.5 In general, changes are not allowed to projects (including compilation) if the project has been invoiced. If a change needs to be made, the project must first be un-invoiced. At the time of un-invoicing, the user must provide a reason in LIMS to explain why the project was un-invoiced. This information is then stored in the Oracle database.

UNCONTROLLED

10.4.6 If a test report requires amendment after it has been issued to the client, the entire report shall be re-issued with the amendment. The amended report shall include a case narrative describing change(s) from the original report. Amended reports shall be uniquely identified and contain a reference to the original report. Typically, the laboratory number assigned to the project serves as the link to the original report. Amendments shall meet all the requirements of ACZ's quality system.

10.5 Documents

10.5.1 Standard Operating Procedures

10.5.1.1 Refer to §2.2 for additional information pertaining to SOPs.

10.5.1.2 The original master copy of each SOP is stored as a PDF in a secured public directory. The cover page indicates approval authorities. Approval is documented through emails. Whenever an SOP or SOP revision is approved, QA emails all staff whose job activities intersect the SOP or SOP revision with training instructions and a request for read receipt. The pertinent technical director shall be included in the email distribution list. This email constitutes QA's signature of approval. Read receipts constitute training signatures and the technical director's signature of approval. Emails requesting read receipts for training documentation purposes shall contain a statement that by sending read receipt the sender attests they have read, understand, and agree to follow the identified policy. MS Outlook's read receipt is mimicked for this process. To send read receipt, trainees and approval authorities reply to the sender and replace "Re" with "Read" at the beginning of the subject field. Emails documenting training and/or approval shall be converted to PDF's and stored in the same directory as the SOP master copy or a subdirectory therein. If applicable, an SOP Control Form (FRMQA003) is kept with the master copy. This form shall indicate each controlled copy of the SOP that was issued, the issue date, and which lab division the copy was distributed to

SOP master copies pre-dating the above paperless policy are located in the document control office.

10.5.1.3 All controlled copies of the previous version are collected and disposed of when a new version of any SOP becomes effective. The collect date is documented on the SOP Control Form maintained with the associated master copy SOP. LabWeb is configured so that only QA & IT staff can print or copy text from SOPs.

10.5.1.4 A printed controlled copy of any SOP may be requested from QA.

1) Each lab or department will be issued a controlled copy of any relevant test SOPs, upon request. Issued controlled copies must not be removed from the assigned area for an extended period of time and may not be photocopied. Additional controlled copies of any SOP or individual replacement pages of an SOP will be also distributed upon request.
2) To ensure outdated information is not inadvertently used as a reference, an uncontrolled copy of any SOP or SOP excerpt is not allowed unless issued by QA. Additionally, an electronic copy of any SOP becomes obsolete and must be deleted from a network drive or email once the effective version has been uploaded to LabWeb.

10.5.1.5 SOP Revisions: Any revision to a procedure must be approved by QA before changes may be implemented.

1) SOP revision proposals shall be submitted by the pertinent department supervisor (exceptions may be granted on a case by case basis) to QA through email. The email shall include:
   a. The full document ID & title in the subject line.
   b. A desired effective date.

UNCONTROLLED

c. The section(s) with proposed revisions. Strikethrough red font shall indicate proposed deletions. Blue font shall indicate proposed additions. (An editable copy or section of the SOP may be requested from QA to facilitate this activity.)

2) If QA approves the revision(s), an email will be sent to all pertinent staff stating the specific revision(s) & requesting a read receipt to document training.

3) The revision will then be incorporated into the electronic SOP stored on LabWeb.

4) On the effective date, all controlled copies of the SOP will be collected from the laboratory and new ones issued with the revision(s) incorporated. This activity shall be documented on the SOP control form.

5) The email from QA (#2 above) and records of read receipt shall be converted to PDF's, compiled, and stored in the same directory as the SOP master copy. The name of the PDF compilation shall be the effective date of the revision.

10.5.2 When documents are found to contain conflicting policies or procedures, the most recent document will be followed unless the conflict is prescribed as an exception to general protocol by a document more specific to the application.

10.5.3 All controlled forms must be printed from LabWeb and may not be stored on a separate network drive. If photocopies are used then any unused copies of the expired version must be disposed of as soon as a new version is uploaded to LabWeb. This ensures that the effective version of any controlled form is in use at all times. Exceptions may be granted by the QAO on a case by case basis.

10.5.4 Any controlled SOP(s) issued to an employee must be collected upon resignation or termination.

10.5.5 Only Document Control and QA personnel are authorized to enter or edit data for a PCN.

10.5.6 The hard copy of each PCN report generated in LIMS is stored in a three-ring binder that is maintained by the Document Control department.

10.5.7 The original certificate of analysis for any stock material, if provided, is attached to the hard copy PCN report.

10.5.8 Accreditation certificates are stored as PDF files to a designated network location. Original copies are maintained by QA. Certificates are also posted to ACZ's website.

10.5.9 Original calibration certificates and related documentation for support equipment (including but not limited to pipettes, thermometers, and glass micro liter syringes) are maintained by the QA Department.

10.5.10 LIMS and other problems pertaining to IT are documented and managed by the electronic system called Help Desk. If an employee encounters a problem that requires attention, that employee will submit a request through Help Desk. The request requires a priority be assigned. This system allows ACZ to track all changes made to computer systems. Help Desk requests are evaluated regularly by IT and upper management.

10.6 Records

10.6.1 Records include, but are not limited to: all logbooks; phone logs; raw data, derived data, and calibration data; training documentation (training forms, MDL studies, DOCs, etc.); proficiency testing results; calibration and certification records; internal audit reports; external audit reports; corrective action reports; management reports; and regulatory correspondence.

10.6.2 Records related to sample log-in are maintained as described in SOPAD045.

UNCONTROLLED

10.6.3 Records related to support equipment calibration and calibration verification are maintained as described in SOPAD013.

10.6.4 Certificates of cleanliness and volumetric accuracy received with consumable supplies (e.g. sample containers, centrifuge tubes) shall be submitted to and maintained by QA. Any other type of certificate that does not have a defined storage location shall be submitted to QA.

10.6.5 Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, dictated observations, and recorded data from automated instruments.

10.6.6 Original copies of records, except those pertaining to analytical data, are maintained by the QA department or Document Control, and access is limited.

10.6.7 Relevant qualifications, training skills, and experience of technical personnel are maintained in the employee's training file.

10.6.8 Records such as transcripts, applications for employment, performance evaluations, etc. are maintained in the personnel files, which are stored in the secured office of the CFO.

10.6.9 The DOC certification statement (FRMAD023), initial method training form (FRMQA004), General Lab Practice Training Form (FRMQA047), and Method Calibration Training Form (FRMQA050) are filed with the workgroup if the DOC was logged-in; otherwise, the DOC package is filed in the method files. An analyst training spreadsheet referencing training dates and documentation locations is maintained on a public drive.

10.6.10 Each employee's legal name, legal signature, and initials are documented on the New Employee Checklist (FRMAD043). The form is maintained in the employee's personnel file, which is stored in the CFO's office. Additionally, employee names, signatures, and initials are documented in a logbook maintained by ACZ's CFO. In the event an employee legally changes their name, the CFO is responsible for garnering new signatures and initials in the logbook; FRMAD043 is not updated in this event.

10.6.11 Each Organic Instrument ICAL data package is scanned to the designated network directory as a PDF and the hard copy stored in labeled boxes. Alternatively, a PDF may be generated directly from the instrument files. ICAL information that needs to be attached to any subsequent workgroup(s) must be printed from the PDF.

10.6.12 Logbooks shall be maintained and controlled as described in SOPAD013.

10.6.13 Project Managers are responsible for maintaining all emails pertaining to a client and/or project. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043).

10.6.14 Changes to electronic records must be traceable to the individual who made the correction, and the reason for the change must be provided. Erroneous entries cannot be destroyed by methods such as overwritten files.

10.6.15 Record Storage and Retention

10.6.15.1 The minimum record retention period of 10 years may be increased dependent upon client request, regulatory requirement, or civil action order.

10.6.15.2 Records stored by a computer must have hard copy or software backup copies.

10.6.15.3 Records stored only on electronic media must be supported by the hardware and software necessary for their retrieval and utilization in the proper format.

UNCONTROLLED

10.6.15.4 Records stored on electronic media must be stored in a way to provide protection from electronic or magnetic sources.

10.6.15.5 If there is a change in ownership and/or a change in location, all records and documents will be made available to clients for 10 years. Under no circumstances shall any records or documents be destroyed – all records and analyses performed that pertain to TNI accreditation are subject to inspection by the TNI accrediting authorities for a 5 year period. (The 10 year record retention policy is client driven, TNI standards require records be retained for a minimum of 5 years.) A new owner of ACZ will assume possession of all records and documents.

10.6.15.6 If ACZ goes out of business, all records and documents will be stored and maintained according to protocol in a location to be determined at the time of closure.

10.6.16 Access to Archived Records

10.6.16.1 Access to archived information must be documented with an access log. A log is kept in each storage location, and any person entering a storage location must provide the required information in the log.

10.6.16.2 Hard copy records are stored in a locked environment with limited access. When a record is removed from its location, a "checkout card" must be filled out to indicate who removed the record, the date the record was taken, and a description of the record. The card marks the place in the storage box, and when the record is returned the card is pulled from the box.

10.6.16.3 Any changes to be made to archived electronic data will require assistance from IT to do so.

10.6.16.4 Electronic data that has been archived to removable media is stored in a bank safety deposit box. Access is limited to ACZ's CEO and CFO and recorded in a logbook maintained by the CEO.

10.6.17 Record Disposal

10.6.17.1 Records are disposed of in a manner that ensures client confidentiality.

10.6.17.2 Stored records will be reviewed to determine which ones can be destroyed in compliance with ACZ's record retention policies.

10.7 Computer Data and Records

10.7.1 Network File Server

Computer files pertaining to all aspects of ACZ's business are stored on a series of file servers. To gain access, an employee logs on to the "LAB" domain. Each employee has a unique network user name so that security rules may be enforced. No "guest" logon is permitted. Every employee belongs to a specific "group" and directory security is enforced through privileges granted to these groups. An employee is granted access to files that pertain to their job functions. Other files will be granted read-only or no access as appropriate to the employee's position.

Data generated and reported by ACZ is extremely confidential and the company may be liable for the consequences of the release of this data to any unauthorized person. The implementation of password security is not arbitrary and ensures data is protected and cannot be disclosed to outside parties. Weak passwords that are not changed frequently make this scenario more likely.

In general, the network will prompt employees to change their password every 30 days. The password must be at least five (5) characters. Numeric characters are optional. Passwords may not be shared with other employees, unless necessary for work purposes. The use of another employee's password without permission from ACZ's

UNCONTROLLED

CEO, QAO, or IS Manager (with the exception of common passwords for shared computers) is grounds for disciplinary action.

10.7.2 LIMS Server

a. Information stored in LIMS consists of all sample and client information needed for day-to-day production activities. The information is stored in an Oracle database. Access is controlled through membership in "groups." Employees may update and change database records according to their job responsibilities. Otherwise, information is restricted to read-only access or no access.

b. No modifications to data can be made through applications not authorized by ACZ's IT department unless a CAR or Help Desk ticket is submitted or documentation is provided on the hardcopy of the workgroup. Unauthorized applications include any form of direct database manipulation.

c. Tracked changes will be audited on a regular basis by the QA department or its designee to ensure sufficient information is being supplied as to why changes occur. The explanations must be both professional and specific.

10.7.3 Docs Server

Access to the docs server is read-only and is permitted through Internet Information Services (IIS) authentication and is logged in IIS log files. The server is updated on a regular basis by automated scripts.

UNCONTROLLED

11 ELEMENTS OF QUALITY CONTROL

A critical focus of ACZ's quality control policies and protocols involves monitoring sample preparation and measurement processes to determine matrix effects and to evaluate laboratory performance. Quality control samples are typically analyzed with every batch of environmental samples. Each test SOP provides detailed information regarding quality control sample types, acceptance criteria, and corrective actions, if applicable to the procedure, and reflects the requirements of the method and/or other regulatory authorities.

Performance control samples demonstrate precision or accuracy and expose out-of-control events. Matrix-specific control samples indicate possible effects of the matrix on method performance and may also identify data as in-control or out-of-control. Data that is out-of-control dictates corrective action ranging from re-preparation and re-analysis to reporting data with qualifiers. In general, the corrective action specified in the SOP shall be performed if any quality control sample does not meet the acceptance criteria.

To the extent possible, client samples are reported only if all quality control measures are acceptable. If any measure is outside of the acceptance criteria, and the data will be accepted and reported to the client, then the appropriate data qualifier(s) must be assigned to all associated samples. The list of current extended qualifiers is maintained in the LIMS database.

11.1 Method Performance

11.1.1 Negative Control – Prep Blank (Method Blank)

A prep blank or method blank shall be analyzed at a minimum of one per batch. The blank shall be processed along with and under the same conditions as the associated samples. Method blanks are not applicable for certain analyses, such as pH, Conductivity, Flash Point, and Temperature.

The prep blank is used to assess possible contamination introduced during sample processing steps. A prep blank is prepared using Type I water or other similar matrix that is free of the target analyte(s) and contains all reagents in the same volumes used to prepare the client samples. Unless specified in the test SOP, sample concentration may not be corrected for the prep blank value.

While the goal is to have no detectable contaminants, each prep blank must be carefully evaluated as to the nature of the interference and the effect on the analysis of each sample in the batch. Contamination in the prep blank results from four principle sources: the environment the analysis is performed in; the reagents used; the supplies and apparatus used; and the analyst performing the analysis. Contamination sources vary and the test SOP must be referenced to determine appropriate corrective action.

When method blanks fail acceptance criteria, potential sources shall be investigated and measures taken to correct, minimize or eliminate the problem, and associated client samples must be reprocessed and reanalyzed. Alternatively, data may be reported with the appropriate qualifier if reprocessing and reanalysis is not possible or if one of the following criteria is met:

i) The concentration of a target analyte in the blank is at or above the acceptance limit and the measured concentration of the analyte in an associated sample is greater than 10 times the measured concentration of analyte in the blank.

ii) The concentration of the target analyte in the associated sample is less than the MDL.

iii) Corrective actions could not be performed or are ineffective. Thoroughly document any corrective action taken and the outcome.

11.1.2 Positive Control (however named): Laboratory Fortified Blank (LFB), Laboratory Fortified Blank Duplicate (LFBD), Laboratory Control Sample Water (LCSW), Laboratory Control Sample Water Duplicate (LCSWD), Laboratory Control Sample Solid (LCSS), Laboratory Control Sample Solid Duplicate (LCSSD).

UNCONTROLLED

1) The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps.

2) The LCS is a quality system matrix, known to be free of the analytes of interest, spiked with known concentrations of analytes. Alternatively, an appropriate Certified Reference Material (CRM) containing the analytes of interest may be used.

3) If no separate preparation method is used (e.g. dissolved metals), an ICV or CCV may double as the LCS. If different acceptance criteria are specified, the most stringent criteria shall be observed.

4) Each test SOP must define the positive control to be used for the procedure, the required frequency, acceptance criteria, and contingencies for corrective action.

5) Unless the reference method specifies a different frequency, the LCS shall be analyzed at a minimum of one per batch, not to exceed 20 environmental samples.

6) Any affected samples associated with a failing LCS shall be re-processed for analysis or the results reported with appropriate data qualification. A failing LCS may be re-tested once to confirm the failure. Additional re-tests must be accompanied by documented corrective action taken between tests. For example, the instrument did not sample from the correct tray position in the first two tests; alignment was corrected for the third test.

   Note: In general, qualification of data for LCS failures is only permitted if there is insufficient sample for re-analysis, the data is extremely time sensitive, or the LCS failed high but the analyte was not detected above the reporting limit in the sample.

7) The components to be included in the LCS shall be as specified by the method, regulation, or as requested by the client. **In the absence of such specifications, the following rules shall be observed (Radiochemistry excluded)** :

   1) For those components that interfere with an accurate assessment, such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike shall be chosen that represents the chemistries and elution patterns of the components to be reported.

   2) For those methods that have extremely long lists of analytes, a representative number may be chosen. The analytes selected shall be representative of all analytes reported. The following criteria shall be used for determining the minimum number of analytes to be spiked. **However, the laboratory shall insure that all targeted components are included in the spike mixture over a two (2) year period**:

      i. For methods that include one (1) to ten (10) targets, spike all components.

      ii. For methods that include eleven (11) to twenty (20) targets, spike at least ten (10) or 80%, whichever is greater.

      iii. For methods with more than twenty (20) targets, spike at least sixteen (16) components.

8) An LCSW duplicate may be prepared and analyzed with the batch, typically in lieu of a matrix duplicate or spike duplicate. Data is acceptable if the LCSW and/or LCSWD is within the acceptance limits and the RPD passes. Associated samples must be re-prepped and reanalyzed if either of the following occurs:

   a) LCSW/D RPD fails the acceptance criteria specified in the SOP.

   b) % R of both the LCSW and LCSWD is outside the acceptance limits.

9) For a solid or semi-solid matrix, an LCSS and LCSSD are often prepared and analyzed.[6] The data is acceptable if the LCSS and/or LCSSD are within the acceptance limits and the RPD passes. Associated samples must be re-prepped and reanalyzed if any of the following occurs:

   a) LCSS/D RPD fails the acceptance criteria specified in the SOP.

[6] Corrective action for Recommendation #5 cited in the 2002 ADHS audit report.

UNCONTROLLED

b) % R of both the LCSS and LCSSD is outside the acceptance limits.

10) When the acceptance criteria for the LCS are exceeded [i.e. high bias] then any associated client sample with a measured concentration less than the reporting limit (MDL or PQL) may be accepted and reported with the appropriate qualifier.

11) Refer to §11.1.3.3 for additional information regarding data assessment for solid-matrix workgroups prepared with both LCSS/LCSSD and MS/MSD.

12) An LCS is not required for those analytes for which no spiking solution is available.

13) The following apply to radiochemistry only:

a) The activity of the LCS shall be at least 10 times the Lower Limit of Detection (LLD) or Minimum Detectable Activity (MDA). Note: this requirement does not apply to DOCs.

b) Whenever possible, the standards used to prepare the laboratory control sample shall be from a source independent of the standards used for instrument calibration.

c) Where a radiochemical method, other than gamma-ray spectroscopy, has more than one reportable analyte isotope (e.g. plutonium, 238Pu and 239Pu, using alpha-particle spectrometry), only one of the analyte isotopes needs to be included in the laboratory control sample at the indicated activity level. However, where more than one analyte is detectable, each shall be assessed against the specified acceptance criteria.

d) Where gamma-ray spectrometry is used to identify and quantify more than one analyte, the laboratory control sample shall contain gamma-emitting radionuclides that represent the low (e.g., Am^{241}), medium (e.g., Cs^{137}) and high (e.g., Co^{60}) energy range of the analyzed gamma-ray spectra. As indicated by these examples, the nuclides need not exactly bracket the calibrated energy range or the range over which nuclides are identified and quantified.

e) The laboratory control sample shall be prepared with similar aliquot size to that of the routine samples for analyses.

11.1.3 Sample Specific Controls

The effect of different sample matrices on the performance of any method can be profound; therefore, matrix spikes, duplicates, and surrogate compounds are analyzed to evaluate matrix effects on data quality. Each SOP includes specific information regarding the usage and evaluation of matrix-specific QC samples and also states the required corrective action to take if any matrix QC fails.

ACZ provides analytical services to numerous and varied clients. Therefore, the possibility of routinely favoring one client or sample is highly unlikely, and over time the samples from all routine sources should be fortified. ACZ recommends that analysts, to the extent possible, select samples to spike or duplicate that are representative of the workgroup. Analysts are not to associate QC with a client sample known to be or believed to be any type of blank or Proficiency Testing sample. Several exceptions exist for selecting samples for spiking or duplicating:

1 A sample is not spiked or duplicated if the volume is inadequate and the client sample and QC sample(s) would require dilution; however, if no other option is available then the client sample and Duplicates should be prepared and analyzed on the same dilution whenever possible. Matrix spikes will not be accepted on different dilutions (minor d.f. variations in soils samples are acceptable) unless no other alternative exists. The data must be qualified in this event.

2 Use the same weights (as close as possible) to prepare duplicates of solid matrix samples.

3 A client may require that one or more of their samples be spiked or duplicated. A “RUN QC” comment is added when the sample is logged in to notify the analyst that QC must be performed for a specific sample or project. Alternatively, the Special Instructions function in ACZ’s LIMS may be used to communicate the request. If a client requests that their sample(s) be spiked or duplicated, ACZ will accommodate the client for a fee.

UNCONTROLLED

4 A reactive sample is unpredictable and is a poor choice for spiking or duplicating.

5 A PT sample is not a real-world sample and is a poor choice for spiking or duplicating, because the data does not provide any useful information about possible matrix effects. When selecting samples for batch QC such as spikes or duplicates, PT samples should be avoided. If insufficient volume exists to spike or duplicate any other samples in the batch, it is appropriate to select a PT sample. It is better to use the PT sample for a duplicate than a spike if this choice is presented. If a batch consists solely of a PT sample, QC designed to assess matrix effects is not required (e.g. spike, SDL); an assessment of precision is still required and may be accomplished by duplicating the PT sample, or preferably, running a duplicate of the positive control.

11.1.3.1 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but are not normally found in environmental samples. Surrogates are included in the scope of Organic methods and are used to evaluate accuracy, method performance and extraction efficiency and are added to environmental samples, controls, and blanks, in accordance with the method requirements.

When surrogate recoveries fail acceptance limits, corrective action stated in the test SOP shall be performed. If corrective action cannot be performed or is ineffective, reported data must be appropriately qualified.

11.1.3.2 Matrix Spike Samples

A matrix spike sample (however named) is used to determine the level of bias (accuracy) associated with a particular matrix. For the purposes of this document, “MS” designates a matrix spike, and “MSD” designates a matrix spike duplicate. Spikes are prepared by adding a known and appropriate quantity of each target analyte to a replicate aliquot of client sample.

The required analytical frequency is specified by the method or other regulating entity and is indicated in the test SOP. Each result is evaluated against the acceptance criteria, and matrix effects are determined and reported to the client. The following evaluation criteria apply to spikes that are subjected to processing steps and post-digestion spikes (analytical spikes).

- Percent Recovery (%R) is considered for all spikes.
- %R is evaluated only if the theoretical concentration in the spiked aliquot is greater than or equal to the reporting limit; otherwise, each associated client sample must be reported with the appropriate qualifier, regardless of %R.
- If %R for the MS and/or the MSD is outside of the acceptance limits, the RPD passes, and all other pertinent prep and instrument QC passes, each associated client sample may be accepted and reported with appropriate qualification.

11.1.3.2.1 The components to be included in the MS & MSD shall be as specified by the method, regulation, or as requested by the client. **In the absence of such specifications, the following rules shall be observed (Radiochemistry excluded)**:

1) For those components that interfere with an accurate assessment, such as spiking simultaneously with technical chlordane, toxaphene and PCBs, the spike shall be chosen that represents the chemistries and elution patterns of the components to be reported.

2) For those methods that have extremely long lists of analytes, a representative number may be chosen. The analytes selected shall be representative of all analytes reported. The following criteria shall be used for determining the minimum number of analytes to be spiked. **However, the laboratory shall**

UNCONTROLLED

insure that all targeted components are included in the spike mixture over a two (2) year period:

a) For methods that include one (1) to ten (10) targets, spike all components.

b) For methods that include eleven (11) to twenty (20) targets, spike at least ten (10) or 80%, whichever is greater.

c) For methods with more than twenty (20) targets, spike at least sixteen (16) components.

11.1.3.3 Matrix Duplicates and Matrix Spike Duplicates

The matrix-specific precision associated with an analysis is determined through the use of a matrix duplicate (DUP) or spike duplicate (MSD), which are performed at a frequency specified by the method or other regulating entity (refer to the specific test SOP). If the method does not prescribe a frequency, a duplicate shall be included in each workgroup, not to exceed 20 samples. The results are evaluated, and the matrix affect on precision are determined and reported to the client.

- Relative Percent Difference (RPD) is used to evaluate precision, unless the test SOP specifies a different technique (§12.4.6).
- RPD for a spike duplicate is evaluated only if the observed concentration is greater than or equal to the reporting limit; otherwise each associated client sample must be reported with the appropriate qualifier.
- RPD for a matrix duplicate is evaluated only if the observed concentration is greater than 10 times the MDL or 2 times the PQL if an MDL has not been established; otherwise each associated client sample must be reported with the appropriate qualifier, regardless of RPD.
- In the absence of other contributing factors, a DUP failure for a solid or semi-solid matrix is attributed to non-homogeneity of the sample, and each associated client sample may be reported with the appropriate qualifier.
- For an aqueous matrix, if the DUP fails then all associated samples must be retested. If permitted by the instrument software the sample and DUP can be reanalyzed at the end of the analysis in lieu of retesting all associated samples.
- For an aqueous matrix, if the MS/MSD RPD fails then the associated samples must be reanalyzed. If permitted by the instrument software the sample and MS/MSD can be reanalyzed at the end of the analysis in lieu of retesting all associated samples.
- If applicable, evaluate the LCS/LCSD if the RPD fails for a matrix duplicate or spike duplicate. Each associated client sample may be reported with the appropriate qualifier if the LCS/LCSD meets the criteria stated in §11.1.3.2.
- For a solid or semi-solid matrix, if both the LCSS and LCSSD recoveries pass but the RPD fails, then acceptable precision may be demonstrated by a passing RPD for the MS/MSD, and each associated client sample may be reported with the appropriate qualifier.
- A sample and duplicate may only be re-analyzed once before additional corrective action is required. If more than one re-analysis is performed, the workgroup documentation must include justification.

11.2 Instrument Specific Controls

UNCONTROLLED

All data must be associated with a passing instrument calibration and initial calibration verification. To the extent possible, all data must be associated with passing continuing calibration verification. If the initial calibration verification results (ICV/ICB) are outside of the acceptance criteria, then the source of the failure must be identified, necessary corrective action performed, and the instrument recalibrated if necessary before proceeding with sample analysis.

If the continuing calibration verification results (CCV/CCB) do not meet the acceptance criteria, then the source of the failure must be identified and corrective action performed, including recalibration if necessary, before continuing with sample analysis. If reanalysis of any sample associated with failing calibration verification is not possible and results will be reported, the data shall be appropriately qualified.

For instruments that permit the analysis of subsequent workgroups using the most recent calibration, two (2) consecutive attempts of the opening CCV/CCB are allowed. If both attempts fail to produce acceptable results then the sources of failure must be identified and corrective action performed, including recalibration if necessary, before commencing sample analysis.

If a CCV or ICV retest fails and the instrument is not recalibrated, 2 consecutive passing CCVs or ICVs are required before continuing with analysis.

Unless stated otherwise by the test SOP, passing calibration verification must bracket all batch quality control samples, and results for additional instrument check standards, if applicable, must be within the acceptance criteria stated in the SOP. However, when the acceptance criteria for a CCV or CCB are exceeded (i.e. high bias) any associated client sample with a measured concentration less than the MDL may be accepted and reported with the appropriate qualification. This exception is not allowed if the workgroup contains a batch LCS (however named) which fails low.

11.3 Other Control Indicators

11.3.3 Internal Standards

Internal Standards (IS) are measured amounts of certain compounds added after preparation or extraction of a sample to be analyzed. The IS is an analyte not likely to be found in the environment and is used in a calibration method to correct sample results affected by column injection losses, purging losses or viscosity effects. The IS is added to client samples, controls and blanks in accordance with the method requirements. When the results are outside of the acceptance limits for applicable quality control samples, corrective actions shall be performed. Once system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions could not be performed or are ineffective and associated sample results will be reported, the data must be appropriately qualified.

11.3.2 Trip Blank

The trip blank is a sample container filled in the laboratory with Type I water that is shipped to the collection site in the sample cooler, returned to the laboratory, logged-in, and analyzed in the same manner as the client samples. With the exception of Hg-1631, trip blanks are not opened in the field.

11.3.3 Instrument Blank

The instrument blank is an aliquot of Type I water processed only through the instrument steps of sample analysis and is used to determine presence of instrument contamination. For Organic instrument methods, neither surrogate nor IS standards are added.

11.3.4 Equipment Blank

An equipment blank is provided by the client and is used to assess the effectiveness of equipment decontamination procedures. Type I water is poured into (or over) or pumped through the sampling device, collected in a sample

UNCONTROLLED

container and transported to the lab to be analyzed for all parameters requested for the environmental samples collected at the site.

11.3.5 Ambient Blank

The ambient blank consists of Type I water poured into a VOA vial at the sampling site (in the same vicinity as the associated samples). It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared when samples are to be analyzed for VOA analytes and are used to assess the potential introduction of contaminants from ambient sources (e.g. active runways, engine test cells, gasoline motors in operation) to the samples during sample collection. The frequency of collection for ambient blanks is specified in the client's field-sampling plan. Ambient blanks are not required for all projects.

11.3.6 Radiological Tracers & Carriers

Radiological tracers and carriers are used for radiological analyses. The control reacts in the same manner as the target isotope and is used to assess analyte recovery. The tracer is added to client samples and QC in accordance with the requirements stipulated in the test SOP. Because the tracer recovery has a direct impact on the LLD, the recovery must be high enough to yield LLDs that are within the scope of the project or meet ACZ's acceptance criteria. Refer to the test SOP for evaluation criteria and corrective action(s) for out-of-control tracer recovery.

11.4 Titrants – Where applicable, test SOPs shall include procedures for verifying the concentration of titrants prepared by the laboratory. Verification is not required for purchased titrants with certified values. If a purchased titrant is diluted, verification is required.

UNCONTROLLED

12 EVALUATING QUALITY CONTROL SAMPLES

In general, acceptance criteria for quality control samples are method-specific; however, compliance with the requirements of clients and regulatory or other accrediting agencies must also be demonstrated. Immediate corrective action must be taken if any quality control is outside of the acceptance criteria. Appropriate corrective actions are described in the test SOP. To the extent possible, client samples are reported only if all quality control measurements are acceptable. If a quality control measure is outside of acceptance criteria, and the data will be reported, then all samples associated with the failed QC must be appropriately qualified. Clients will occasionally request limits different from those in a published method. Deviations from ACZ's policies pursuant to client request must be explicitly noted on client reports. ACZ will not be held liable in the event such deviations do not meet client regulatory needs.

Unless otherwise stated, for the purpose of determining conformance to specifications, ACZ employs the rounding method described in ASTM E29. When using this method, observed values are rounded to the same decimal place limits are expressed before assessing conformance. For example, if the calculated percent recovery for an LCS is 89.5% and the QC limits are 90 to 110%, the percent recovery would be rounded to 90% and evaluated as passing. (Note: double rounding is NOT permitted, e.g. 89.48 rounds to 89.5 rounds to 90.) Conversely, if limits were expressed as 90.0 to 110.0%, the same LCS would be evaluated as failing acceptance criteria. Analysts must consider whether the QC limits expressed in the test method cohere in a technically sound manner with the rounding method. If they do not, the SOP must express the limits to a technically sound numerical place value, or the absolute method must be employed. The absolute method takes a limit of 6˚C, 6.0˚C, and 6.000˚C all to mean the same thing, exactly 6 degrees Celsius.

For methods that permit the use of control charts or do not specify acceptance criteria for quality control measurement, limits may be generated by plotting historical data obtained from analytical processes considered in control. Whenever practical, a minimum of 20 data points is used. The process of rejecting data points relies heavily on the statistician's judgment and control chart activities are therefore restricted to supervisors and experienced analysts. All points must be associated with passing calibrations and calibration verification(s). Data points with known anomalies must be rejected. Data points should not be rejected solely because they fail acceptance criteria. Control chart documentation must clearly indicate rejected data points. ACZ's LIMS has a utility for querying and retrieving historical data for control chart applications. Control chart limits are typically set at ± 3σ. All control chart limits are reviewed and approved by the QA department prior to implementation. When possible, a comparison to previous limits is included in the review and may form the basis for rejecting new limits and requiring an investigation of the analytical system's condition. Previous limits are archived in a network folder. Default acceptance criteria established by the Arizona Department of Health Services (ADHS) may be used in lieu of generating a control chart to establish limits; however the SOP must specify which limits are in use.[7] **NOTE:** For all data evaluation, final results ending with 1 – 4 are rounded down and results ending with 5 – 9 are rounded up.

12.1 Accuracy

Accuracy is defined as "The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations". Control samples (LCS or LFB) and spiked samples are analyzed with every batch of samples or as stipulated by the specific test SOP to assess accuracy and matrix effects.

- Percent Recovery (%R) for a control sample is calculated as follows:

$$\%R = \frac{M}{S_p} \times 100$$

Where: M = Measured concentration of the control sample
S_p = True value of the control sample

[7] Arizona Administrative Code (A.A.C.), Title 9, Ch. 14, Article 6, Exhibit II (December, 2006)

UNCONTROLLED

- Percent Recovery (%R) for a spike is calculated as follows:

$$\%R = \frac{M - S}{S_p} \times 100$$

Where: M = Measured concentration of the spiked sample
S = Measured concentration of the sample aliquot
S_p = True value of the spike concentration

12.2 Precision

Precision is defined as "The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms." Matrix duplicates and spike duplicates are analyzed with every batch of samples or as stipulated by the test SOP to determine the precision associated with the analysis. If any method does not specify acceptance criteria for the RPD, then default criteria of RPD $\leq$ 20 is used (a value that rounds to 20 is acceptable). [8] The Relative Percent Difference (RPD) as an absolute value is calculated as follows:

$$|RPD| = \frac{(S - D)}{[(S + D) / 2]} \times 100$$

Where: S = Sample Value
D = Duplicate Value

12.3 Other Calculations

- Solids Dilution Factor:

$$\text{Dilution Factor} = \frac{V}{(W)(\%\ solid)}$$

Where: V = Final digestate volume, in mL
W = Sample weight used, in g
%solid = %solid of the sample as a fraction

- Sample Concentration for Solids:
  - wet weight [biota tissue, fruit or vegetable matter, etc.]: $mg/Kg = \frac{DF * C * V}{W}$
  - dry weight [plant matter, grasses, soil, sludge, etc.]: $mg/Kg = SF * C * DF$

Where: DF = instrument dilution factor
C = raw data value, in mg/L
V = Final volume of digestate, in L
W = sample (as received) weight used, in Kg
SF = soil dilution factor

- Percent Difference for Serial Dilution (SDL):

$$|\%D| = \frac{[I - (s * 5)]}{I} \times 100$$

Where: I = initial sample result
s = serial dilution result (raw data value)

For SDL calculations in LIMS, "s" is multiplied by 5 and the resulting "reg value" is compared to the "found value" to calculate %D.

[8] ADHS Information Update #87 (July 7, 2005)

UNCONTROLLED

12.4 Radiochemistry Calculations: (**NOTE**: Specifications in the individual test SOPs supercede the information detailed below.)

12.4.3 Activity

The results of radioactivity are typically reported in terms of activity per unit volume or mass. Units are normally expressed in picocuries (pCi), which equal 2.22 disintegrations per minute (dpm). Specific formulas to determine activity are in the SOP for each method. The general formula is as follows:

$$C = \frac{R_{net}}{(e)(y)(i)(v)(u)}$$

Where: C = activity per unit volume (pCi/L)
R_{net} = net counts per minute
e = counting efficiency, cpm/dpm
y = chemical yield
i = ingrowth correction factor
v = volume or mass being counted (L)
u = units correction factor, 2.22 for cpm to pCi

12.4.4 Counting Error

Radiochemical data are considered incomplete without reporting associated random and systematic errors. For this reason all radiochemical results should be accompanied by a counting error at the 95% confidence level (1.96*standard deviation). The general counting error formula is as follows:

$$E = \frac{1.96(R_o / t_1 + B / t_2)^{1/2}}{(e)(y)(i)(v)(u)}$$

Where: E = counting error
R_o = gross sample, cpm
t_1 = sample count duration, min
B = background, cpm
t_2 = background count duration, min
e, y, i, v, and u are as previously defined.

12.4.5 Lower Limit of Detection (LLD)

LLD (also referred to as Minimum Detectable Activity or MDA) is considered the smallest quantity of sample radioactivity that will yield a net count for which there is a pre-determined level of confidence that radioactivity is present. At the 95% confidence level, the following equation calculates the LLD for any single nuclide. The calculation uses the standard deviation for the background counting rate, assuming the sample and background counting rates should be very similar at the LLD. The formula for determining LLD is as follows:

$$\mathrm{LLD}_{95} = \frac{4.66 S_b}{(e)(y)(i)(v)(u)}$$

Where : LLD_{95} = Lower limit of detection at the 95% confidence interval
S_b = Standard deviation of the instrument background counting rate, cpm
e, y, i, v, and u are as previously defined

UNCONTROLLED

12.4.6 Precision

The normalized absolute difference, or Replicate Error Ratio (RER), between the sample and the laboratory duplicate, given by the following equation shall be used to determine that results do not differ significantly when compared to their respective 2* sigma uncertainty.

$$RER = \frac{|Sx - Dup|}{\sqrt{(Sx_{error})^2 + (Dup_{error})^2}} \leq 2.0$$

Where: Sx = sample concentration in pCi/L
Sx_{error} = sample counting error (in pCi/L) at the 95% confidence level.
Dup = duplicate concentration in pCi/L
Dup_{error} = duplicate counting error (in pCi/L) at the 95% confidence level.

NOTE: For Radchem samples, both RPD and RER may be used to evaluate precision. RPD is the default assessment for Drinking Water samples; RER is the default assessment for non-Drinking Water samples. Data for both RER and RPD are uploaded to LIMS for all analyses. Use the following guidelines to correctly assess precision. Further details are provided in ACZ's Wiki and should be consulted to ensure data for each workgroup is correctly evaluated. Go to LabWeb \ Wiki \ Analytical Departments \ Radio Chemistry.

Drinking Water:

RPD $\leq$ 20, RER < 2.0 – Precision is judged to be in control
RPD $\leq$ 20, RER > 2.0 – Precision is judged to be in control;
RPD > 20, [sx] < 5x [LLD], RER < 2.0 – Precision is judged to be in control; qualify data.
RPD > 20, [sx] > 5x [LLD], RER> 2.0 – Precision of the prep batch is questionable.
RPD > 20, [sx] > 5x [LLD], RER < 2.0 – Precision of the prep batch is questionable.

Non-Drinking Water:

RER < 2.0, RPD $\leq$ 20 – Precision is judged to be in control.
RER < 2.0, RPD > 20 – Precision is judged to be in control;
RER > 2.0, RPD $\leq$ 20 – Precision of the sample prep batch is questionable.
RER > 2.0, RPD > 20 – Precision of the sample prep batch is questionable.
RER > 2.0, [sx] > 5x [LLD], RPD $\leq$ 20 – Precision is judged to be in control; qualify data.

UNCONTROLLED

13 VALIDATION AND REVIEW OF ANALYTICAL DATA

ACZ has a responsibility to provide the best data possible to ensure our clients can make sound and cost-effective decisions regarding public health and the environment. In order to generate and report reliable data, the analytical systems used need to be properly functioning, and the review process must be conducted in a manner that is logical and reasonable and would be defensible if subjected to legal scrutiny. Decisions regarding data quality must be meaningful and must be backed by good science and sound professional judgments.

The entire validation and review process encompasses more than solely evaluating the final results for client and quality control samples. To this extent, the necessary steps must also be performed *prior* to sample preparation or analysis to ensure the quality of the data. Following sample analysis, data is uploaded to the LIMS database and then submitted to a variety of process chains such as calculations, rounding, application of qualifiers, etc. A multi-level data review process is utilized to verify the uploaded analytical data meets all documented ACZ requirements as well as any client-specific quality objectives. At a minimum, the validation process must include the following steps, as applicable:

- Monitor the expiration dates for all stock, intermediate, and working standards, reagents, and chemicals.

- Prior to analysis, determine that holding times have not been exceeded. Unless otherwise specified by the test SOP, sample preparation and analysis must be completed within the holding time.

- Prior to analyzing samples, verify the correct set-up and operation of the instrument or equipment. Perform calibration, maintenance, and optimization as necessary to ensure proper functioning.

- QC Association
  1) In general, for QC frequency of 1 per10 or less client samples, the first set of QC is associated with samples 1 – 10. If there are fewer than 20 samples in the workgroup, then the remaining client samples are associated with the second set of QC.
  2) If sample characteristics or amount dictate that 2 of the first 10 samples be spiked or dup'd, then the first spike or DUP is associated with samples 1 through 11 excluding the 2nd sample spiked or dup'd, and the 2nd spike or dup is associated with itself and samples 12-20. For example, if samples 3 & 5 are spiked in a 20 sample batch, sample 3 is associated with 1-4 & 6-11, and sample 5 is associated with 5 and 12-20. The same principle applies if both spiked or dup'd samples reside in the 2nd set of ten within the workgroup sequence.
  3) Variations to the QC association rules noted above are permitted but must be documented with the WG. The documentation must define the altered QC association and provide a compelling, technically sound reason for the deviation. QC association may **not** be changed after data has been acquired.
  4) QC association must be properly defined in LIMS.

- Before completing workgroup creation, verify the correct PCNs and/or SCNs have been entered. Percent recovery for control samples and spikes is calculated using the information in LIMS for each.

- Verify the proper sub-sample (green dot, yellow dot, etc.) is being used for preparation or analysis.

  - Notify the supervisor or Production Manager as soon as possible if a sample cannot be located.
  - Document on the bench sheet if a sub-sample other than the type indicated in the SOP is used.

- Clearly label tubes, beakers, autosampler cups, etc. to identify the sample (and dilution factor, if applicable).

- Manage sample volume to ensure all analyses from a bottle type can be completed.

- Document all dilution factors at the time the dilution is performed.

UNCONTROLLED

- Record complete and accurate observations when an analysis, sample preparation, or sample matrix is unusual or problematic.

- Ensure transcription errors do not occur. Verify all data manually entered into LIMS is correct before completing the upload process.

- The calibration workgroup must be associated with all subsequent workgroups. Record the calibration workgroup number (or calibration file name) on the data review checklist.

- Provide complete traceability for all standards and reagents used for sample preparation and analysis.

- Batch quality control samples must be treated in the same manner as client sample, including preparation.

- If it is necessary to perform a calculation manually, use the values in the raw data [do not truncate] and then round the final result to the appropriate numerical place value. If the final result passes the acceptance criteria then pass the QC in LIMS and note on the data review checklist that it passes.

- LIMS performs several additional QC calculations on the approved data including cation/anion balance (CAB) checks, calculated TDS versus actual TDS ratios, and Total versus Dissolved ratios. The Project Manager may update the status of pertinent samples to REDO if one of these calculations indicates a discrepancy with the associated data.

- If two attempts fail to produce acceptable data then notify the supervisor or Production Manager before taking further action. It may be necessary to first determine if a larger problem is interfering with the analysis. Investigate the problem before qualifying the associated data.

- If there is an indication the analytical system is out of control, the issue must be investigated. Notify the supervisor immediately. Conduct troubleshooting in a systematic, organized manner.

- All data must be reviewed initially in LIMS [AREV] by the analyst who performed the analysis or another individual authorized to perform or AREV the procedure. The department supervisor or another individual authorized for SREV performs the secondary review [SREV]. The following are data review guidelines:

  1. A data review checklist must be completed during the review process. Verify all items listed and note any errors, problems or non-compliances and the corrective action(s) taken.

  2. If applicable, review the raw data to verify the analytical system was in control and to ensure no anomalies exist. Check for notes on the bench sheet regarding the preparation or analysis.

  3. For client samples and quality control samples, ensure all results are within the measurement range and are bracketed by a passing calibration and passing calibration verification [ICV/ICB or CCV/CCB]. Sample values outside of the measurement range must be appropriately qualified if reanalysis is not possible.

  4. The corrective action specified in the SOP must be performed if any quality control sample does not meet the acceptance criteria.

  5. Data generated after the hold time has elapsed may not be usable for the client. If reprep or reanalysis will be conducted outside of the holding time, check first with the supervisor.

  6. Confirm all dilutions are appropriate. A reasonable explanation must be provided on the bench sheet if a sample was diluted and the value is less than the quantitation limit (refer also to §15).

UNCONTROLLED

7 If a spike fails, determine if the sample concentration is disproportionate to the spike added. If the analyte concentration in the sample is more than 4 times the spike concentration, note the failure on the checklist and appropriately qualify the associated samples.

8 If a spike recovery suggests the sample was not spiked, matrix interference must be confirmed prior to qualifying samples. If matrix interference cannot be confirmed, then re-prep and/or re-test all associated samples.

9 Each associated client sample must be appropriately qualified if the matrix spike, matrix duplicate, or spike duplicate data cannot be used for validation purposes.

10 Confirm failed QC by verifying the correct PCN or SCN was entered. Make corrections if necessary before proceeding with data review.

11 Verify all assigned qualifiers are appropriate. Does use of a particular qualifier make sense? Could data be defended using the qualifier assigned to the scenario or problem?

12 If a case narrative is necessary, the reason for accepting and reporting the data must be sound and logical. Provide sufficient and accurate verbiage to ensure the data is legally defensible.

13 If a sample was retested in the same workgroup, verify the correct data will be reported. All other data for the sample must be failed; LIMS cannot report multiple datum for the same sample-product-analyte combination.

14 Confirm all samples have the correct status (PASS, FAIL, REDO, REDX) before completing the review process. For multi-parameter workgroups, all analytes must have the correct status.

15 Refer also to §11 for data evaluation criteria.

UNCONTROLLED

14 DETECTION LEVELS

Current practice identifies several detection levels, each of which has a defined purpose: Instrument Detection Limit (IDL), Method Detection Limit (MDL), Reporting Limit (RL), and Practical Quantitation Limit (PQL). The MDL and PQL are stated in each test SOP and are adjusted accordingly in LIMS when data is uploaded to reflect the use of smaller sample volume (dilution) or larger sample volume (concentration).

14.1 Instrument Detection Limit (IDL)

The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the selected analytical mass(es). (EPA Method 200.8 definition.)

14.2 Method Detection Limit (MDL)

The EPA defines the MDL as the "minimum concentration of substance that can be measured by a specific testing protocol and reported with 99% confidence that the analyte concentration is greater than zero…" This confidence interval means that any substance detected at a concentration equal to the MDL is 99% likely to be present, but it also means there is a 1% chance that the substance will be considered falsely present (false positive). The MDL procedure is designed so that the probabilities of both false positive and false negative errors are acceptably small; however, the procedure has limitations. Data users must understand the limitations when evaluating low level data and must proceed with caution when interpreting data reported between the MDL and PQL in order to minimize the risk of making poor environmental decisions.

MDLs are dependent on variables (temperature, instrument conditions, analysts, matrix, etc.) and are typically determined by processing, preferably over the course of several days, at least seven individual replicates of a fortified blank sample through the method's preparation and analytical schemes. MDLs determined for the same method / matrix / technology must be compared to ensure they are in agreement.

ACZ maintains a current MDL for each applicable method. A qualitative verification of the MDL must be performed annually for each applicable method, analyte, instrument, and matrix and before a new instrument or method is utilized for client samples. Refer to ACZ's SOP *Demonstration of Capability & Method Detection Limit Studies* (SOPAD001) for additional information.

14.3 Practical Quantitation Limit (PQL)

The PQL represents the lowest quantitative level that can be reported with a specified degree of confidence. Data reported at or above the PQL is considered reproducible, allowing for comparison of analytical results over a relatively long period of time, which is important to the monitoring of environmental data. ACZ *typically* defines the PQL as a value 2 – 10 times the MDL with an accuracy of 70 to 130% in a matrix free of interferents. The low calibration standard shall be at or below the PQL. Reported values less than the PQL are qualified as estimated. The region between the MDL and PQL is a continuum of uncertainty, lacking distinct cutoff points, and the error below the PQL is increased to the extent that the statistical validity of the result is questionable.

UNCONTROLLED

15 SAMPLE DILUTIONS

Sample dilution may be necessary for one or more of the following reasons: (1) sample concentration exceeds the established measurement range of the procedure/method; (2) sample volume or material is limited; (3) matrix interference is indicated or suspected; (4) sample matrix is reactive; (5) aqueous sample contains high sediment; (6) color, odor or other physical characteristics are present; (7) For ICP and ICPMS, TDS is greater than 2000 mg/L. In all cases, the analyst must use good professional judgment when determining the most appropriate dilution. Whenever possible, prepare and analyze client samples and any complimentary duplicates or spikes on the same dilution.

For samples that contain high concentration of analyte(s), the analyst will use their knowledge of the measurement range of the procedure to determine an optimal dilution that yields quantifiable data with minimal error propagation. In general, prepare the dilution so the final concentration is near the mid-point of the measurement range. A sample must be retested on a smaller dilution if analyte concentration is less than the reporting limit; exceptions must be explained on the bench sheet. For multi-parameter analyses, it may not be practical to report all analytes within the desired range, and the analyst must use their best judgment when determining a reasonable dilution factor.

The following requirements pertain to all dilutions:

- Document all dilution factors, and the reason for dilution, when the dilution is performed.
- Assign the appropriate "D" qualifier if data for the diluted sample is less than the reporting limit
- Retest sample on smaller dilution if the result is less than the reporting limit (or document justification for accepting the data on the bench sheet or data review checklist)
- Document the reason for any dilution on the bench sheet [not required for sample values that exceed the measurement range of the procedure]

16 ERROR CORRECTION PROTOCOL

When an error occurs in any type of record it must be crossed out with a **single line**. The error must not be erased, deleted, overwritten, obliterated, or made illegible. Alterations to make data legible are considered error corrections. The correct value must be entered alongside. All changes to hard copy records must be initialed and dated by the person making the correction. [9]Under no circumstances may White-Out® or any other substance be used to conceal data. Concealing or improperly altering data is fraudulent and may be grounds for termination from ACZ. Equivalent measures must be taken to avoid loss or change of original data in the case of records stored electronically. Refer to §10 for details of corrections made to electronic records. The following is an example of proper error correction:

fleece BWC 10-20-06
Mary had a little lamb, it's ~~feet~~ as white as snow. And everywhere that ~~Lary~~ went, the lamb was sure to go.
Mary BWC 10-20-06

[9] There is one exception to this rule. Client identification may be obliterated from a record if it's presence compromises client confidentiality (e.g. client ID is mistakenly entered in a logbook). In this event, the rationale for obliteration must be clearly stated and initialed and dated by the person making the correction.

UNCONTROLLED

17 COMPUTER / AUTOMATED PROCESSES

ACZ employs its proprietary LIMS (Laboratory Information Management System) to acquire, record, process, store, and archive data. LIMS is the primary application for all employees and encompasses the combination of hardware and software throughout the entire facility. Tasks performed with LIMS include but are not limited to creating workgroups, reviewing data, and generating client reports. ACZ implements the defined standards of Good Automated Laboratory Practices (GALP) to establish a uniform set of procedures to assure that all LIMS data used by our clients is reliable, credible, and legally defensible.

17.1 Software

The software used to achieve GALP goals is a combination of industry standard commercial off the shelf (COTS) software and internally developed applications. COTS software is purchased through professional and well-developed companies such as Oracle, Microsoft, and Lab Vantage Systems that complete sufficient testing and quality control to assure their products function properly. Internal applications undergo testing before being implemented and distributed throughout the laboratory.

Electronic records are protected, backed up, and archived to prevent unauthorized access or amendment. Refer to §10 of this document and ACZ's SOP *Backup and Archive of Instrument Data Files* (SOPAD044) for details.

17.2 Hardware

ACZ deploys many servers using industry standard architecture. All servers run standard enterprise operating systems such as Microsoft Windows Server and SuSE Linux. All data residing on network servers is routinely backed up.

To the extent possible, instrument PCs comply with at least the minimum recommendations of the instrument manufacturer and they are connected to ACZ's network. This allows transparent backup and access to computers by system administrators.

17.3 Security

GALP security is controlled through a set of passwords. A log-in name and password are required to access ACZ's network. User passwords must be at least five characters and must be changed when the user is prompted. Each user has a given set of network rights and is restricted to software necessary to complete their job functions as well as his/her own documents. Refer also to §10.7.1 for additional information.

A firewall protects the network from internet traffic. The only traffic permitted access to the internal network is protocols approved by ACZ such as IMAP, SMTP and HTTP. Incoming and outgoing E-mails are scanned for viruses and content. Email that fails this automated scan is quarantined for further review. Web traffic that is potentially harmful or inappropriate is automatically blocked by ACZ's proxy server.

UNCONTROLLED

18 CLIENT SERVICES

18.1 Contracting Services

ACZ's sales representatives and project managers are responsible for reviewing requests, preparing quotes, and entering contractual commitments with clients. Prior to accepting new work, it must be verified that the laboratory has appropriate facilities and resources to meet client needs. To the extent possible and pragmatic, ACZ shall use the latest valid edition of a standard. This is dictated largely by what ACZ's accrediting authorities will issue certification for. Where an older standard is universally recognized by ACZ's accrediting authorities but the latest is not, ACZ will typically use the older standard. As necessary, sales representatives and project managers must collaborate with ACZ's Production Manager, QAO, and/or technical directors to evaluate laboratory capacity, capability, and resources. Refer to SOPAD043 for additional details.

18.2 Subcontracting

ACZ utilizes subcontract labs to perform analyses for various reasons. A subcontracted lab must meet the clients DQOs and laboratory certification requirements for the subcontracted analysis. When applicable, ACZ advises its clients in writing of its intentions to subcontract any portion of the testing to another party. Any non-accredited tests shall be clearly identified as such to the client. ACZ scans this report as an attachment to be included as part of ACZ's final report. A comment is added to ACZ's final report indicating which subcontracted laboratory performed the analyses, if the name is not indicated on the attachment. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043) for additional information.

18.3 Data Reporting

Once all analyses and the entire review process have been completed, a client report is generated and submitted for final validation by the Project Manager. If necessary, a case narrative is written describing the details of the project and any non-conformances or other relevant issues. The PM electronically signs the report, and the Document Control department sends the report to the client in an electronic format. At a minimum, the following information appears on an ACZ analytical report:

Client Name	Sample Matrix
Client Address	Parameter/Analyte
Client Contact	Method Reference
Lab Sample ID	Result
Client Sample ID	Units
Client Project ID	LIMS Qualifier (U, B, J, H)
ACZ Report ID	MDL or LLD
Date/Time Sampled	PQL
Date/Time Received	Analyst's Initials
Date/Time Analyzed	Extended Qualifiers (as separate page)

A complete electronic data package contains the analytical reports, the external chain of custody records, sample shipping documentation, and any other relevant project information. Department Reference Sheets explaining acronyms, qualifiers, and method references are also included. All of these documents are an integral part of the final data package and must always be viewed as a whole. To prevent the separation of reports, each page identifies the project number, the sequential page number, and the total number of pages in the data package. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043) for more detail.

UNCONTROLLED

If requested by a client, custom and standard Electronic data deliverables (EDDs) are generated by the Document Control department. These deliverables, containing data in client specified format, are sent by e-mail with the client report. EDDs and analytical reports access data from the same Oracle tables, thus eliminating the possibility of inconsistent results. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043) for more detail.

Results may be reported in a simplified manner for internal customers or in accordance to a written agreement with a customer.

18.3.1 ACZ Report Packages

ACZ provides different levels of data packages based on client request. ACZ defines the different levels as follows:

Level 2: Standard analytical reports

Level 3: Standard analytical reports; Electronic Data Deliverable (EDD); Standard QC summary

Level 4A: Standard analytical reports, Extended QC Summary (standard QC plus calibration verification checks, interference checks and serial dilutions) EDD, raw data and run logs. This package can be provided either on a disk or in a full paginated data package with the raw data

Level 4B: "CLP like" data package: CLP like forms 1-12; Run Logs and raw data incorporated into the full paginated data package.

NOTE: Surcharges apply for non-standard reports.

18.4 Data Confidentiality

ACZ has an obligation to each client to maintain custody of samples, data, and reports and to keep all data or other information confidential. To uphold this responsibility, ACZ retains custody of the information at all times – data or other client information obtained by ACZ is not allowed to leave the premises. This includes but is not limited to Chains of Custody, raw data, workgroups, run logs, logbooks, reports, QC summaries, data packages and other media containing data. Client data cannot be released to anyone except the client (as directed on the Chain of Custody) or the client's designated representative, and project data, including any client information, is not to be discussed with anyone other than ACZ employees and/or the client without first receiving written permission from the client. Additionally, client-specific information is not to be documented on raw data, workgroups, logbooks, or other records that may be provided to any client as part of an extended data package. All information must be referenced using only the ACZ log-In number. Refer to ACZ's SOP *Data Integrity Principles and Policies* (SOPAD039) for additional details of policies pertaining to confidentiality.

External access to the ACZ network is limited to employees that may need to access information remotely. Employees requiring such access use ACZ's Virtual Private Network (VPN). The VPN client is setup on the employee's computer so that it adheres to ACZ security standards. These standards include (1) a unique user name (2) a password with at least 12 characters, and (3) 128 bit encryption of data to and from the client from the ACZ servers. After the VPN server has authenticated the employee, the employee must logon to the ACZ domain through normal domain security in order to access any ACZ network resources. Most employees initiate a "Remote Desktop" connection to their office PCs, thus ensuring that ACZ data is never accessible from the client PC hard drive.

18.5 Client Feedback

Handling client feedback is a joint effort between QA, Project Managers, Production Supervisors, and Client Service representatives. If a client has a concern or complaint, either a Project Manager or Client Service Representative takes the call and initiates the feedback procedure by documenting the complaint or problem and requesting the assistance of the Production Supervisor and/or QA Officer. If the issue cannot be easily resolved, then it must be documented using FRMAD024, which is routed from the initiator to other appropriate parties, including the QAO if necessary. All client feedback is submitted to upper

UNCONTROLLED

management as part of the Management Review of the Quality System. Refer to ACZ's SOP *Client Service Policies and Procedures* (SOPAD043) for additional information.

UNCONTROLLED

19 FACILITIES

ACZ Laboratories, Inc. inhabits a modern 31,000 square foot laboratory facility architecturally designed and specifically organized to ensure efficient operation and meet the needs of a large capacity analytical laboratory. Complete lists of instrumentation, balances, thermometers, & weight sets are maintained on a network drive. Incompatible activities are effectively separated.

19.1 Accommodation of Environmental Test Conditions

19.1.1 Temperature and room pressure are controlled by an HVAC system which maintains 19 independent zones. The clean room, metals lab, and organic instrument lab are kept under positive pressure to prevent contaminant infiltration. The radiochemistry and organic prep labs are kept under negative pressure to prevent the migration of fire, smoke, and chemical releases from the laboratory space. All other zones are maintained at a neutral pressure.

19.1.2 In humid environments, a sudden rise in temperature can result in condensation on microcircuitry leading to problems such as reduced life cycle, inaccurate readings, corrosion, etc. Due to the laboratory's location at 6730 feet above sea level, these concerns are irrelevant and humidity monitoring is only required for desiccators and the clean room.

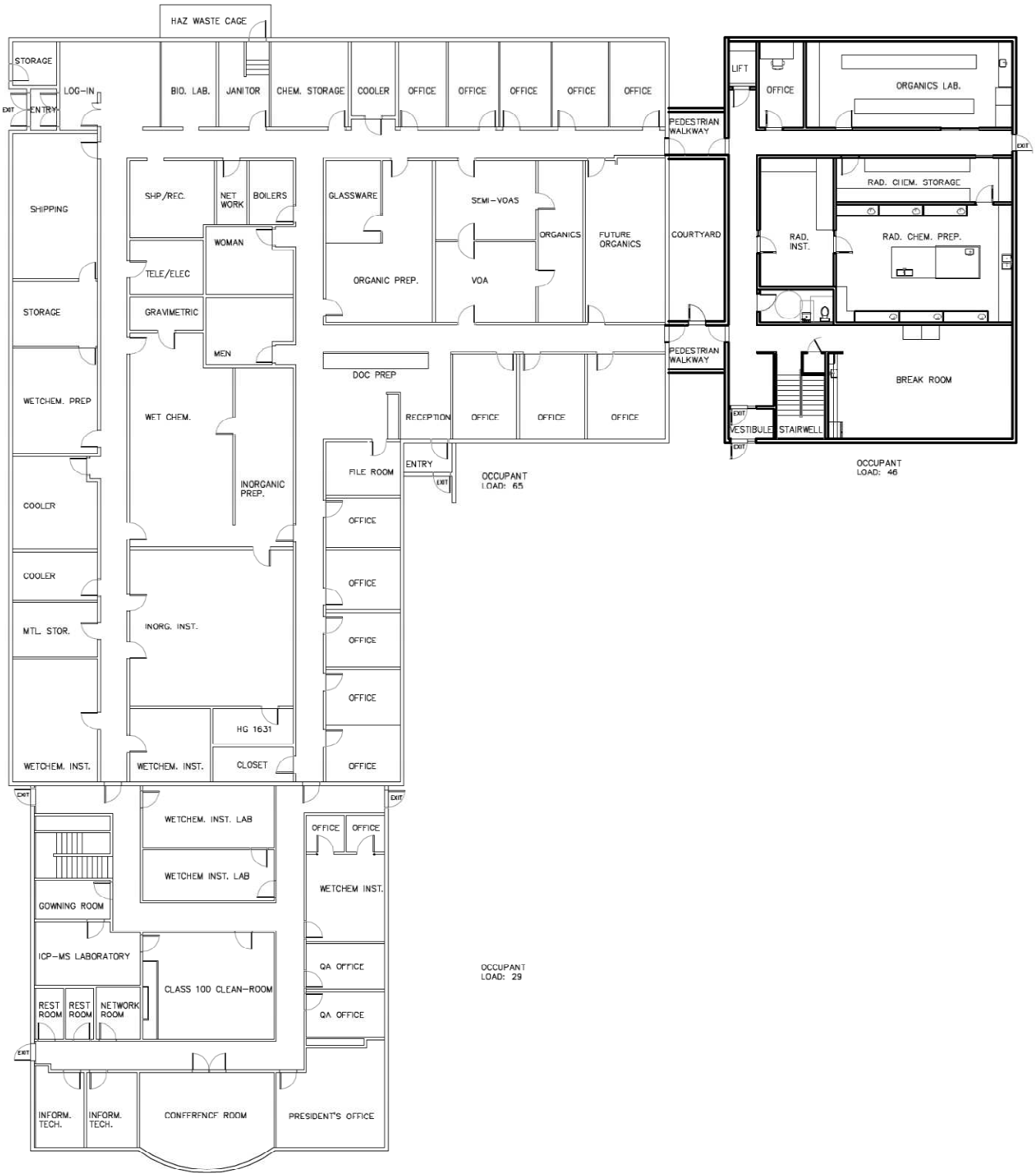
19.1.3 Servers have a 20 minute backup power supply. If there is an interruption in power, the IS Manager receives a text. This provides sufficient time to ramp down the servers.

19.2 Security

A secure facility is essential to maintaining sample and data integrity and to providing safety to employees and visitors. ACZ has an electronic security system, which controls and limits access to only authorized personnel. The following steps have been taken to ensure this security:

- All entryways are secured. ACZ has three entries equipped with proximity readers which allow access to an employee only after he/she presents their access card. Access to the front visitor entry is controlled by an interior push button monitored by ACZ staff.
- All employees are required to use their access cards to enter and exit the building.
- If any employee does not have their access card, they must sign in at the front desk and notify ACZ's CFO. This ensures a record is maintained of which personnel were in the building at any time. A temporary access card will then be activated and issued to the employee for the day. These access cards are identified by the word "Temporary" written on a scenic background.
- During normal business hours, public access into the building can be made at the front entrance and the west shipping entrance. Both doors are equipped with a buzzer.
- Visitors must enter and exit through the main entrance and must sign the register at the front desk upon arrival and before departure. A visitor pass is issued at sign in and collected at sign out. There are two types of visitor passes. A red pass identified by the word "Visitor", will not function as an access card and symbolizes the visitor requires an escort. The other visitor pass is identified by the word "Visitor Pass" written on a scenic background and will not function as an access card. This visitor does not require an escort. The determination of which pass the visitor gets is made first, by the visitor's trust level and, second, by the visitors access needs. Visitor passes must be collected when the visitor leaves for the day.
- Companies or individuals under contract to perform recurring or extensive work for ACZ are assigned an access card similar to employees. Contractor passes function as an access card for a defined period of time commensurate with the contract work.
- Emergency Exit doors are to be used only for emergency purposes. If a door is opened, an alarm will sound.
- Loaning or transferring access cards to anyone, including other ACZ employees, is prohibited.

UNCONTROLLED



ACZ LABORATORY INC. MAIN LEVEL PLAN

UNCONTROLLED

ACZ LABORATORY INC. BASEMENT LEVEL PLAN

UNCONTROLLED

20 RADIOCHEMISTRY

20.1 DATA TRANSFORMATION

Unlike other laboratory divisions, ACZ's radiochemistry department utilizes excel spreadsheets to transform instrument response into final results. Spreadsheet equations are locked and password protected in order to reduce the likelihood of inadvertent modifications. Additionally, spreadsheet equations are validated by the radiochemistry supervisor or a sufficiently experienced analyst on an annual basis. Initial validation must be performed by hand calculating results. Annual validation may be performed by populating the current template with data that has been hand calculated in a previous validation and comparing the calculated results from the current template to the hand calculated results from the previous validation. Documented secondary review is required for all updates to spreadsheet templates (e.g. incorporating new mass attenuation coefficients).

20.2 INSTRUMENTATION

Radioanalytical instrumentation is located adjacent to the radiochemistry prep lab. In order to maintain appropriate temperature control in the instrument lab, separation must be maintained. The door between the two lab areas must be kept closed when not in use. Except as noted, instrument checks and other determinations must be performed and documented annually, or more often if necessary.

NOTE: To eliminate potential contamination, planchets must be stored in a covered container or in a drawer.

20.2.1 Gas-Flow Proportional Counter

20.2.1.1 Instrument Reliability Test (Voltage Plateau Determination) – The proper voltage plateau for alpha and beta is where the counting rate is consistent (should not exceed > 5% over a 150 volt change in anode voltage).

20.2.1.2 Cross Talk (Carryover) Check - Cross talk is defined as the percentage of alpha counts represented on the beta plateau. Once the amount of cross talk is determined, the cross talk settings are adjusted on the instrument to eliminate cross talk.

20.2.1.3 Detector Efficiency Curve (Self Absorption) - Efficiency curves are graphs plotting counts versus sample residue density and determine the efficiency of the alpha and beta counter as a function of sample residue density. This factor is part of the overall determination of sample activity.

20.2.1.4 Background Determination - Characteristic of most detectors is a background or instrument count rate attributed to cosmic radiation, radioactive contaminants in instrument parts, counting room construction material and/or the proximity of radioactive sources. The background is determined weekly by counting an empty planchet for 12 hours. On each day of use the instrument is checked for background drift by counting an empty planchet for 90 minutes. Background counts must fall within established control chart limits or corrective action must be taken before analyzing samples. Although most radiation measurement systems are noteworthy for their stability, sudden changes can occur due to instrument component failure, loss of gas pressure, vacuum, or contamination of a detector or sample chamber from a high activity sample. Subsequently, instrument drift in detector efficiency and background must be checked both before and after measuring samples used for drinking water compliance monitoring. Refer to individual test SOPs for additional details.

20.2.1.5 Instrument-Response Check (Performance Check) – This continuing calibration check verifies the instrument response and stability and is performed daily for each detector. For a performance check measurement, the same calibration sources must be used as for the calibration measurement in order to verify the current measuring results still match the results of the calibration measurement stored last. At the end of the check the count rates and the relative deviations from older calibration measurements are displayed. The system signals "OK" if the deviations do not exceed the maximum deviation defined by

UNCONTROLLED

the user. Samples used for drinking water compliance monitoring must be bracketed by passing performance checks. Refer to individual test SOPs for additional detail.

20.2.2 Liquid Scintillation Counter

20.2.2.1 *Optimal Window* - When determining radionuclides by liquid scintillation, it is necessary to select the optimal window by counting a standard for five minutes and generating a sample spectrum. For better clarity, a log scale for the channel number axis should be used. On the graph, the region of interest is determined by the energy of the peak one is trying to quantitate. The optimal window is formed by extending this region by 10% on each side of the alpha peaks.

20.2.2.2 *Efficiency Quench Curve* – The liquid scintillation instrument, a Beckman LS 6000TA, automatically corrects for quenching by the H - Method. Refer to SOPRC010 for details.

20.2.2.3 *Background Check* - Three background blanks are run with every batch. The first two are run immediately after calibration. The third, the CCB, is employed as a measurement of instrument drift and is run immediately before the final LCS. For both checks, the counting duration must be equivalent to the longest sample counting duration.

20.2.2.4 *Instrument-Response Check Source* - This continuing calibration check verifies instrument response and stability and must be performed daily. If the source count is within two standard deviations (sigma) of the previously determined average count rate, instrument reliability and stability is established. If the source rate is outside the ±2 sigma-warning limit then the variability should be further investigated. If the source check is outside the ±3 sigma out of control limits, then no further samples should be analyzed until the problem is resolved. Resolution might include a new efficiency curve, background checks, and/or instrument maintenance. If insufficient data exists for control charts, ±10% of the initial source value is considered acceptable. The source for this check is a Tritium standard.

20.2.3 Alpha Spectrometer

20.2.3.1 *Energy vs. Channel Calibration* - Each alpha spectrometer has a set number of channels associated with it. To associate these channels to a specific alpha particle, the channels must be calibrated. One known calibrated solid source is placed into the detector and analyzed for five minutes to determine its associated channel to its calibrated energy peak. Since the energy is linear across the channels, all of the channels now have an associated energy. This determination is performed on an annual basis, or whenever maintenance is performed that could potentially affect the calibration.

20.2.3.2 *Background Checks* - Characteristic of most detectors is a background or instrument count rate attributed to cosmic radiation, radioactive contaminants in instrument parts, counting room construction material and/or the proximity of radioactive sources. Placing an empty sample tray in the counting chamber and counting it for as long as the longest sample-counting duration can determine the background rate (or a background check can be completed overnight). An overnight background determination must be completed at least quarterly.

20.2.3.3 *Instrument-Response Check Source* - This continuing calibration check verifies the instrument response and stability and is performed daily. If the source count is within two standard deviations (sigma) of the previously determined average count rate, instrument reliability and stability is established. If the source rate is outside the ±2 sigma-warning limit, then the variability should be further investigated. If the source check is outside the ±3 sigma out of control limits, then no further samples should be analyzed until the problem is resolved. Resolution might include a background check, and/or instrument maintenance. If insufficient data exists for control charts then ±10% of the true value is considered acceptable.

20.2.4 Gamma Spectrometer

UNCONTROLLED

20.2.4.1 *Background Checks* –Characteristic of most detectors is a background or instrument count rate attributed to cosmic radiation, radioactive contaminants in instrument parts, counting room construction material and/or the proximity of radioactive sources. A cave background must be measured monthly and the background gross activity recorded. The cave background is determined by counting the empty cave for a period of time at least as long as the longest sample-counting duration. When drinking water samples are present in the batch, and additional background check is measured at the end of the batch to monitor instrument drift.

20.2.4.2 *Instrument-Response Check (Performance Check)*- The total activity of a calibration or check source will check the efficiency calibration currently in use and the general operating parameters of the system, including source positioning, contamination, library values, and energy calibration. This activity calculation uses the general analysis program to ensure that the total system is checked. This check is performed for every workgroup. If the performance check is within the defined acceptance limits, instrument reliability and stability is established. If the performance check does not meet acceptance criteria, then no further samples should be analyzed until the problem is resolved. Samples used for drinking water compliance monitoring must be bracketed by acceptable performance checks. Resolution might include a background check, and/or instrument maintenance. Refer to SOPRC016 for additional information.

UNCONTROLLED

21 CLINICAL LABORATORY IMPROVEMENTS

Pursuant to Section 353 of the Public Health Services Act (42 U.S.c. 263a) as revised by the Clinical Laboratory Improvement Amendments (CLIA), ACZ Laboratories, Inc. may accept human specimens for the purposes of performing laboratory examinations or procedures. ACZ's clinical laboratory services are currently limited to the analysis of metals in blood and Uranium in urine.

ACZ adheres to the following guidelines as they pertain to work under the Clinical Laboratory Improvement Amendments (CLIA)

- ACZ adheres to the Health Insurance Portability and Accountability Act (HIPPA) regarding client confidentiality and the release of patient information.
- Client ID's for CLIA samples are transcribed from the CoC and adhere to the following naming protocol: **LAST NAME**_SPACE_ **FIRST NAME**_SPACE_ **DATE OF BIRTH (MM/DD/YY)**_SPACE_**SEX (M/F)**. (i.e. William F Grimes, DOB July 5, 1977, Sex: Male: would be expressed as "GRIMES WILLIAM 07/05/77 M"). In rare instances where the number of characters is greater than the Client ID field's max character length, the First Name is truncated to accommodate the other characters.
- Competency assessments: Employees analyzing samples associated with CLIA regulation are observed and reviewed for competency in performing the relevant tests semi-annually in their first year of analysis and annually thereafter. A General Supervisor or Technical supervisor is required to perform the assessment which is documented by completing the CLIA Personnel Assessment Form (FRMQA061).
- For continuing method validation of analyses that fall under CLIA regulations, ACZ analyzes CRM samples and/or single-blind spiked samples biannually. See the associated test SOP for additional ongoing analyst and method Quality Control requirements.

22 CERTIFICATIONS

ACZ has primary or secondary (reciprocal) certification with numerous states and EPA regions. Current certificates can be viewed at http://acz.com/certifications/. Each certificate contains a scope of accreditation listing each method the laboratory is accredited for by the issuing authority.

UNCONTROLLED

APPENDIX A Required Container Type, Preservation Techniques, and Holding Times

Parameter	Container	Preservation [a, b]	Maximum Holding Time [c]
Alkalinity	HDPE or Glass	≤ 6.0 °C	14 days
Acidity	HDPE or Glass	≤ 6.0 °C	14 days
Ammonia (N-NH_3)	HDPE or Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days
Anions	HDPE	≤ 6.0 °C	28 days (Br^-, F^-, Cl^-, SO_4^{2-})
As(III), As(V)	Amber HDPE	EDTA and Acetic Acid	28 days
BOD, CBOD	HDPE or Glass	≤ 6.0 °C	48 hours
COD	HDPE or Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days
Color	HDPE or Glass	≤ 6.0 °C	48 hours
Conductivity	HDPE or Glass	≤ 6.0 °C	28 days
Cyanide	HDPE or Glass	≤ 6.0 °C; NaOH to pH > 12	14 days
Chromium (VI)	HDPE or Glass	≤ 6.0 °C	Refer to SOP for holding time
Dissolved Oxygen	Glass	None required	Analyze immediately
Metals (unless specified otherwise)	HDPE or [10]Glass	HNO_3 to pH < 2	180 days
Mercury (CVAA, ICP/MS)	HDPE or Glass	HNO_3 to pH < 2	28 days
Mercury (CVAFS)	Glass	5 mL 12N HCl and 5 mL/L BrCl	90 days
N – NO_2 / NO_3	HDPE or Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days (48 hours if unpreserved)
N – NO_3	HDPE or Glass	≤ 6.0 °C	48 hours
N – NO_2	HDPE or Glass	≤ 6.0 °C	48 hours
Nitrogen, Total Kjeldahl	HDPE or Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days
Oil & Grease	Glass	≤ 6.0 °C; HCl or H_2SO_4 to pH < 2	28 days
Orthophosphate	HDPE or Glass	≤ 6.0 °C	Filter within 15 minutes, analyze within 48 hours
pH	HDPE or Glass		Analyze within 15 minutes
Phenols	Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days
Phosphorus (Total)	HDPE or Glass	≤ 6.0 °C; H_2SO_4 to pH < 2	28 days
Sulfide	HDPE or Glass	≤ 6.0 °C; Zn acetate + NaOH to pH > 9	7 days
Sulfite	HDPE or Glass	≤ 6.0 °C; EDTA	Analyze immediately
Settleable Solids	HDPE or	≤ 6.0 °C	48 hours

[10] Glass is not a suitable container for Boron or Silicon.

UNCONTROLLED

Parameter	Container	Preservation [a, b]	Maximum Holding Time [c]
	Glass		
Total Organic Carbon	HDPE or Glass	≤ 6.0 °C; HCl, H_2SO_4, or H_3PO_4 to pH < 2	28 days
Total & Dissolved Inorganic Carbon	HDPE or Glass	≤ 6.0˚C	28 days
Turbidity	HDPE or Glass	≤ 6.0 °C	48 hours
Total Dissolved Solids	HDPE or Glass	≤ 6.0 °C	7 days
Total Suspended Solids	HDPE or Glass	≤ 6.0 °C	7 days
Total Solids	HDPE or Glass	≤ 6.0 °C	7 days
Total Volatile Solids	HDPE or Glass	≤ 6.0 °C	7 days
Radon-222	Glass Vial [d]		4 days
Total Volatile Hydrocarbons	Glass Vial or jar [d]	≤ 6.0 °C; HCl to pH < 2 (water)	Refer to SOP for holding times
Total Petroleum Hydrocarbons	Amber Glass	≤ 6.0 °C	Refer to SOP for holding times
BTEX / MTBE	Glass Vial or jar [d]	≤ 6.0 °C; HCl to pH < 2 (water)	Refer to SOP for holding times
Organochlorine Pesticides	Glass Vial or jar [d]	≤ 6.0 °C; pH 5 – 9	Refer to SOP for holding times
PCBs	Amber Glass	≤ 6.0 °C	Refer to SOP for holding times
PAHs	Amber Glass	≤ 6.0 °C	Refer to SOP for holding times
BNAs (semi-volatiles)	Amber Glass	≤ 6.0 °C	Refer to SOP for holding times
VOAs (volatiles)	Glass Vial or jar [d]	≤ 6.0 °C; HCl to pH < 2 (water)	Refer to SOP for holding times
TCLP	Glass [d]	≤ 6.0 °C	Refer to SOP for holding times
Radchem (except Rn)	HDPE cube	HNO_3 to pH < 2	180 days
Metals in blood	Vial	EDTA ≤6.0˚C or -10 to -20˚C	180 days
Metals in urine	HDPE specimen jar	HNO_3 to pH <2 ≤6.0˚C	30 days

a. No pH adjustment for soil
b. Preservation with 0.008% $Na_2S_2O_3$ required only when residual chlorine is present.
c. Unless otherwise specified in the test SOP, complete sample preparation and analysis within holding time.
d. Teflon-lined septa or lid
e. Aqueous samples must be preserved at ≤6.0 °C, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. Also, for purposes of NPDES monitoring, the specification of "≤ °C" is used in place of the "4 °C" and "< 4 °C" sample temperature requirements listed in some methods. It is not necessary to measure the sample temperature to three significant figures (1/100th of 1 degree); rather, three significant figures are specified so that rounding down to 6 °C may not be used to meet the ≤6 °C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).

Refer to test SOPs for additional details and considerations.

UNCONTROLLED

APPENDIX B – Forms for Management Review of the Quality System

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

DEPARTMENT REPORT FOR MANAGEMENT REVIEW OF THE QUALITY SYSTEM

Department:_____ Quarter Ending:_____

1) **OPERATIONS:**
EVALUATE ALL OPERATIONS FROM LOG-IN TO REPORTING AS IT PERTAINS TO YOUR DEPT.

   a. What company wide operations-related issues has the department encountered during the last quarter? Were any of the issues reoccurring?

   b. What actions were taken to resolve the issues?

   c. What actions can be taken to reduce/eliminate these issues in the future?

2) **RESOURCES & PERSONNEL:**
EVALUATE RESOURCES & PERSONNEL AS THEY PERTAIN TO THE DEPARTMENT

   a. Did the department have adequate resurces (supplies, instrumentation, facilitied, etc.) and properly trained staff for the volume of work?

   b. What resources must be available for the work expected next quarter?

   c. What obstacles do employees within the department routinely experience that hinder efficiency/productivity?

3) **QUALITY ASSURANCE & QUALITY CONTROL:**
EVALUATE QA/QC AS THEY PERTAIN TO THE DEPARTMENT

   a. Are any failed QC indicators reoccurring? If so, describe.

   b. Were any changes to policies/procedures implemented during the past quarter as a result of corrective and/or preventive actions? If yes, were they effective? If no, what changes would be effective?

4) **CLIENT COMPLAINTS/ FEEDBACK**

   a. What client feedback has the department encountered during the last quarter? Where any of the issues reoccurring?

5) **MISC: PROVIDE ADDITIONAL FEEDBACK**

FRMQA041.11.08.03

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

MANAGEMENT REVIEW OF THE QUALITY SYSTEM

DATE OF REVIEW: _____

Attendees:

SUITABILITY OF POLICIES & PROCEDURES: **SUMMARY OF MEETING**
(REVIEW FRM QA041 SECTIONS 1A, 1B, 1C, 2A, 2C, 3A, 3B, 4A)

- Do ACZ's policies and procedures accurately reflect management's Quality Policy Statement?
- Are ACZ's policies and procedures effective? If no, what changes are necessary?

REVIEW OF STAFF RESOURCES & TRAINING:
(REVIEW FRM QA041 SECTIONS 2A, 2C)

- Did ACZ have appropriate staff to handle the volume of work received during the past quarter?
- Was all staff properly trained and was training documented before independently analyzing client samples?

Geochemistry

Clean Room / Prep

Inorganic Inst / Prep

Wet Chemistry Instrument

Wet Chemistry Manual

Organics

Radiochemistry

Log-In

Client Services (Sales / PMs)

Document Control

Information Systems

REVIEW OF INSTRUMENTATION / EQUIPMENT, SUPPLIES & CONSUMABLES:
(REVIEW FRM QA041 SECTIONS 1A, 2B) (COMPARE EXPENSES TO REVENUE)

- Did ACZ have necessary and properly functioning instrumentation and equipment to perform the volume of work received last quarter?
- Did ACZ have adequate supplies and consumables on hand to perform the volume of work?

UNCONTROLLED

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

MANAGEMENT REVIEW OF THE QUALITY SYSTEM

Geochemistry

Clean Room / Prep

Inorganic Inst / Prep

Wet Chemistry Instrument

Wet Chemistry Manual

Organics

Radiochemistry

Log-In

Client Services (Sales / PMs)

Document Control

Information Systems

REVIEW OF RECENT INTERNAL AUDITS: **QA OFFICER**
(REVIEW FRM QA041 SECTIONS 3A, 3B)

- Did the QA/QC department adhere to its internal audit schedule?
- Did any department(s) have significant issues?
- Were corrective actions completed properly and within the agreed time frame?
- Was follow-up completed for all corrective actions?

REVIEW OF RECENT EXTERNAL AUDITS: **QA OFFICER**

- Did the audit report(s) cite any repeat deficiencies?
- Did any department(s) have significant issues?
- Were all corrective actions completed properly and within the agreed time frame?
- Was follow-up completed for all corrective actions?

REVIEW OF RECENT PROFICIENCY TESTING STUDIES: **QA OFFICER**

A) Were all analyte values reported for each study?

WP	NA ☐	Yes ☐	No ☐
WS	NA ☐	Yes ☐	No ☐
RAD	NA ☐	Yes ☐	No ☐
Soil/UST	NA ☐	Yes ☐	No ☐

B) Did ACZ passed 2 out of the 3 most recent PT studies for each analyte?

WP	NA ☐	Yes ☐	No ☐
WS	NA ☐	Yes ☐	No ☐
RAD	NA ☐	Yes ☐	No ☐
Soil/UST	NA ☐	Yes ☐	No ☐

C) Were corrective actions completed within the agreed time frame for all studies?

WP	NA ☐	Yes ☐	No ☐
WS	NA ☐	Yes ☐	No ☐
RAD	NA ☐	Yes ☐	No ☐
Soil/UST	NA ☐	Yes ☐	No ☐

UNCONTROLLED

ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

MANAGEMENT REVIEW OF THE QUALITY SYSTEM

REVIEW OF RECENT CORRECTIVE / PREVENTATIVE ACTIONS: **QA OFFICER**

- What corrective / preventive actions were implemented during the past quarter?
- What trends are apparent?
- Were corrective actions completed within the agreed time frame?
- Have changes resulting from corrective / preventive actions been implemented? Are they effective?

REVIEW OF CLIENT COMPLAINTS/FEEDBACK:
(REVIEW FRM QA041 SECTIONS 4A)

- Did ACZ receive client feedback (positive or negative) during the past quarter?
- For complaints received, did ACZ adhere to its client complaint policy?
- Were complaints handled in a manner satisfactory to the client?
- Were all complaints resolved?
- What quality indicators are repeated?

REVIEW OF CHANGES IN VOLUME / TYPE OF WORK:
(REVIEW FRM QA041 SECTIONS 1A, 1B, 1C, 2A, 2B)

- Did ACZ experience a significant change in volume and/or type of work last quarter? How did we do?
- What improvements can be made?
- Is ACZ prepared for volume and/or type of work expected next quarter?

REVIEW OF ETHICS PROGRAM:

- Were all Ombudsman issues addressed in a timely manner?
- Were any data intergrity issues/concerns brought to the attention of the Ombudsman issues or dilemmas?
- Were all employees trained on ACZ's Ethics and Proactive Prevention Program (SOPAD039)?
- Was follow-up training conducted within the time frame stated in SOPAD039?

REVIEW OF DEPARTMENTS:

Geochemistry

Clean Room / Prep

Inorganic Inst / Prep

Wet Chemistry Instrument

Wet Chemistry Manual

Organics

Radiochemistry

Log-In

Client Services (Sales / PMs)

Document Control

Information Systems

UNCONTROLLED

APPENDIX C REFERENCES UTILIZED BY ACZ

- “TNI Standards,” National Environmental Laboratory Accreditation Conference, (current version).
- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," USEPA, Federal Register Vol. 67, No. 205, October 23, 2002.
- "Manual for the Certification of Laboratories Analyzing Drinking Water," USEPA, (current version).
- "Methods for the Chemical Analysis of Water and Wastes," USEPA, EPA-600/4-79-020, March 1983.
- "Test Methods for Evaluating Solid Waste," USEPA, SW-846 Third Edition, Update IV, January 2008.
- “Guidelines in Establishing Test Procedures for the Analysis of Wastewater Pollutants,” Code of Federal Regulations 40, Parts 136, 141, 143.
- "Quality Assurance of Chemical Measurements,” Taylor, J., Lewis Publishers, Michigan, 1987
- "Annual Book of Standards, Water Analysis," ASTM, 1989.
- "Quality Control in Analytical Chemistry," Kateman, G., Vol. 60, 1985.
- "Principles of Environmental Analysis, Analytical Chemistry," Keith, L.H., et al., Vol. 55, 1983.
- "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," USEPA, 1979.
- “Guidance for the Data Quality Assessment: Practical Methods for Data Analysis,” USEPA, EPA 600/R-96-084, July 2000.
- “Methods for the Determination of Metals in Environmental Samples,” USEPA, EPA 600/4-91-010, June 1991.
- “Methods for the Determination of Metals in Environmental Samples,” Supplement I [to EPA 600/4-91-010], USEPA, EPA 600/R-94-111, May 1994.
- “Methods for the Determination of Inorganic Substances in Environmental Samples,” USEPA, EPA 600/R-93-100, August 1993.
- "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," USEPA, EPA 821/B-96-005, December 1996.
- "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," USEPA, EPA 600/4-80-032. August 1980.
- “Determination of Lead-210, Thorium, Plutonium and Polonium-210 in Drinking Water: Methods 909, 910, 911, 912,” 01A0004860 (Region 1 Library), March 1982.
- “Good Automated Laboratory Practices - Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations” USEPA, 2185, 1995.
- “Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications”, ASTM E29-08

UNCONTROLLED

APPENDIX D DEFINITIONS OF TERMS

Acceptance Criteria: specified limits places on characteristics of an item, process, or service defined in requirement documents.

Accreditation: verification by a competent, disinterested, third party that a laboratory possesses the capability to produce accurate test data, and that it can be relied upon in its day-to-day operations to maintain high standards of performance.

Accrediting Body: The Territorial, State, or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation.

Accreditation body: Authoritative body that performs accreditation.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Aliquot: A discrete, measured, representative portion of a sample taken for analysis.

Analyte: The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together. (EPA Risk Assessment Guide for Superfund; OSHA Glossary)

Analytical Spike (AS): an aliquot of client sample to which a known amount of target analyte is added and that demonstrates the absence or presence of interference in the matrix. The AS is prepared exactly the same way as the LFB, only spiking into sample instead of reagent blank, and is not prepped (digested) prior to analysis. The AS may also be referred to as a post-digestion spike.

Analytical Spike Duplicate (ASD): a second replicate analytical spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Analytical System: the combination of events, techniques, and procedures used to generate analytical results.

Analyst Review (AREV): See Primary Review.

Atomization: A process in which a sample is converted to free atoms.

Audit: a systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same matrix, meeting the above criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of 20 or less prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group. QC samples (e.g. LCS, MS, MSD) do not count towards the maximum of 20.

All required QC samples must be prepared and/or analyzed with each batch at the frequency required by the method, even if there are less than 20 client samples in the batch. If the workgroup has more than 20 samples, then sufficient batch QC must be analyzed for additional samples. Every batch of environmental samples is assigned a unique (i.e. traceable) six-digit numerical identifier called the LIMS Workgroup number.

Blank: a sample that has not been exposed to the analyzed sample stream utilized to monitor contamination during sampling, transport, storage, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. See also Equipment Blank, Field Blank, Instrument Blank, Method Blank, Reagent Blank. Refer to §11.3 for types of blanks.

UNCONTROLLED

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst or laboratory may know the identity of the sample but not its composition. It is used to test the analyst or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations, or a series of calibration standards and their instrument responses.

Calibration Range: The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Case Narrative: Additional documentation provided in the client report that describes any abnormalities and deviations that may affect the analytical results and summarizes any issues in the data package that need to be highlighted for the data user to help them assess the usability of the data.

Certified Reference Material (CRM): A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

Chain of Custody Form: a legal record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses.

Client: Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations. (ANSI/ASQ E4-2004)

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

- Second column confirmation;
- Alternate wavelength;
- Derivatization;
- Mass spectral interpretation;
- Alternative detectors; or
- Additional cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ ASQC E4-1994)

Congener: A member of a class of related chemical compounds (e.g., PCBs, PCDDs)

Continuing Calibration Blank (CCB): the same solution as the calibration blank, it detects baseline drift in the calibration of the instrument. When specified by the method, analyze a CCB immediately after each CCV, including the final CCV.

Continuing Calibration Verification (CCV): a solution of method analytes of known concentrations used to confirm the continued calibration of the instrument. The CCV is analyzed at the frequency indicated in the test SOP.

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e. the data meet specified acceptance criteria)

UNCONTROLLED

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Definitive Data: Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making. (UFP-QAPP)

Demonstration of Capability (DOC): a procedure to establish the ability of the analyst to generate acceptable accuracy [and precision, if applicable].

Detection Limit: the lowest concentration or amount of target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value (see Method Detection Limit).

Digestion: A process in which a sample is treated (usually in conjunction with heat) to convert the sample to a more easily measured form.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Eluent: A solvent used to carry the components of a mixture though a stationary phase. (Skoog, West, and Holler. *Fundamentals of Analytical Chemistry*. 1992)

Elute: To extract; specifically, to remove (adsorbed material) from an adsorbent by means of a solvent. (Merriam-Webster's Collegiate Dictionary, 2000)

Elution: A process in which solutes are washed though a stationary phase by the movement of a mobile phase. (Skoog, West, and Holler. *Fundamentals of Analytical Chemistry*. 1992)

Equipment Blank: a sample of analyte-free media that has been used to rinse common sampling equipment to check the effectiveness of decontamination procedures.

False Positive (Type I or alpha error): concluding that a substance is present when it truly is not.

False Negative (Type II or beta error): concluding that a substance is not present when it truly is.

Field Blank: a blank prepared in the field by filling a clean container with Type I water and appropriate preservative, if any, for the specific sampling activity being undertaken.

Holding Time (Maximum Allowable Holding Time): the maximum time that samples may be held prior to analysis and still be considered valid or not compromised.

Homologue: One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, CH3OH (methanol), C2H5OH (ethanol), C3H7OH (propanol), C4H9OH (butanol), etc., form a homologous series. (*The Condensed Chemical Dictionary* G.G. Hawley, ed. 1981)

Initial Calibration Blank (ICB): a solution identical to the calibration blank and confirms the absence of background contamination in the calibration blank. When specified by the method, an ICB is analyzed immediately after the ICV.

Initial Calibration Verification (ICV): a solution of method analytes of known concentrations intended to determine the validity of the instrument calibration. The ICV must be analyzed immediately after each calibration and must be prepared from a source independent of the calibration standards, preferably purchased from a different manufacturer.

UNCONTROLLED

Instrument Blank: an aliquot of Type I water or solvent processed through the instrument steps of the measurement process; used to determine presence of instrument contamination.

Interference, spectral: Occurs when particulate matter from the atomization scatters the incident radiation from the source or when the absorption or emission of an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible. (Skoog, West, and Holler. *Fundamentals of Analytical Chemistry*. 1992)

Interference, chemical: Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte. (Skoog, West, and Holler. *Fundamentals of Analytical Chemistry*. 1992)

Internal Standard (IS): a known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Isomer: One of two or more compounds, radicals, or ions that contain the same number of atoms of the same elements but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane. (Websters)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Laboratory Fortified Blank (LFB): a reagent blank spiked with a known concentration of analyte. The LFB is analyzed exactly like a sample and determines whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements.

Legal Chain of Custody Protocols: procedures employed to record the possession of samples from the time of sampling until analysis and are performed at the special request of the client. These protocols include the use of a Chain of Custody form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.

Linear Dynamic Range (LDR): concentration range over which the instrument response to analyte is linear.

Matrix Duplicate (DUP): a second aliquot of a client sample that is prepared and analyzed in the same manner as all other samples in the same workgroup. The DUP demonstrates the precision of the method.

Matrix Spike (spiked sample or fortified sample): a sample prepared by adding a known amount of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes (MS or LFM) are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate: a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Maximum Contamination Limit (MCL): the numerical value expressing the maximum permissible level of contaminant in water that is delivered to any user of a public water system.

May: denotes permitted action, but not required action.

Measurement Quality Objectives (MQOs): The desired sensitivity, range, precision, and bias of a measurement.

Measurement System: A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

UNCONTROLLED

Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as client samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for the sample analyses.

Method Detection Limit: the minimum concentration of an analyte, in a given fortified matrix, that can be measured and reported with 99% confidence that the concentration is greater than zero.

Method of Standard Additions: A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration. (This process is often called spiking the sample.) (Modified Skoog, Holler, and Nieman. Principles of Instrumental Analysis. 1998)

Must: denotes a requirement.

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Nonconformance: An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.

Outlier (Statistical): an observation or data point that deviates markedly from other members of the population.

Performance Audit: the routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Primary Review (AREV): The first level of data review conducted after data has been generated and uploaded to LIMS. Primary review is typically conducted by the analyst who generated the data but may be performed by another authorized individual. Quality control and corrective actions are evaluated as part of this review. Where acceptance criteria fails, samples are scheduled for re-preparation and/or re-analysis or data is appropriately qualified.

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Testing Study Provider: Any person, private party, or government entity that meets stringent criteria to produce and distribute TNI PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA, and TNI.

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

UNCONTROLLED

Protocol: a detailed written procedure [SOP] for laboratory operation that must be strictly followed.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality.

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual [QAP]: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products, and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control.

Quantitation Limit [Limit of Quantitation, Practical Quantitation Limit]: level, concentration, or quantity of a target variable (i.e. target analyte) below which data is reported as estimated. The quantitation limit may or may not be statistically determined, or may be an estimate that is based upon analyst experience or judgment.

Quantity Sufficient (QS): Refers to the addition of appropriate diluent to the solution to achieve the final volume.

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for reconstructing and evaluating the report of the activity or study.

Reagent Blank (method reagent blank): a sample consisting only of Type I water and reagent(s) without the target analyte(s) or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so (EPA, etc.). The reference method is included on the client report.

Reporting Limit (RL): The lowest analyte level (concentration or mass) the laboratory will report as a detected result. ACZ's default reporting limit is the MDL; however the RL may be defined as the PQL or another level dependent on project needs.

Retention Time: The time between sample injection and the appearance of a solute peak at the detector. (Skoog, West, and Holler. *Fundamentals of Analytical Chemistry*. 1992)

Sample: Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis

Sample Tracking: procedures employed to record the possession of the samples from the time of sampling until analysis, reporting, and archiving. These procedures include the use of a Chain of Custody form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.

Secondary Review (SREV): The second level of data review conducted after primary review (AREV) has been completed. Secondary review is typically conducted by the pertinent department supervisor but may be performed by another authorized individual. Quality control and corrective actions are evaluated as part of this review. Data qualifiers and sample statuses assigned at AREV are evaluated and corrected if necessary.

Selectivity: (Analytical chemistry) The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

UNCONTROLLED

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (i.e. concentrations) of a variable of interest.

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there is no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Should: denotes a guideline of recommendation whenever noncompliance with the specification is permissible.

Signal to Noise Ratio (S/N): a dimensionless measure of the relative strength of an analytical signal (S) to the average strength of the background instrumental noise (N) for a particular sample.

Spike: a known amount of target analyte added to a blank sample or client sub-sample; used to determine the recovery efficiency or for other quality control purposes.

Standard Deviation: the measure of the degree of agreement (precision) among replicate analyses of a sample. The population standard deviation (n degrees of freedom) should only be used for more than 25 data points; otherwise, when referenced, standard deviation implies sample standard deviation (n-1 degrees of freedom).

Standard Operating Procedure (SOP): a written document which details the manner in which an operation, analysis, or action is performed. The techniques and procedures are thoroughly prescribed in the SOP and are the accepted process for performing certain routine or repetitive tasks.

Supervisor [however named]: the individual designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training, and experience to perform the required analyses.

Surrogate (SURR): a substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.

Test Method: adoptions of a scientific technique for a specific measurement problem, as documented in a laboratory SOP or published by a recognized authority.

The NELAC Institute (TNI): a voluntary organization of state and federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Tuning: A check and/or adjustment of instrument performance for mass spectrometry as required by the method.

Validation: The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: Confirmation by examination and provision of evidence that specified requirements have been met.

UNCONTROLLED

APPENDIX E TECHNICAL DIRECTORS

Name	Department	Degree
Christopher Wakefield	Organics (reserve)	BS, Chemistry
Isaac Klaus	Organics	BS, Biological Sciences, Minor in Chemistry
Steve Pulford	Metals	BS, Chemical Engineering, Minor in Biochemistry
Billy Grimes	Wet Chemistry Instrument (reserve) Metals (reserve) Wet Chemistry Manual (reserve)	BA, Biology
Alyssa Dybala	Wet Chemistry Manual	BS, Pharmaceutical Marketing
Matt Sowards	Radiochemistry (reserve)	BA, Neuroscience
Jennifer Fox	Wet Chemistry Instrument	BA, Environment Studies, Minor in Mathematics
Brett Dalke	Geochemistry	BA, Geology & English
Mark McNeal	Radiochemistry	BS, Biology
If a technical director is absent for a period exceeding fifteen calendar days, another qualified full time employee shall be assigned to temporarily fulfill the duties of technical director. Defined reserve technical directors shall assume these duties by default. Where reserves are not yet defined, management shall appoint a qualified individual as necessary. If a technical director is absent for more than 34 days, it is the QAO's (or delegee's) responsibility to notify accrediting bodies in writing.		

ENERGY LABORATORIES-CASPER, WY
QUALITY ASSURANCE MANUAL

Revision May 15, 2015

Energy Laboratories, Inc.
Main Building Address: 2393 Salt Creek Hwy.
Radiochemistry Building Address: 2325 Kerzell Lane

PO Box 247
Casper, Wyoming 82602

Toll Free (888) 235-0515
Local: (307) 235-0515
Fax: (307) 234-1639
E-mail: casper@energylab.com

Casper Laboratory Manager
Digitally signed by Daniel W. Lashbrook
Date: 2015.05.26 08:47:10 -06:00

Laboratory Manager
Daniel Lashbrook
Date:

Technical Director
Digitally signed by Steve Vien
Date: 2015.05.27 08:44:31 -06:00

Laboratory Technical Director
Steve Vien, Ph.D.
Date:

Quality Assurance Manager
Digitally signed by Donny Juarez
Date: 2015.05.18 10:22:01 -06:00

Quality Assurance Officer
Donny Juarez
Date:

TABLE OF CONTENTS

Quality Assurance Manual 1
Table of Contents 2
ELI Commitment 4
Introduction 4
Chapter 1 – Quality Control Program 6
Quality Policy Statement 6
Quality Assurance Program 6
Estimation of Uncertainty 9
Maintenance of Performance Records 9
Method Quality Control Specifications 10
Chapter 2 – Quality Assessment Program 11
Proficiency Testing (PT) Samples 11
Quality Control Check Samples 12
Quality Assurance Audits 12
Chapter 3 – Laboratory Facilities 14
Chapter 4 – Personnel Requirements and Laboratory Organization 15
Laboratory Organization 15
Personnel Requirements 16
Laborator Manager 16
Quality Assurance Officer 17
Technical Director 17
Laboratory Supervisor 17
Analysts 17
Laboratory Technicians 18
Approved Signatories 18
Chapter 5 – Sampling Procedures 19
Chapter 6 – Sample Handling 21
Sample Receipt 21
Chain-of-Custody 21
Sample Tracking 22
Sample Disposal 22
Subcontracting Policy 22
Chapter 7 – Instrument Operation and Calibration 24
Chapter 8 – Records and Reporting 26

Document Management 26
Laboratory Notebooks 26
Records 27
Data Reduction 27
Validation 28
Reporting 28
Chapter 9 – General Laboratory Practices 30
Chemicals and Reagents 30
Reagent Interference 30
Glassware Preparation 31
Laboratory Pure Water 31
Employee Training 31
Data Integrity 32
Standard Operating Procedures 33
Client Confidentiality 33
Chapter 10 – Quality Control Monitoring 34
Routine Monitoring 34
Instruments/Methods 34
Chapter 11 – Corrective Action 36
Procedure for Dealing with Complaints 37
Penalty for Improper, Unethical or Illegal Actions 38
Chapter 12 – Management of Change 39
Chapter 13 – Major Equipment and Methods 40
Chapter 14 – Preventive Maintenance 41
Chapter 15 - References 42
Chapter 16 – Glossary of Terms 44
Acronyms and Abbreviations 49
APPENDIX A 51
Quality System Controlled Documents 52
APPENDIX B 53
Quality Assurance / Quality Control Specifications 54
APPENDIX C 57
Organizational Charts 58
APPENDIX D 60
Curricula Vitae of Key Laboratory Personnel 61
APPENDIX E 83
Equipment and Methods List 84
Record of Review 85

ELI COMMITMENT

Energy Laboratories, Inc. Strives Toward:

1. Being highly skilled in the field of analytical chemistry.
2. Delivering quality and service with integrity.
3. Encouraging the professional development of our staff.
4. Offering our employees a safe and positive work environment.
5. Being profitable and using resources wisely for a sustainable future.

INTRODUCTION

Energy Laboratories, Inc. provides chemical, industrial hygiene, and environmental analytical services to private industry, agricultural industry, engineering consultants, government agencies, and private individuals. Analytical services include: analysis of waters and soils for inorganic and organic constituents, aquatic toxicity testing, hazardous waste analysis, radiochemistry, industrial hygiene, microbiology, soils and water physical parameters, and petroleum analysis.

Founded in 1952, Energy Laboratories currently incorporates five separate testing laboratories. The corporate headquarters are located in Billings, MT, with branch laboratories located in Casper, WY; Gillette, WY; College Station, TX and Helena, MT.

ELI, as a coordinated company of five participating branches, has developed a QA program that takes into account the various method types and EPA programs, while also considering sample matrices, to develop a single comprehensive set of QA guidance. We have used scientific approaches, Good Laboratory Practices, EPA Methods and Guidance documents, and accreditation audit guidance to develop our overall QA Program.

The Quality Assurance Program establishes acceptable performance criteria for all routine analytical procedures being performed by laboratory personnel. The Quality Assurance Assessment Program provides a formal system for evaluating the quality of data being generated and reported. The ELI Laboratory Safety Manual & Chemical Hygiene Plan defines the safety and monitoring procedures used by laboratory personnel in laboratory operations. These, in addition to the experience and expertise of our analysts, provide a comprehensive Quality Assurance Program. Energy Laboratories, Inc., in Casper, Wyoming, is certified under the Safe Drinking Water Act by Region (SDWA) VIII EPA. Individual state approval for SDWA is managed through reciprocal certifications when required by a specific state. ELI-Casper also holds accreditation for Clean Water Act, Safe Drinking Water Act and Resource Conservation Recovery Act (RCRA) parameters through the National Environmental Laboratory Accreditation Program (NELAP), which is supported by the EPA. The NELAP certification is maintained through the state of Florida. Individual state approval for CWA (NPDES),SDWA, and RCRA is managed through the Federal/State DMRQA program or through reciprocal certifications when required by a specific state. To perform radon testing, ELI is certified under the National Radon Proficiency Program administered by the National Environmental Health Association. Branch laboratories of ELI are certified in their own state and in additional states. Copies of ELI's certificates for all laboratories are maintained on ELI's website: www.energylab.com.

The ELI Quality Assurance Manual, the ELI Qualifications Manual, and the ELI Technical Services and Fee Schedule together are used to outline the ELI Quality Assurance/Quality Control Program. This Quality Assurance Manual is appropriate to all departments of Energy Laboratories-Casper. The procedures discussed or referenced in this manual describe our day-to-day laboratory practices and adhere to USEPA Safe Drinking Water Act, and TNI (The NELAC Institute) requirements as well as Good Laboratory Practices (GLPs). Information on ELI-Casper's, and all other ELI branch laboratories', applicable accreditations and certifications are maintained on the ELI website at www.energylab.com. Where possible, ELI uses EPA, AOAC, ASTM, APHA, NIOSH, OSHA, or published analytical methods and follows the procedures with strict adherence to described protocol and recommended QA/QC parameters. The analytical methods approved and in use are described in Standard Operating Procedures, and are available for review at the laboratory. Vital parts of our Quality Assurance Program, Quality Control and Quality Assessment programs are outlined in Chapters One and Two of this manual.

To generate data that will meet project-specific requirements, it is necessary to define the type of decisions that will be made and identify the intended use of the data. Data Quality Objectives (DQOs) are an integrated set of specifications that define data quality requirements and the intended use of the data. Project-specific DQOs will be established as needed for both field and lab operations. Through the DQO process, appropriate reporting limits, extraction/digestion methods, clean-up methods, analytical methods, target analytes, method quality control samples, sample security requirements, quality control acceptance ranges, corrective action procedures, reporting formats and reporting limits can be specified. Professional laboratory project managers are available to assist clients in specifying appropriate laboratory analyses and reporting procedures necessary to meet project requirements.

Client-specific DQOs can be coordinated with the laboratory through our Project Managers via quotations or contracts, or with relevant documentation provided to the laboratory prior to (or at time of) sample receipt. Client-specific requirements are communicated to analysts and final report validators through the laboratory LIMS system. By default, our methods, analytes, and QC parameters are set up to meet the DQOs specified in the referenced method and/or federal/state regulations. ELI encourages clients to provide ELI documentation of any client-specific, regulatory or project monitoring requirements.

Certain types of requests may not be suitable to standardized analytical methods. These custom requests are handled individually with laboratory management and staff scientists. Project-specific methods and reporting packages are available. Attention to documentation of the analytical procedure and use of suitable QC parameters is maintained according to good scientific discipline and Good Laboratory Practice guidelines.

The ELI-Casper Laboratory Manager, or their designee, will evaluate all new contracts to determine that the laboratory is capable of performing the requested work. This process includes ensuring that the laboratory maintains the required accreditation, equipment and resources. In the event that sample analysis is not performed at our Casper location, clients are notified, on the laboratory analytical report, if the work is subcontracted to a qualified branch laboratory or an outside laboratory (See Subcontracting Policy – Chapter 6 in this QA Manual).

This Quality Manual and related quality documentation meet requirements of the National Environmental Laboratory Accreditation Program (NELAP), which is an EPA approved accreditation program.

CHAPTER 1 – QUALITY CONTROL PROGRAM

Quality Policy Statement

Energy Laboratories, Inc. is committed to producing laboratory data of known and documented quality that is scientifically valid, meets method specifications, satisfies regulatory requirements, and accomplishes the data quality objectives of the client and project. Management ensures that the laboratory maintains current certifications and is in compliance with accreditations through USEPA, State Agencies, and NELAP. Those method, regulatory, and client requirements (as well as the policies, procedures, and all referenced documents) are incorporated into our Quality Assurance Program; which is outlined within this Quality Assurance Manual. Our Quality Systems are designed to comply with the standards as defined by the most current version of the NELAC accreditation standard and ISO 17025 standards. To ensure compliance with these standards, all laboratory personnel are required to be familiar with quality documentation and implement those policies and procedures in their work. ELI is dedicated to the continual improvement of the management system's effectiveness by providing appropriate corporate resources to set objectives, offering training opportunities, and monitoring the quality performance of our staff. ELI also provides facilities and equipment adequate and appropriate to these objectives.

Quality Assurance Program

The purpose of the Quality Assurance Program is to ensure that the analytical services provided by Energy Laboratories are of high quality, data is within established accuracy and precision limits (required by the referenced method or Standard Operating Procedure), and each analytical result produced meets or exceeds our accreditation requirements. Management ensures that the integrity of the management system is maintained. The Technical Directors, or their designees, ensure that changes to the management systems are planned, implemented and documented.

Management establishes and maintains data integrity by providing the following to ELI's data integrity system:

1) Data Integrity Training (Including the highest standards of ethical behavior)
2) Periodic review of data integrity procedural documentation
3) Annual review of data integrity procedures with updates as needed
4) Periodic, in-depth monitoring of data integrity
5) Maintenance of signed data integrity documentation for all laboratory employees

All employees are expected to implement and follow the policies contained within the Quality Assurance Program. Internal documents (controlled and associated with the Quality Assurance Program) are listed in Appendix A.

The quality systems in the program consist of the policies and procedures, and all referenced documents, described in this Quality Assurance Manual. The Quality Control Program also functions to maintain the laboratory's compliance with accreditations through USEPA, State Agencies, and NELAP.

The Quality Control Program requires that the following points be met for each applicable analytical method:

- Performance of any analytical method requires that the proper equipment and instrumentation are available. A list of major equipment is listed in Appendix E. The procedure for operation of an analytical instrument is described in the equipment manufacturer's operating manual, and may also be supplemented with a specific Standard Operating Procedure (SOP) for the instrument and/or the method.

- Specific SOPs cover operation of the instrument including the sequence of operations involved in instrument start-up, calibrating, analyzing, and shutting down. Chapter Thirteen of this manual includes recommended preventative maintenance, and/or a list of parameters used to identify other types of maintenance. SOPs outline any special safety precautions for operation of the instrument.

- SOPs of well-detailed Standard Methods, EPA, ASTM, NIOSH, APHA, OSHA, or published procedures include, as appropriate, a list of any method-specific items or variances, a list of QC parameters and their recommended method performance ranges, recommended or example analytical sequences, specific or unique safety information, method references, and a signed signature page. SOPs details, and format of method SOPs, follow NELAP requirements. Detailed SOPs may be prepared for those procedures that do not have published methods. Further details of SOP format and information required in method SOPs can be found in the ELI SOP, *Preparation, Numbering, Use, and Revision of Standard Operating Procedures.* Written Standard Operating Procedures referenced within this manual are available at the laboratory for review. (ELI SOPs are considered confidential proprietary information and ELI does not allow copies to be removed).

- For radiochemical analysis performed at Casper and ELI's branch labs, each method undergoes Method Validation as outlined in EPA's specific method and/or the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), Chapter 6.

- The required detection level (RDL) for radiochemical analysis of drinking water samples is calculated based on the requirements in 40 CFR 141.25(c), which is a sample specific determination. The equation is specific for each method and noted in the method-specific SOP.

- The initial test method evaluation for chemical analysis involves Method Detection Limit (MDL) studies, (refer to ELI SOP, *Determination of Method Detection Limits (MDL) and Quantitation Limits*), confirmation of the Limit of Detection (LOD) and/or Practical Quantitation Limit (PQL), also known as the Limit of Quantitation (LOQ), an evaluation of method performance (using four or more replicates of quality control samples), evaluation of the selectivity of the method, and any additional method-specific requirements

- ELI demonstrates that laboratory staff are qualified and capable of performing the method. Analysts are assigned duties based on their skills and experience. Training records are maintained for all analysts. Curricula vitae of supervisory and senior analysts are described in Appendix D and the ELI *Qualifications Manual*.

- It is the responsibility of the analyst to become thoroughly familiar with the methodology and instrument operation before performing the analysis. It is the responsibility of the person providing training to monitor all laboratory results generated for a reasonable time. The amount of time necessary may vary depending on the method and the experience of the analyst. At a minimum, the analyst's performance is to be monitored until the analyst demonstrates the ability to generate results of acceptable accuracy and precision according to the method.

- All analysts are required to demonstrate and maintain a record of proof of competency by routinely analyzing quality control samples appropriate to the analytical procedures they perform. Competency in analyzing these control samples is documented in analysts' training files per NELAP requirements (for more information, see ELI SOP, *Personnel Training and Training Records*). For those analyses where external proficiency testing (PT) samples are not routinely analyzed, competency is documented by including the results of routine analysis of method-specific quality control samples (prepared by laboratory staff) and/or a verifying statement of procedural review by a supervisor or trained analyst.

- Each analytical method is subjected to quality control monitoring. The purpose is to demonstrate that results generated meet acceptable accuracy and precision criteria for the method. Precision and bias are determined for standard and non-standard methods. Precision and bias are determined for standard methods through control charting of data from quality control samples. Precision and bias using non-standard, modified standard or laboratory-developed methods are compared to the criteria established by the client (when requested), the method, or the laboratory.

- Quality control requirements are outlined in the methods and ELI, at a minimum, follows the guidelines specified in the methods used. Additional QC requirements are also added as appropriate. Performance is periodically evaluated against method requirements using control charts.

- Quality control monitoring to measure accuracy for each method generally requires that five to ten percent of all samples analyzed be fortified (spiked) with a known concentration of target analytes tested by the method. The percent recovery is then calculated. This provides a means for monitoring method accuracy and evaluating sample matrix effects. Where appropriate, surrogates are included in the method to monitor method performance on each individual sample. Blank spike samples replace matrix spike samples for certain methods, or when there is insufficient sample for a matrix spike analysis. Historical, routine batch QC sample performance can be used to estimate the precision and accuracy of the method.

- Quality control monitoring to measure precision for each method requires replicate samples be prepared and analyzed when appropriate. Actual requirements are outlined in the specific SOP. When replicate samples or matrix spike duplicates are analyzed, relative percent difference is calculated and used to monitor precision of the method. In instances where there are no specific method requirements, it is the policy of this laboratory to analyze five to ten percent of all samples in duplicate. Duplicate test results must be within the control limits established for each analysis type or data is

qualified. Acceptance limits generally follow specifications listed in the method. Matrix spike duplicates replace sample duplicates for most methods.

- When not defined in the method, and as appropriate, method blanks and/or instrument blanks are analyzed one in every 20 samples at a minimum. Method blanks are used to verify that contamination from laboratory reagents and glassware is not present in the analytical sample process. Generally, the method blank should be less than the reporting limit, or 10 times less than the concentration amount in the sample, for the analytical parameter being tested, whichever is greater.

- When not defined in the analytical method and as appropriate, method spikes (blank spikes) are analyzed one in every 20 samples, at a minimum.

- Calibration standards are analyzed and calibration curves are developed for all applicable methods. For additional information on instrument calibration, see Chapter Seven of this QA manual.

- The initial calibration is continuously monitored by analyzing a continuing calibration standard every 10 to 20 samples, or within a specified time frequency, and at the end of each analytical sequence; depending on the method and instrumentation. Results must be within an established range as described by the method SOP. Initial calibrations are verified against a standard from a second source.

- Proficiency testing samples and further quality control check samples may be required for various methods. Refer to Chapter Two of this QA manual for further details.

Estimation of Uncertainty

The estimation of uncertainty consists of the sum of the uncertainties of the individual steps or processes of an analytical procedure. The variability of the sampling plan, sample heterogeneity, extraction procedure, instrument calibration, instrument drift, systematic bias, and many other factors all contribute to the uncertainty of a measurement or result.

ELI estimates uncertainty utilizing Confidence Intervals defined as ±2σ (95%) and ±3σ (99%) where σ is the standard deviation of the recovery of quality control samples. The confidence intervals calculated from these QC samples are based on the spike level concentrations for each method. Uncertainty at low concentrations may be one to three times the quantitation limit. Real world samples, depending on matrix interferences, may have a greater amount of uncertainty associated. Due to limitations in assessing the uncertainty for each matrix type, the confidence intervals calculated from method QC samples provides an estimate of uncertainty.

Energy Laboratories, Inc. uses the procedures outlined in ELI SOP, *Control Chart Generation and Maintenance*, for the purpose of evaluating estimation of uncertainty for chemical analyses and uses the determination of uncertainty on a sample-specific basis for all radiochemistry measurements. These estimates of uncertainty have formulas documented in the individual SOP.

Maintenance of Performance Records

All quality control monitoring is recorded and documented. Quality control data is recorded in laboratory notebooks, electronic summary files, and/or analysis sheets. Generally, review of QC data and trends is managed within the Laboratory LIMS system. QC data management and control chart generation, maintenance, and usage are described in ELI SOP, *Control Chart Generation and Maintenance*. It is the responsibility of the analyst to see that all results are recorded in a timely manner.

All quality control data is filed and available for inspection and assessment by analysts, supervisors, management, and quality control personnel.

Method Quality Control Specifications

A general summary of Quality Assurance/Quality Control specifications are outlined in Appendix B. Exact details of method QC can be found in the applicable method SOPs. These types of QA parameter tables are available upon approved request for our clients to use in the preparation of Quality Assurance Project Plans (QAPPs).

CHAPTER 2 – QUALITY ASSESSMENT PROGRAM

The function of the Quality Assessment Program is to provide formal evaluation of the quality of data being generated and reported by the laboratory. External and internal quality control measures are used in this assessment. These measures include proficiency testing samples, laboratory quality control check samples, and routine internal and external audits on methodology and documentation procedures.

Proficiency Testing (PT) Samples

PT samples are supplied by an outside entity and contain known amounts of constituents. The laboratory does not have access to known values of the samples. Only the PT provider has knowledge of constituent levels prior to the formal publishing of the test results.

PT samples are received on a minimum bi-annual basis, with results sent to the providing entity for evaluation. Proficiency Testing (PT) samples for USEPA, NELAP and various State certifications are Water Pollution Study samples (WP or DMRQA), Water Supply Study samples (WS), and LPTP Soil PT samples provided by either Resource Technology Corporation (RTC) and/or Environmental Resource Associates (ERA); both being NELAP approved PT providers. Routine participation in LPTP, WS and WP PT sample studies is used to maintain certifications for Safe Drinking Water Act (SDWA), Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES), Discharge Monitoring Report Quality Assurance (DMRQA), permit monitoring analyses, Resource Conservation and Recovery Act (RCRA) analyses, as well as other states and projects requiring method accredited parameter analyses. The samples are analyzed in the same manner as any routine sample in the laboratory. Acceptable results are those that fall within a defined range as determined by the vendor/EPA/ NELAP; based on multi-laboratory study results. The provider sends results to USEPA and other certifying agencies as requested by ELI-Casper. PT study results are posted on the ELI website www.energylab.com.

A copy of the certificate for our primary certifications to perform drinking water analyses issued by the Environmental Protection Agency (USEPA) and the NELAP certificate from Florida Department of Health are maintained on the ELI website at www.energylab.com.. The EPA certification includes a list of parameters/methods for which drinking water certification has been granted. The NELAP certificate also includes RCRA methods used for hazardous waste characterizations and CWA parameters/methods which are used for NPDES monitoring permits. ELI also participates in the Federal/State DMRQA programs for clients which require/request this with their NPDES permits. Reciprocal accreditation in other states is based on either of these, or both, depending on specific state certification requirements/parameters. A list of current certifications is maintained on the ELI website at www.energylab.com.

Blind Quality Control Check Samples are samples submitted as regular lab samples and are processed through the system in the same manner as any other sample. The analysts do not know the true values of these samples when performing the analyses. Method performance reports are returned to the analysts. Clients occasionally submit these types of samples for their QAPP.

Inter-Laboratory comparison samples are samples containing known/unknown quantities of analytes that are split and analyzed by more than one laboratory.

Quality Control Check Samples

Quality Control Check Samples are performance evaluation samples used for routine method performance monitoring. As appropriate, analytical procedures include the analysis of a quality control sample with every sample batch analyzed. The materials are obtained from a commercial source when available, or they may be prepared in-house. Acceptable results are within a defined range based on certified ranges, or against statistically determined control limits, method-defined criteria or client defined Data Quality Objectives. Routinely used methods not subjected to PT sample monitoring are evaluated with Quality Control Check Samples, as appropriate.

QC samples are processed through the system in the same manner as any other sample, except the analyst is aware of the source, concentration, and acceptance ranges of target analytes and calculates analyte recoveries to evaluate method performance in real time.

Quality Assurance Audits

Quality Assurance Audits consist of internal and external laboratory inspections designed to monitor adherence to Quality Systems and quality control requirements. These audits check general laboratory operations, overall Quality Systems, adherence to QA program requirements, sample tracking procedures, sample holding times, storage requirements, adherence to procedures during analysis, calculations, completion of required quality control samples within the group surrounding the sample, and proper record-keeping.

Internal quality control audits are conducted or coordinated by the Quality Assurance Officer of the laboratory. See ELI SOP, *Internal Quality Assurance Audits*, for further information. ELI conducts internal inspections on a regular basis to monitor adherence to quality control requirements. Results of formal audits are given to management with possible recommendations for corrective action in the event any discrepancies are found. As necessary, a follow-up review is conducted to determine that identified problems have been addressed. Annually, the overall quality systems of the laboratory are reviewed and a summary report is prepared.

Per NELAP/ISO 17025-2005 requirements, the management of the laboratory will conduct an annual review of the Quality System, including policies, procedures and environmental testing activities. This is done to ensure the continuing suitability and effectiveness of the QA systems, as well as provide the opportunity to introduce necessary changes or improvements. The review shall take into account, at a minimum, the following:

- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventative actions
- Assessments by external bodies
- The results of inter-laboratory comparisons or proficiency tests
- Changes in the volume and type of work

- Client feedback
- Complaints
- Recommendations for improvement
- Other relevant factors, such as quality control activities, resources and staff training

The findings from management reviews and the corrective actions that arise from these findings shall be recorded. The management shall ensure that any corrective actions are carried out within an appropriate, pre-determined time frame.

ELI also conducts Peer Audits as part of an internal auditing program established within the company. This process utilizes analysts and supervisors from other branch laboratories to evaluate a designated ELI branch. The Peer Audits serve to not only address conformance issues, but also provide ELI with a tool to continuously improve process and consistency throughout the company. The goals of the Peer Audits are to:

- Encourage relationships between analysts
- Transfer technical knowledge between peers
- Establish consistency of analytical process/method between branch laboratories
- Identify the depth of analysts' knowledge at each position by observing what analysts are doing at the bench
- Determine training needs of personnel
- Document process/method and verify that issues are being corrected when found
- Work with, and in support of, QA department efforts

Depending on the size of the laboratory, a large number of methods and processes are examined during a Peer Audit. Results from these audits are provided to the branch management, as well as Corporate Management. Corrective Action Plans of a Peer Audit are initiated with the assistance of the Corporate Quality Assurance Officer for resolution of any findings.

ELI welcomes external Quality Assurance Audits, by qualified outside auditors, for review and comment on the overall QA program. To maintain certifications, accrediting authorities from the USEPA, and NELAP conduct periodic comprehensive external audits. External audits to meet Quality Assurance Project Plans (QAPPs), as applicable to environmental remediation projects, or for major industries, are conducted as requested. For more information, see ELI SOP, *External Quality Assurance Audits*.

CHAPTER 3 – LABORATORY FACILITIES

The Energy Laboratories, Inc. – Casper, WY facilities consists of five buildings; three of the buildings are on the same property with the main building address of 2393 Salt Creek Highway, Casper, WY 82601. The fourth and fifth buildings, located at 2325 Kerzell Lane, are the radiochemistry laboratory facilities.

The phone number for Casper's Energy Laboratories, Inc. is (307) 235-0515, the fax number is (307) 234-1639, the toll free number is 888-235-0515, and the email address is casper@energylab.com.

Laboratory space includes adequate bench top and floor space to accommodate periods of peak work load. Working space includes sufficient bench top area for processing samples; storage space for reagents, chemicals, glassware, bench and portable equipment items; floor space for stationary equipment; and adequate associated area for cleaning glassware. Laboratory departments are organized and the facilities are designed for specific laboratory operations in order to protect the safety of analysts and to minimize potential sources of contamination between and within department areas (for more information, see ELI SOP, *Facility Description, Access, and Security*).

The laboratory is appropriately ventilated and illuminated, and is not subject to excessive temperature changes. Specific laboratory areas are temperature and humidity controlled as required. Ample cabinets, drawers and shelves are available for storage and protection of glassware. Exhaust fume hoods are available as needed for use during preparation, extraction, and analysis of samples. Employee exposure monitoring is conducted to provide a safe working environment.

To maintain security, all visitors must enter their name on the ELI sign-in log at the front desk and wear a visitor's badge.

The laboratory has provisions for the disposal of chemical, radiochemical and microbiological wastes. These provisions are described in Standard Operating Procedures as well as outlined in the Laboratory Safety Manual & Chemical Hygiene Plan along with other safety and health guidelines. For more information, see ELI SOPs, *General Laboratory Waste Disposal*, and *Radiochemistry Waste Disposal*.

CHAPTER 4 – PERSONNEL REQUIREMENTS AND LABORATORY ORGANIZATION

Relationship between Management, Technical Operations, Support Services and the Quality System

Laboratory Organization

The corporate organization of the five ELI laboratories located in Montana (2), Wyoming (2), and Texas is provided in Appendix C. The Billings laboratory is the center for all corporate functions. Each laboratory is managed and operated individually under the supervision of a Laboratory Manager. Branch laboratories have fiscal and QA/QC responsibilities to Corporate, as well as general operating policies and goals. Quality Assurance Manuals are prepared individually for each branch and follow the QA/QC program outlined in the ELI-Billings QA manual.

The ELI-Casper Organizational Chart is also included in Appendix C with curricula vitae of key ELI-Casper laboratory personnel maintained in Appendix D of this manual. A Personnel Summary for all ELI employees listing title, academic background, and years of relevant experience is alsomaintained in the Corporate Qualifications Manual. Job descriptions are maintained by the Human Resources Department.

Quality Assurance receives direct support from senior management. Branch Quality Assurance Officers report directly to the Corporate Quality Assurance Officer as well as the Laboratory Manager. Quality Assurance Officers provide independent oversight of Quality Systems within the overall Energy Laboratories structure. When Quality Assurance Officers fill more than one role within the organization, they operate independently of direct environmental data generation while fulfilling quality assurance responsibilities. Quality Assurance Officers facilitate development of and maintain the branch Quality Assurance Manual, provide assistance to personnel on quality assurance / quality control issues, maintain a quality assurance training program, and review quality documentation including SOPs.

Management ensures the development and implementation of programs and policies to continuously improve the effectiveness of ELI's QA Program and Management Systems. Management performs an annual review of the laboratory's Quality System (policies, procedures, work instructions) to assure their continuing suitability and effectiveness (See ELI SOP: *Management Reviews*, for detailed procedures). As appropriate, management identifies and implements any necessary changes or improvements. Corrective and preventive actions are detailed in a Corrective Action Report and filed with the QA Department. (Refer to ELI SOP: *Nonconformance Procedures and Corrective/Preventive Action Reports,* for detailed procedures.) In addition, management performs meetings with supervisory and key staff members throughout the year. Supervisors and QA personnel provide input on their specific areas of responsibility and evaluate the following:

1) Client-Related Items
2) Internal and External Audit Reports
3) Proficiency Testing Results
4) Review of Performance by Department
5) Corrective and Preventive Actions

6) Personnel Training Needs
7) Quality System Policies and Procedures
8) Resources including Personnel, Equipment and Facilities

Laboratory Management Review findings are compiled into a summary report. The report includes deficiencies identified and areas for improvement. The QA department ensures items from the Management Review are tracked, including actions that must be addressed, assignment of parties responsible for the actions to be taken, and recommendations on improvements to the Quality System. The Technical Director, Laboratory Manager, QA Manager or designee, shall assign specific persons to address management review findings and establish deadlines for their completion. The Technical Director, Laboratory Manager, QA Manager or designee, reviews and approves all documents issued to personnel in the laboratory as part of the management system. The Technical Director, or designee, has overall responsibility for the technical operations of the laboratory. Any procedural deviations to SOPs that are client or project-specific must receive approval either from the Technical Director, Laboratory Manager, or Quality Assurance Officer. Work is stopped when identification of any of the following is made: unapproved departures from the management system, unauthorized deviations from the procedures for performing tests and/or calibrations, and data quality or data integrity issues. The Technical Director, Laboratory Manager, QA Manager, or designee, is responsible for providing authorization for the work to resume once the identified issue has been addressed.

Personnel Requirements

ELI maintains experienced staff and management. Below is a summary of the primary roles, responsibilities and qualifications for the designated positions. Laboratory experience can be substituted for academic requirements. At ELI's smaller laboratory operations, the technical director may serve multiple roles. Detailed job descriptions are maintained by the Human Resources Departmet. Specific titles of employees are at the discretion of the Laboratory Manager.

Laboratory Manager

The Laboratory Manager is required to have education equivalent to a Bachelor of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

The Laboratory Manager is responsible for all operations, client management, analysis scheduling, equipment acquisition, as well as compliance with all employment, safety, environmental and NELAP/ISO 17025 regulations. The Laboratory Manager may delegate daily activities of these work aspects to appropriate personnel. The Laboratory Manager reports directly to the Corporate Operations Manager. All Laboratory Managers have both technical and management responsibilities.

Quality Assurance Officer

The Quality Assurance Officer is required to have an education or experience equivalent to a Bachelor's of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is preferred.

The Quality Assurance Officer is responsible for quality systems development, implementation, and management. The Quality Assurance Officer is also responsible for maintaining and improving compliance with all applicable state and federal regulations as well as maintaining compliance with NELAP/ISO 17025 regulations regarding Quality Systems. The Quality Assurance Officer or his/her designee manages the laboratory's certification programs to meet government regulatory requirements. The QA program is implemented in cooperation with all levels of management and staff. Quality Assurance Officers report directly to the Corporate Quality Assurance Officer. The Laboratory Manager will direct daily laboratory-specific QA/QC requirements.

Technical Director

The Technical Director is required to have a Bachelor of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

The Technical Director is responsible for ensuring compliance with all laboratory policies and that the analyses conducted under their supervision are compliant with all state, EPA, and NELAC/ISO17025 standards. The Technical Director reports directly to the Laboratory Manager.

The Technical Director may serve multiple roles. The Laboratory Manager can also serve as one of the branch technical directors.

Laboratory Supervisor

A Laboratory Supervisor is required to have education or experience equivalent to a Bachelor of Science degree in Chemistry or related science. Two years of relevant laboratory experience is required.

ELI's Laboratory Supervisors are responsible for the day-to-day operation of the laboratories: scheduling testing, assigning work, and completing the technical review of laboratory data. Supervisors are responsible for ensuring compliance with all laboratory policies and ensure that the analyses conducted under their supervision are compliant with all state, EPA, and NELAC/ISO17025 standards. They report directly to the Laboratory Manager.

Analysts

Laboratory Analysts are required to have an education equivalent to a Bachelor of Science degree in Chemistry (or related science), or a High School diploma with experience as an analyst in training. New analysts require a minimum of six months of on-the-job training, under direct supervision of a qualified analyst, in the measurements being considered for certification. After the initial training period, and on a continuing basis thereafter, the analyst must demonstrate acceptable skills through the successful participation in the analysis of applicable performance evaluation and quality control samples.

Laboratory Analysts perform the following duties: Preparation of samples and reagents, analysis and preliminary data input, as well as various other tests. Laboratory Analysts are responsible for complying with all laboratory policies and procedures.

Laboratory Technicians

Laboratory Technicians are required to have a High School Diploma or equivalent. Laboratory Technicians work under the supervision of the primary analyst performing general laboratory tests.

Under the supervision of a primary analyst, Laboratory Technicians perform the following duties: preparation of samples and reagents, analysis, and preliminary data input, as well as various other tests.

Laboratory Technicians are responsible for complying with all laboratory policies and procedures.

Approved Signatories

Signatures for policies are based on appropriate individuals, roles and responsibilities as determined by the policy being reviewed and approved. A list of significant signatories is included below. Additional signatures may be required for specific procedures.

- Laboratory Manager
- Technical Director
- Quality Assurance Officer
- Radiation Safety Officer (RSO)Corporate Officer- Board of Directors

A master list including signatures and initials for all employees is maintained for reference and signature verification.

CHAPTER 5 – SAMPLING PROCEDURES

Private individuals or companies, who are responsible for using proper collection procedures, collect most of the samples processed in this laboratory. Members of the staff are acquainted with proper sample collection and handling procedures and advise those who need help in this area. Instructions and forms for initiating Chain-of-Custody are available from ELI. Laboratory procedures for logging in samples for analysis and maintaining Chain-of-Custody are described in ELI SOP, *Sample Receipt, Login, and Labeling*.

When the laboratory has been assigned the responsibility of sample collection, there is strict adherence to correct sampling protocols, initiation of chain-of-custody, sampling documentation, complete sample identification, and prompt transfer of sample(s) to the laboratory. Procedures are described in ELI SOP, *Field Sampling*.

This laboratory provides proper sample containers and preservatives as specified for the procedure. Certified sample bottles may be ordered upon request. Sample containers, preservatives, coolers for shipping, re-sealable plastic bags for ice containment, trip blanks for monitoring contamination during shipping, temperature blanks for accurately monitoring sample receiving temperatures, Chain-of-Custody forms, Chain-of-Custody seals, sample bottle labels, instructions for sampling, sample labeling, sample preservation, and sample packaging/shipping are provided upon request. Sample container type, sample volume, preservation requirements, and maximum holding times, are detailed for each analyte/method in the ELI Technical Services and Fee Schedule. See the ELI website, www.energylab.com for the current pricing.

Energy Laboratories maintains a strict Sample Acceptance Policy. The client is immediately notified (as appropriate) upon sample receipt if there is any doubt concerning the sample's suitability for testing, including but not limited to, when:

- Samples are out of temperature compliance;
- Samples are received in unacceptable containers;
- Samples have not been properly preserved;
- Samples have labels or chain-of-custody procedures that are incomplete;
- Samples cannot be analyzed within method recommended holding time; or
- The custody seal has been broken.

Notification of sample receipt condition is available through the final report, Energy Source, Email, telephone and/or voice.

Samples not collected or documented properly can be rejected for any regulatory-based analysis with re-sampling recommended. If re-sampling is not possible, or the client cannot be contacted, the sample may be analyzed, and if analyzed, the sample will be clearly qualified in the data package.

The laboratory will preserve samples at the time of sample login if samples are unpreserved and preservation is required by the methodology. Aqueous samples for volatile analysis are checked for preservation at the time of analysis. Samples for microbiological analysis are collected in pre-sterilized 120 mL plastic bottles containing sodium thiosulfate.

Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at collection. Refer to ELI Technical Services and Fee Schedule for detailed information on sample preservation requirements per applicable method and regulatory requirements.

The laboratory initiates a sample condition report titled Login Prep Checklist at the time of sample receipt. The sample condition report contains Chain-of-Custody procedures, sample preservation status, carrier used for sample shipment, sample receipt temperature, and provides general comments concerning sample condition. In addition, the samples may be screened for potential radioactivity. The sample condition report is provided with the analytical data report package. For more information, see ELI SOP, *Sample Receipt, Login, and Labeling*.

When any sample is shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements as described in the ELI Technical Services and Fee Schedule, the Office of Hazardous Materials, Material Transportation Bureau, and Department of Transportation has determined the Federal Hazardous Materials Regulations do not apply to the following:

A) Hydrochloric Acid - (HCl) in water solutions of 0.04 % by weight or less (pH of 1.96 or greater).
B) Nitric Acid - (HNO_3) in water solutions of 0.15 % by weight or less (pH of 1.62 or greater).
C) Sulfuric Acid - (H_2SO_4) in water solutions of 0.35% by weight or less (pH of 1.15 or greater).
D) Sodium Hydroxide - (NaOH) in water solutions of 0.080% by weight or less (pH of 12.30 or less).

For regulatory compliance monitoring, it is required that all samples be analyzed within the prescribed holding times. Holding times are the maximum times allowed between sampling and analysis for results to still be considered valid. Samples should be delivered to the laboratory as soon as possible following collection to assure that holding times can be met. Samples are analyzed as soon as possible after sample receipt. When maximum holding times cannot be met, re-sampling is requested. If samples are analyzed out of hold, data is appropriately qualified.

To ensure that drinking water analysis for radiochemistry is met, the requirements for sample handling, preservation, and instrumentation for radiochemical analysis are included in ELI SOP: "*Sample Receipt, Log-In and Labeling*". (For additional information, refer to "Manual for the Certification of Laboratories Analyzing Drinking Water", Table VI-2: Sample Handling, Preservation, and Instrumentation, EPA 5th Edition, January 2005).

CHAPTER 6 – SAMPLE HANDLING

The ELI laboratory utilizes a sample tracking policy that includes client-initiated chain of custody. Upon receipt, the security of the samples is maintained by the implementation of the laboratory access and security policies. See ELI SOP, *Facility Description, Access and Security*.

Sample Receipt

All samples arriving at the laboratory are logged in the Laboratory Information Management System (LIMS). Each sample container is given a unique laboratory sample number. The sample receipt checklist evaluates Chain-of-Custody procedures, sample preservation status, carrier used for sample shipment, sample temperature, and provides general comments concerning sample condition. The completed checklist is provided with the analytical report package. Chain-of-Custody forms are checked for pertinent information. If necessary information has been omitted, the collector is notified, if possible, and the missing information is requested.

Samples requiring preservation are checked to determine if the client performed preservation. If requested, ELI staff will preserve or filter samples as appropriate. Samples that degrade quickly or cannot be opened (such as aqueous samples for volatiles) are not preserved at the time of sample login. If samples are improperly preserved, or the maximum holding times are exceeded upon arrival at the laboratory, the client is notified and re-sampling is requested.

Samples are stored per method specifications, or as method/parameter storage requirements are updated per later EPA guidance in Federal Regulations posted in 40CFR (Method Update Rules).

During sample login, all sample information such as sample description, client name and address, analyses requested, special requirements, etc. are entered into the computer database of the Laboratory Information Management System (LIMS). Requested analysis parameters and special requirements are communicated to the analysts via their LIMS work lists. Project-specific requirements are maintained in the LIMS for any samples received from a special project. This process ensures that individual requirements are maintained.

Chain-of-Custody

Evidence level internal chain-of-custody (COC) procedures are available on a project-specific basis. For these procedures, internal COC sample custody is maintained down to the individual analyst level. When transferring the possession of the samples, the transferee must sign and record the date and time on the chain-of-custody record. Every person who takes custody must fill in the appropriate section of the chain-of-custody record. When received by ELI, sample identification information on the sample containers is compared to the custody report form. The sample is inspected and information regarding the condition of the sample and seal (if used) is recorded on a report form; the method of shipping is also documented on the report form. A copy of the report form is kept with the sample data file and a copy is sent to the client with the analysis report. Internal chain-of-custody forms are used to document the progress of the sample through the laboratory. ELI's routine COC policy is maintained at the laboratory level

through our laboratory access and security policies. See ELI SOP, *Facility Description, Access, and Security*.

Sample Tracking

Samples are tracked through the analytical process by the LIMS. Completed analyses, which have been approved by the appropriate reviewer as valid data, are reported in the LIMS. When all analyses are complete, the data is reviewed as a whole to ensure results pass data quality checks. The completed report is signed by an approved signatory. The signed report is sent to the client via requested delivery format. Generation of the invoice automatically completes the work order in the LIMS and removes the samples from the status report. For more information, see ELI SOP, *Document and Record Management, Control and Archiving*.

Sample Disposal

It is preferred that remaining hazardous sample material be returned to the originator (client) for disposal. When this is not possible or reasonable, ELI will dispose of remaining hazardous sample materials with a waste disposal surcharge added to the cost of the analysis.

The disposal of laboratory wastes will be performed in accordance with local, state, and federal regulations which apply to such activities. Each method SOP addresses waste minimization and management specific to the method procedure. See ELI SOPs, *General Laboratory Waste Disposal,* and *Radiochemistry Waste Disposal* for more information.

Subcontracting Policy

The ELI Casper laboratory utilizes the expanded branch laboratory capability and expertise to provide comprehensive analytical services. This occurs when the laboratory is requested to perform an analysis outside of the laboratory's capabilities (If sample overload is experienced; if equipment is out of service; or when the laboratory is not accredited for the particular analysis). Upon completion of the analyses, the branch laboratories report the sample results, and their quality control package, to the primary laboratory. The results are reviewed before being reported.

Branch laboratories are certified to perform drinking water analysis in their state and in neighboring states. Samples are forwarded to our branch laboratories only if the laboratory is certified in the state from which the sample originated. Individual branch laboratory Quality Assurance Programs are consistent with the Corporate Quality Assurance Program and are monitored through internal laboratory audits.

To support Energy Laboratories, Inc. Casper analytical services, ELI branch laboratories (which maintain specific instrumentation for specialized analysis) are utilized to provide complete analytical services. All branch laboratory certificates are available on the Energy Laboratories website at www.energylab.com.

In the event that ELI is dependent on the service of an outside laboratory for analyses not available through our facility or our branch laboratories, the client is notified that their samples

are subcontracted to an outside laboratory. The outside laboratory reports the results to ELI and these results become part of the final report. Any external or internal subcontracted analyses that require accredited analyses will be performed by a laboratory accredited for those parameters in the State from which the sample originated. All final reports indicate where the analyses were performed.

CHAPTER 7 – INSTRUMENT OPERATION AND CALIBRATION

Laboratory instruments and equipment are operated and calibrated according to the manufacturer's instructions and according to the requirements of the method being used. Exact calibration procedures are outlined in the appropriate SOP. For most instruments, a calibration curve composed of three to five standards covering the concentration range of the samples is prepared. The acceptance criteria for the calibration curves are listed in the individual methods. Unless otherwise specified in the method, at least one of the standards is at or below the practical quantitation limit (PQL) of the method. Routine PQLs for each method are given in the ELI Technical Services and Fee Schedule. Calibration standards are routinely compared to second source calibration standards to verify accuracy. These second source standard results must fall within an established range, as described by the SOP, to be accepted. Whenever possible, the laboratory uses calibration standards prepared from certified stock standards. Initial instrument calibration curves are verified and routinely monitored by analyzing a continuing calibration standard every 10 to 20 samples (or within a specified time frequency) and at the end of every analytical sequence, depending on the analysis method and instrumentation. When applicable to the method, high-level samples, which produce an analytical response outside the calibrated range of the instrument, are diluted (or reduced in mass) and re-analyzed until a response within the calibrated range is obtained and/or the result is appropriately qualified.

System cleanliness is verified through the analysis of reagent/instrument blanks prior to analysis, between highly contaminated samples, and at regular intervals during the analysis.

Use of measuring equipment and reagents (glassware, water, chemical reagents, and industrial gases) conform to Good Laboratory Practice guidelines. Good Laboratory Practices (GLPs) are laboratory guidelines which were established by the Food and Drug Administration and published in the Federal Register (21 CFR, part 58). The GLP guidelines were adopted by the Environmental Protection Agency. SOPs are developed in accordance with GLP and NELAP guidelines. Laboratory volumetric glassware conforms to National Institute of Standards and Technology (NIST), American Society for Testing and Materials (ASTM) Class A or B standards. All mechanical pipettes are calibrated at least quarterly. Laboratory balances are serviced annually and calibrated by certified technicians. Calibration checks of balances are performed each day of use, using ASTM Class 1 or 2 weights. Laboratory thermometers are calibrated annually against a NIST traceable thermometer. Laboratory drying ovens, incubators, freezers, refrigerators, and water bath temperatures are monitored and recorded each working day, or at frequencies as described in the specific SOP. Laboratory pure water is generated by commercial water purification systems and is monitored and documented each working day in accordance with specifications needed for applicable methods. The routine analysis of laboratory blanks is used to verify laboratory water quality and the suitability of sampling containers. Chemical reagents and gases meet or exceed purity requirements for their intended uses. Laboratory stock and working standards are derived from ISO 17025 and/or 9001 (or equivalent-certified) commercially available primary standards whenever possible. Standard preparation notebooks document the reagent/standard type, source, purity, content, concentrations, preparation date, and analyst. All calibration standards are documented in the analytical records such that they are uniquely identified and traceable to stock standards and their source.

Standard Operating Procedures (SOPs) detail the sequence of operations involved in instrument start-up, calibration, analysis, shut-down, and routine maintenance. Suggestions for

corrective action are included with the SOPs and parameters are identified which dictate certain types of maintenance. Instrument and method detection limit studies are performed at the method required frequency or whenever there is a significant change in instrumentation. Method Detection Limits are determined according to EPA guidelines found in 40 CFR, part 136, Appendix B for general chemistry and 40 CFR 141.25 (c) for radiochemistry (except for the few methods that are not amenable to MDLs). Refer to ELI's Technical Services and Fee Schedule for practical quantitation limits (method reporting limits). Acceptable instrument response/performance criteria are based upon the manufacturer or the analytical method specifications. SOPs exist for all major pieces of analytical equipment/methods.

Instrument logbooks and/or electronic logbooks are used to document instrument maintenance and repairs. Instruments that are no longer being utilized are documented in the applicable instrument logbook as "out-of-service" with the date the instrument was taken out of use noted. All out-of-service instruments are labeled with an out-of-service tag that identifies the effective date the instrument was taken out of use.

Laboratory analysts record and document all instrumental runs in Laboratory Instrument Logbooks or computer files. Instrument Logbooks and/or dated computer files record instrument performance data, analytical sequences, instrument maintenance, calibration standards data, and any other additional information pertinent to operation of the instrument.

CHAPTER 8 – RECORDS AND REPORTING

Document Management

Energy Laboratories Inc. QA manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

A CONTROLLED document is one that is uniquely identified, issued, tracked, and kept current as part of the Quality System. Controlled documents may be internal documents or external documents. A list of ELI's controlled documents is listed in Appendix A. All ELI controlled documents are written and reviewed by personnel technically competent to perform that procedure and approved for use by the Laboratory Manager as well as the Quality Assurance Officer.

APPROVED documents have been reviewed, signed and dated by the technical reviewer, the Quality Assurance Officer and the Laboratory Manager or designee.

OBSOLETE documents are documents that have been superseded by more recent versions. Obsolete documents are retained for legal use or historical knowledge preservation. Old or archived SOPs are available for review using the laboratory's electronic document system. ELI's OBSOLETE document records are maintained for at least ten years.

Documents are reviewed on an annual basis to ensure their contents are suitable and in compliance with the current quality systems requirements, and accurately describe current operations. SOPs include a Record of Review/Revision page, which details revisions or reviews. The branch Quality Assurance Officer maintains a master list of controlled documents (which include title, author, and date of issue).

Procedures for identification, collection, access, filing, storage, and disposal of records are found in ELI SOP, *Document and Record Management Control and Archiving*.

Laboratory Notebooks

Several different types of Laboratory Notebooks are maintained at the ELI Laboratory. These include, but are not limited to, the following:

- Method/Parameter Notebooks
- Project Notebooks
- Instrument/Equipment Use and Maintenance Notebooks
- Standard Preparation Logbooks
- Balance Calibration Logbooks
- Pipet Calibration Logbooks
- General Logbooks

The general purpose of maintaining each of these Laboratory Notebooks is to record the details that may be important in repeating a procedure, interpreting data, or documenting certain operations. Entries in the notebook may include data such as standard and sample weights, pH measurements, instrument operating parameters, preparation of calibration curves, analytical run sequences, calculations, recording of instrument operating parameters, sample condition,

etc. The analyst's notebook is particularly important in documenting analyses that deviate in any way from routine or standard practices. It can also be an important training record. All pertinent data is to be recorded directly in the notebook. Some notebooks or data records are maintained in electronic format (LIMS, spreadsheets, or databases). Electronic data records are duplicated using hardcopy and/or alternate electronic backup techniques.

It is the responsibility of each analyst to maintain a laboratory notebook according to Good Laboratory Practices (GLP) Guidelines. All physical laboratory notebooks are assigned a unique logbook control number and are assigned to an analyst and/or supervisor. These notebooks remain the responsibility of the ELI staff member's supervisor to whom they are assigned until they are formally transferred to another staff member, until they are completely filled and returned to the ELI QA Department for archiving. ELI staff members, other than the individual to whom the laboratory notebook is issued to, may make entries in the notebook as long as those entries are consistent with the intended use of the notebook and such entries are initialed and dated. Procedures for use and maintenance of laboratory notebooks are detailed in ELI SOP, *Laboratory Notebooks*.

Records

The laboratory maintains records of all chemical analyses, including all quality control records, for a minimum of ten years. In the event that Energy Laboratories, Inc., or any individual laboratory transfers ownership or goes out of business, the records will be transferred to the new owners. If a branch laboratory is closed, records will be maintained by Energy Laboratories Corporate office in Billings, Montana. Energy Laboratories, Inc. reserves the right to offer the records to the clients in the event of complete closure. Details are described in ELI SOP, *Document and Record Management, Control and Archiving*.

Data Reduction

Data reduction refers to the process of converting raw data to reportable units. The reporting units used and analytical methods performed are described in the ELI Technical Services and Fee Schedule.

Wherever possible, the instrument is calibrated to read out directly in the units reported. In this case, the value is recorded directly into a laboratory notebook, logbook, bench sheet, or electronic file and presented for review.

In cases such as titration, gravimetric measurements, or other techniques that require calculation prior to reporting, raw data is recorded in the appropriate laboratory notebook or electronic file, or on the appropriate laboratory form. The calculations specified in the methods are used to determine the reported value. That value is also entered into the laboratory notebook or bench sheet. Most calculations are automated to reduce the chance of arithmetic or transcription errors.

Wherever possible, electronic data results are transmitted throughout the laboratory via the LIMS computer network. This process is intended to minimize manual data transcriptions within the laboratory. Additional advantages include the opportunity for rapid comprehensive data validation by supervisors, and more rapid data reporting.

Validation

Data validation includes the procedures used to ensure that the reported values are consistent with the raw data, calculated values, sample type, sample history, and other analysis parameters requested.

The data recorded is validated with several review steps. The analyst who submits the analytical results checks all the values reported for omissions and accuracy. Elements of this review also evaluate all instrument and method QC results. Automated data management programs are designed with an interactive step allowing data review by the analyst. Results to be reported are approved by the analyst.

The report is reviewed for the suitability of the data according to project and method performance specifications. Analytical results for each requested parameter may be evaluated against other requested parameters, project specifications, other samples within the set, historical files associated with the project/client, and/or any other information provided with the sample.

The reports are generated, proofread, and reviewed by designated reporting staff.

The Laboratory Manager, project managers, supervisors, Quality Assurance Manager or their designees, may also examine the data included in the final report.

Internal and external laboratory audits review selected sets of data to ensure that the analytical results are correct and accurate, analytical methods are appropriate, documentation and record keeping procedures are complete, and that there is compliance to the overall objectives of the Quality Assurance Program. Data integrity is being monitored on an on-going basis.

All controlled automated programs used to process and report data are initially verified using manually calculated results. Whenever a modification is performed to a program, re-verification of overall software function is performed.

One step of the Quality Control process involves data outlier detection; data that falls outside of established limits. If an outlier is observed, corrective action is taken as appropriate, to investigate and/or correct the cause. Actions to correct these causes may include, but are not limited to, inspection of the instrumentation, checking calibrations, checking sample numbers or dilutions, re-analyzing samples or calibrations.

Reporting

One copy of the report is distributed to the client, via requested delivery format, after the report is validated and signed. A standardized report format is used unless otherwise specified. Client-specified report formats are available upon request. Results can be sent via physical media, email, EDD, website FTP and/or FAX when requested by the client. Energy Laboratories, Inc. offers its clients access to electronic records through our Energy Source Portal.

Various levels of data reporting are available. All analytical results, regardless of the level of reporting used, have record keeping procedures which allow an appropriate "data validation package" to be produced. Note that a comprehensive "data validation package" is most easily generated at the time of sample analysis. Example data packages are available upon request.

Safe Drinking Water Act (SDWA) compliance monitoring samples for microbiological and chemistry samples that exceed the SDWA maximum contaminant level (MCL) may require notification to the appropriate state agencies. Generally, notification to the client, and to the state, of any SDWA MCL exceedance must be within 24 hours of completion of analysis/review, or by noon the next business day. If requested by the client, additional copies of the report will be sent to a specified address or person.

The final copy of a completed report is maintained in an electronic format. An electronic copy of this file is available upon request. Energy Source is a client resource of ELI that provides secure online access for clients to view their data and documents. Clients are able to access their electronic files through ELI's secure website at https://energysource.energylab.com/. For more information, see ELI SOP, *Document and Record Management, Control and Archiving*.

In addition to traditional ink signatures, Energy Laboratories has approved the use of electronic signatures within our company-produced PDF documents. These signatures comply with Title 15 of the US Code Section 101 regarding legal requirements of a digital signature.

Electronic signatures verify that the document has not changed after it was produced. Upon opening the document, notifications automatically display to inform the recipient of the validity of the sender's electronic signature and all included certificates. Should any changes be detected, an alert message is automatically displayed, noting that the signatures cannot be validated due to changes made to the document. Detailed instruction on how to view/validate ELI's electronic signatures is available.

CHAPTER 9 – GENERAL LABORATORY PRACTICES

Chemicals and Reagents

When available and appropriate, chemicals used in the laboratory are analytical reagent grade (AR) chemicals purchased from reliable suppliers. Reagents are prepared, standardized, and made fresh as mandated by the method, their stability, and according to Good Laboratory Practices. Procedures for purchasing of materials may be found in ELI SOP, *Property Procurement, Inventory, and Control*.

Normalized standards are checked regularly against independently prepared reference materials.

All standards and reagents are dated when received, opened, or prepared, and each is labeled with an expiration date when applicable. Standards and reagents are checked for discoloration or signs of degradation and are discarded if these are observed.

Certified primary standards are obtained from ISO accredited commercial sources when available. Standards used for calibration are verified against second source standards. Secondary and working standards are accurately prepared with volumetric flasks, or other calibrated glassware, from primary standards and stored in appropriate containers.

ELI has determined 10 years to be a reasonable expiration date for stable salts where the manufacturer does not supply such information. Titrants, standards, and other solutions used for analytical purposes are frequently standardized upon preparation with certified or traceable standards. Method SOPs specify if standardization is necessary. The date and analyst's initials must be recorded on the container whenever re-standardized and these records are maintained in a laboratory notebook or in the LIMS.

Individual SOPs may also provide additional details for reagent requirements.

Reagent Interference

To determine the extent of reagent interference, method blanks are analyzed prior to sample analysis whenever appropriate.

If any interference cannot be eliminated, the magnitude of the interference is considered when calculating the concentration of the specific constituent in the sample, but only when permitted within the applicable method.

If reagents, materials, or solvents contain substances that interfere with a particular determination, they are replaced.

Individual method SOPs may also provide additional requirements for handling reagent interferences.

Glassware Preparation

All glassware used for inorganic and radiochemical analysis is washed in warm detergent solution and thoroughly rinsed in tap water. Glassware is then rinsed well three times with laboratory-purified water. This cleaning procedure is sufficient for many analytical needs, but individual SOPs detail additional procedures when necessary. Glassware washing procedures for various analysis are described in ELI SOPs, *Cleaning of Glassware Used in Inorganic Analyte Sample Preparation and Analysis*, *Cleaning of Glassware Used in Volatile and Semivolatile Analyte Sample Preparation and Analysis*, and *Cleaning of Glassware Used in Radiochemical Sample Preparation and Analysis.*

All glassware used for organic analysis is washed in warm synthetic detergent solution and thoroughly rinsed in tap water. The glassware is then rinsed well with laboratory-purified water, followed by rinses with acetone to remove any residual organics. Prior to use, the glassware is rinsed three times with the organic solvent to be used with the glassware.

All glassware used for microbiological analysis is washed in warm detergent solution. The detergent must be proven to contain no bacteriostatic or inhibiting substances. The glassware is rinsed thoroughly with laboratory-purified water. Specific details are described in method specific SOPs.

Disposable, glassware/plasticware is preferred for many procedures in the laboratory. The cleanliness and suitability of disposable glassware/plasticware is continuously evaluated for each test with the routine analysis of method blanks.

All volumetric glassware used in precise measurements of volume is Class A or laboratory calibrated.

Laboratory Pure Water

Laboratory-purified water is used in the laboratory for dilution, preparation of reagent solutions and final rinsing of glassware. For organic analysis, organic-free water is prepared and used. Energy Laboratories, Inc. uses water purification systems that are designed to produce deionized water that meets the requirements of the methods. Use and maintenance of laboratory reagent water systems are described in ELI SOP, *Use and Maintenance of the Laboratory Purified Water System.*

Water quality is monitored for acceptability in the procedure in which it is used. Specific details are listed in the appropriate SOPs.

Employee Training

All new ELI employees and contract personnel are given an initial general orientation and tour of the laboratory facilities. Personnel are shown the locations of safety equipment such as safety showers, eye wash fountains, fire extinguishers, and first aid supplies. Personal protective equipment such as lab coats, disposable gloves, and safety glasses (if applicable) are issued at this time.

Safety considerations are a vital part of the training process. All hazards associated with the performance of a procedure or with the operation of an instrument are to be understood by the

trainee before training can be considered complete. General laboratory safety procedures are a part of the new and current employee training. Specific safety procedures are outlined in SOPs and in instrument Operator's Manuals. Training in use of protective clothing, eye protection, ventilation, and general safety are provided to each employee. Each employee is required to read and sign the *Laboratory Safety Manual & Chemical Hygiene Plan*.

All new and existing employees must demonstrate capability prior to performing an analytical procedure independently (see Chapter One). Method performance on Quality Control Samples is used to document employee training and work quality. Employees are required to read the Quality Assurance Manual and all appropriate SOPs. Employees are required to sign a Quality Assurance Manual Acknowledgement form which states that they have read, understood, and will comply with the requirements of the Quality Assurance Manual. Employees also are required to sign, for all applicable SOPs, a Record of Acknowledgement Form that states they have read, understood, and agree to abide by the SOP. In the case of method SOPs, the employees sign a Record of Acknowledgement form that states they have read, understood, and agree to abide by the SOP.

Employees also receive training on general laboratory policies including ethics and conflict of interest. All employees are required to read, understand and comply with the Corporate Compliance & Ethics Manual. Data integrity training is provided for all employees initially upon hire and annually thereafter. In addition to the *Corporate Compliance & Ethics Manual*, the ELI Quality Assurance department maintains a *Laboratory Ethics & Data Integrity Manual*, which supplements the corporate manual and provides specific training on data integrity. All employees are required to read, understand and comply with the ELI *Laboratory Ethics & Data Integrity Manual*. An annual Ethics training course is given to all laboratory employees. Attendance is required and is recorded with a signature attendance sheet or other form of documentation that demonstrates all staff have participated and understand their obligations related to data integrity and ethics policies. For details pertaining to ethics training and additional ethical procedures and policies refer to ELI SOP, *Personnel Training and Training Records*.

ELI encourages attendance at courses, workshops and other forms of continuing education available from on-site seminars, private institutions, local schools, and State and Federal regulatory agencies. Staff and department meetings are held routinely to communicate company policies and procedures. All training on procedures and policies is documented, per NELAP guidelines, in employee training files. For more information see ELI SOP, *Personnel Training and Training Records*.

Data Integrity

In order to provide for the integrity of ELI and client data, the laboratory has multiple controls on the network, LIMS and applications used. These controls limit access to and the ability to change data as well as provide for redundancy in case of loss.

These include but are not limited to:

- Users connecting to ELI computer systems are authenticated through a user name and password combination.
- Passwords are required to be changed on a regular basis.

- Permissions within ELI applications are role based with different roles having various levels of access and control. Users (analysts, supervisors, and managers) are assigned to these roles.
- In the LIMS, analytical data locks after a period of time and cannot be modified without special handling.
- Certain information has been identified for additional tracking and logging. Changes to this information is not only tracked in an audit log but also reported to select personnel.
- Information on ELI servers including the ELI LIMS system is backed up and recoverable.

Standard Operating Procedures

Laboratory operations and procedures are documented in Standard Operating Procedures (SOPs). SOPs provide information on the consistent and safe operation of the laboratory... For analytical methods, SOPs provide information on the details of the analysis that is not specified in a published analytical method. For routine procedures other than analytical methods, SOPs define the steps required in accomplishing a given task. All SOPs are reviewed and updated periodically to reflect any changes in laboratory operations. Method SOPs follow NELAP requirements. For more information on generation and distribution of SOPs, see ELI SOP, *Preparation, Numbering, Use, and Revision of Standard Operating Procedures*.

Client Confidentiality

Each employee has the responsibility to maintain confidentiality in all matters pertaining to our clients, samples submitted, and Energy Laboratories, Inc. Information obtained during employment with this laboratory, regarding the specific business of this laboratory, or its clients shall at no time be revealed to any outside sources without permission from the owner of the data.

Sample submittal, analysis and the report contents are considered confidential information of the client. When requested to provide results (either in person, via telephone or email), the employees shall verify that the requestor is either the person associated with the project, on the COC, or on a list provided by the client who are authorized to receive data. If a person who is not associated with the project personnel (or is not on the approved list), the base client will be contacted to inquire about authorization to release data. These contacts are documented and associated with the work order in the LIMS system to provide archival proof of authorization to release data. If the client does not authorize a release of data, the requestor will be contacted and informed of this decision.

Client confidentially is maintained electronically through the use of password-protected logins on all laboratory computer systems. Additionally, the laboratory maintains network security such as anti-virus programs and firewalls that prevent any unauthorized outside access. All copies of the original report are stored on the laboratory's document archival system, which is also protected from unauthorized use by the network security systems. Raw data, reports, and LIMS records are kept in a secure location of the laboratory or off-site. All client confidential paper waste, including printouts, is shredded.

CHAPTER 10 – QUALITY CONTROL MONITORING

Routine Monitoring

Temperatures of incubators, water baths, refrigerators, and ovens are checked and recorded according to a prescribed schedule using an automated monitoring system. In the event that the automated monitoring system is inoperable for more than twelve hours the appropriate temperatures will be recorded manually on instrument specific forms.

Conductivity of the laboratory-purified water is continuously monitored using an automated monitoring system and as method blanks in routine analytical runs. In the event that the automated monitoring system is inoperable for more than twelve hours the recorded method blanks will serve as the required monitoring.

Reagents are dated and initialed at the time of receipt. Expirations dates are assigned as a fundamental component of their receipt and/or preparation. Reagents are not used after manufacturer's expiration date is exceeded.

Balances are checked daily, or as required, against ASTM Class 1 or 2 NIST traceable weights and are calibrated and serviced by certified technicians annually.

SOPs are reviewed periodically for accuracy.

Laboratory Notebooks are reviewed periodically for correctness and accuracy by supervisors.

Proficiency Testing (PT) Samples are analyzed as required (See Chapter Two of this QA Manual).

Quality Control Check Samples are analyzed with each analytical batch.

Internal and external audits are performed as specified or requested (See Chapter Two of this QA Manual for additional discussion).

Additional monitoring requirements may also be specified in individual SOPs.

The Laboratory maintains an active fraud protection program that is implemented through the laboratory ethics policy. Additionally, the potential of fraud is monitored through analyst supervision, management supervision, regular internal audits, PT study participation, and an active quality assurance program.

Instruments/Methods

Calibration is performed as outlined in Chapter Seven of this QA Manual.

Generally, and depending on method requirements, the standard curve is verified with a known second source reference sample. The reference sample results must fall within the appropriate target range for the calibration to be accepted.

In most cases, the calibration stability is checked by analyzing a continuing calibration standard every 10 to 20 samples, depending on the analysis and instrumentation. The verification standard results must fall within an established range as described by the SOP.

All laboratory instruments are subjected to preventive maintenance schedules. Preventive maintenance schedules are specified in instrument maintenance logbooks.

As appropriate, instrument and/or method detection limits are determined annually, or more frequently if changes in instrument performance are noted or per method requirements. Procedures for the determination of instrument detection and method detection limits are described in ELI SOP, *Determination of Method Detection Limits (MDL) and Quantitation Limits*.

Precision and accuracy requirements for each method are specified in the SOPs. General guidelines are given below.

- Each analytical batch will contain QC samples to measure the accuracy of the method. Each QC sample result is monitored to be within QC specifications of the method. Results of blank spiked sample analysis must be within the established control limits. Quality Control Limits are specified in the SOPs and meet recommended QC limits as described in the referenced method.

- Each analytical batch will contain QC samples to measure the precision of the method. (See Chapter One for discussion on duplicate sample analysis.) Criteria for duplicate sample acceptance are found in the SOP and are generally taken from the referenced method.

- Each analytical batch will contain QC samples to measure the performance of the method on the sample matrix. These are typically identified as a matrix spike analysis and may be performed in duplicate to assess method precision. Typically the sample is fortified with a known amount of target analyte and spike recoveries are calculated. Results outside of method QC guidance are flagged. Quality control limits and appropriate corrective actions steps are specified in the method SOP.

- Several methods are considered to be concurrent methods in that they are either nearly identical or are identical to a method with a different citation. Even if two methodologies are identical in procedure, slight differences in the QC requirements might be the only difference between the two methodologies. These types of methods may also be considered "concurrent" if the procedures are identical and the more stringent of the two method criteria are used. During data reduction and reporting, the referenced method specifications and criteria will always take priority.

As appropriate, the performance trends of QC sample results are evaluated with Quality Control Charts. Suitability of existing QC limits is evaluated and possibly adjusted, but not to exceed method specification.

CHAPTER 11 – CORRECTIVE ACTION

When the quality control checks indicate that an analysis is not within the established control limits, corrective action is needed. This section gives general guidelines for corrective action. Corrective actions for each method or instrument are detailed in individual SOPs. Records are maintained of non-conformances requiring corrective action to show that the root cause(s) was investigated, and includes the results of the investigation. The QA Officer will monitor implementation and documentation of the corrective action to assure that the corrective actions were effective.

Method QC samples that fail to fall within QC control limits may be analyzed again to verify if a problem exists. However, matrix spike or matrix spike duplicate QC samples are not required to be re-analyzed if the performance can be attributed to matrix effects; data results are then reported and flagged.

If the repeat analysis is not within control limits, the particular instrument or procedure is checked according to the specific protocols outlined in the method or according to the instrument manufacturer's guidelines. Once results are within control limits, analysis of all samples that were analyzed while the procedure was out of control are repeated, i.e., all analyses are repeated back to the previous acceptable control sample. In the case of radiochemical analysis, the term “analyze again” means to recount the final sample on the same (or different) detector.

If the analyst is unable to achieve acceptable results after following the corrective action guidelines detailed in the SOP, a supervisor and/or the Technical Director is consulted. If necessary, the appropriate service personnel are contacted if the problem is determined to be due to instrument error, and cannot be resolved. It is also possible that the result is due to statistical variation of the results based on the tolerable error rate that has been determined for the analysis (usually 0.05). In certain cases, where control limits are exceeded, it is possible that problems cannot be corrected to satisfy QC criteria. This could be due to problems such as matrix interference, instrument problems, lack of sufficient sample, missed holding times, high blank contamination, etc. If all possible solutions available to correct the problem are examined and the sample results are still considered valid, qualifying comments are attached to the sample report describing the non-compliance and probable cause.

In the case of a single radiochemistry detector being returned to service, this refers only to the samples counted on that detector. For example, an individual gas proportional counter instrument may have up to 16 detectors; if only one does not pass the QC check the others are still valid and sample analyses performed on the others do not need to be repeated.

In the event that a QC audit or other informational review shows an analysis report to be incorrect, incomplete, or adversely compromised, a revised report and explanation is submitted to the client within ten business days unless otherwise communicated to the client with another time period. The report will clearly be identified as a revised report. As appropriate, an explanation submitted to the client should give a detailed review of the problem and document any unapproved deviations from the regulations, standard operating procedures, or project-specific scope of work that may have caused it. The explanation to the client may include, but not be limited to, the following components:

1) What actions have been taken regarding the affected data set(s),
2) Identification of the cause, and
3) Corrective action(s) taken to prevent future occurrence.

In the event that a QC check fails, the analyst will follow the procedures outlined in the QA/QC summary of the SOP.

Quality Control Checks for each method or instrument may vary. Energy Laboratories Inc. follows the QC checks set by each governing method. Due to the wide variations between methods, specifics are listed within each SOP for the given method. Please reference the SOP for specific QC checks for the given method. The QC checks may include: ICV, MB, CCV, CCB, LCS, LCSD, LOD, MS, MSD or others specific to that method.

A general summary of Quality Assurance/Quality Control specifications is outlined in Appendix B. Exact details of method QC can be found in the applicable method SOPs.

Procedure for Dealing with Complaints

DEFINITIONS

Complaint: For the purposes of this procedure, a complaint comes from a client, a user of our data, or employee. The complaint might cover issues about the quality of our data, sample turnaround time, method used, pricing, or other expectations.

Client: The client is a person or company that ordered and paid for the services.

Procedure: The staff person receiving the complaint exercises judgment in deciding the severity and disposition of every complaint. The judgment must be used to decide whom, if anyone, is alerted to the complaint and what actions are appropriate. The complaint issued should be handled with a high degree of discretion and tact by the supervisor or manager involved. The individual handling the complaint is instructed to follow ELI's guidelines provided in this section on how to handle the complaint. This involves listening to the client and getting adequate information so the complaint can be investigated and resolved. The appropriate laboratory staff is notified and a solution to the problem, as well as a timeline for action, is given.

After the complaint is investigated or resolved, as necessary, the client is made aware of the results and determination is made as to what further actions are needed. Complaints and investigations may result in the need to submit a revised report or invoice. Complaints that are straightforward and can be resolved using the resources available to the person handling the complaint should be resolved there. These include such things as minor revisions of reports or invoices. If other decisions need to be made, the appropriate person should be contacted.

It may be appropriate to initiate or prepare a non-compliance report. This report should be completed with the intention of informing the affected staff about the problem from which everyone may learn, change our procedures and improve our service. A procedure to document non-compliance reports is documented in ELI SOP, *Nonconformance Procedures and Corrective/Preventive Action Reports.*

If an employee sees an issue, they are encouraged to report concerns regarding Quality Systems, unethical behavior, and/or financial mismanagement. This issue should initially be brought to the attention of their supervisor. The supervisor will take appropriate action to resolve the concern. If the employee is uncomfortable with approaching their supervisor or feels that the issue was not properly dealt with, they may approach higher levels of management with their issue.

Energy Laboratories, Inc., has also implemented a program to facilitate confidential reporting to upper management. This tool allows employees to report situations or behaviors that they consider to be unethical, immoral, or improper. It also allows the reporting of suggestions or comments. The program has been implemented at ELI so that anyone reporting a situation can be assured that there will not be retaliation for reporting. It is meant to encourage parties to communicate with upper management when there appears to be no alternative for resolving the types of issues already described. . Access to the program is available on the ELI internal and external websites as well as through a 24-hour telephone hotline number (877-874-8416).

Penalty for Improper, Unethical or Illegal Actions

Energy Laboratories, Inc. employees are expected to work in an ethical, proper, and legal manner. They are expected to perform laboratory analyses according to the cited method(s) and in conjunction with the SOP and the Quality Assurance Plan. Employees are expected and required to report any violations of this policy. All employees are mandated to participate in an ethics-training program as part of their orientation upon hire.

Improper, unethical, or illegal actions by an employee will be addressed on a case-by-case basis as determined by the seriousness of the offense. Corrective actions may include disciplinary action up to and including discharge.

CHAPTER 12 – MANAGEMENT OF CHANGE

Management of change is the process used to review and manage proposed changes to materials, technology, equipment, procedures, personnel and facility operations. These changes may be permanent or temporary depending on circumstances. Change is managed, communicated, and documented as appropriate to the level of change, by the Laboratory Manager and the Supervisors of each department. Significant revisions to controlled documents may require employees to sign a record of acknowledgement.

- New Equipment Validation – Documented in the Instrument Maintenance Module. Supporting studies are documented in the LIMS.
- Implementation of new test methods and method updates – Documented in the method SOP and Instrument Maintenance Module. Supporting studies are documented in the LIMS.
- The QA Manual and SOPs – Documented in the Record of Revision and stored in the Document Control Software.
- Work order changes are documented in the work order report and stored in the LIMS or Document Control Software.
- LIMS changes - documented in a version control repository.

  Personnel changes - documented in employee training records or personnel records.

CHAPTER 13 – MAJOR EQUIPMENT AND METHODS

A summarized listing of major instrumentation utilized is included in Appendix E. Refer to the ELI Technical Services and Fee Schedule, located on the ELI website at http://energylab.com, for a list of all methods and analyte parameters that Energy Laboratories, Inc. performs.

CHAPTER 14 – PREVENTIVE MAINTENANCE

Preventive maintenance is performed on laboratory equipment according to the manufacturer's guidelines and our operational experience. Repairs and maintenance are accomplished in-house by experienced laboratory personnel whenever possible. Other than consumable equipment items, an inventory of spare parts is not maintained. Spare parts are available from outside vendors on an as needed basis. (To ensure method capability, some methods have more than one instrument available). An example of maintenance performed follows:

Instrument	**Maintenance**	**Frequency – Note that Daily is based on use.**
Balances	Check with Class I weights	Daily
	Independent Service	Annually
Pipettes	Check volume	Quarterly/Daily
ICP-Atomic Emission	Check Pump Tubing	Daily
	Check Coolant Levels	Daily
	Lubricate Autosampler	Quarterly
	Air Filter	Quarterly
	Optics Servicing	As needed
ICP-Mass Spectrometry	Check Pump Tubing	Daily
	Check Coolant Levels	Daily
	Check Electron Multiplier	Monthly
	Lubricate Autosampler	Quarterly
	Air Filter	Quarterly
Gas Chromatograph	Change Septum	As needed
	Check Injection Liner	Daily
	Clean Detector	As needed
	Change Gas Cylinders	At 200 psi
	Change Column	As needed
Auto Analyzers	Check Bath Temperature	Daily
	Check For Leaks	Daily
	Change Tubing	When wear is visible
	Align Flow Cell	Quarterly
	Lubricate Pumps	Annually
	Lubricate Sampler	Annually
Mass Spectrometers	Monitor Vacuum Pressures	Daily
	Monitor Background Levels	Daily
	Monitor Electron Multiplier	Daily
	Change Pump Oil	Annually
Microbiology	Monitor Room Temperature	Twice daily
	Monitor Incubator Temperature	Twice daily
	Autoclave Maintenance	Annually
	Monitor Water Bath Temperature	Twice daily
Reagent Water Systems	Change/Check Cartridges	Quarterly, or as needed
Compressed Gases	Change Gas Cylinders	At 200 psi, monitor daily
Liquid Chromatograph	Flush System	Daily
	Change Filters	As needed
	Change Lamps	As needed
	Replace Seals	As needed
Radiochemistry Detection Equipment	Check Background	Daily
	Check Efficiency	Daily
	Clean Window	As needed
	Change Gas Cylinders	At 200 psi

CHAPTER 15 - REFERENCES

ANSI N42.23-1996, American National Standard Measurement and Associated Instrument Quality Assurance for Radioassay Laboratories.

ASTM Annual Book of Standards, Part 31 (water), American Society for Testing and Materials.

ASTM D 7282-06 Standard Practices for Set-up, Calibration, and Quality Control of Instruments Used for Radioactive Measurements.

Handbook for Analytical Quality Control in Water and Wastewater Laboratories, Environmental Protection Agency. EPA 600/4-79-019

ELI Technical Services and Fee Schedule, Current Revision, Energy Laboratories, Inc.

Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Ed., EPA 815-R-05-004, 2005.

Manual for the Certification of Laboratories Analyzing Drinking Water, Supplement to 5th Ed., EPA 815-F-08-006, June 2008.

Methods for Chemical Analysis of Water and Wastes Environmental Protection Agency, 600/4-79-020.

Methods for the Determination of Metals in Environmental Samples – Supplement I, EPA/600/R-94-111, May 1994.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93-100, August 1993.

Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1998.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement I, EPA/600/4-90/020, July 1990.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement II, EPA/600/R-92/129, August 1992.

NELAC Chapter 5: Quality System Standard, 2003 or most current version approved by Florida and Texas NELAC Accreditation program.

NELAP, National Environmental Laboratory Accreditation Program http://www.nelac-institute.org/newnelap.php

Qualifications Manual, Current Revision, Energy Laboratories, Inc.

Standard Methods for the Examination of Water and Wastewater; 20th, 21st and -22nd Editions, APHA.

Technical Notes on Drinking Water Methods, EPA/600/R-94/173, October 1994.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Environmental Protection Agency. http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm

TNI Standard, Volume 1 (EL-V1-2009), The NELAP Institute.

CHAPTER 16 – GLOSSARY OF TERMS

Accuracy - The degree of agreement between an observed value and an accepted reference value.

Analyst - The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Sample - Any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank.

Audit or Assessment- A systematic evaluation to determine the conformance to quantitative specifications of some operational function or activity.

Batch - Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to twenty environmental samples of the same matrix, meeting the criteria above. An analytical batch is composed of prepared environmental samples, extracts, digestates, or concentrates, which are analyzed together as a group.

Blank (BLK) - A sample of clean water that accompanies the samples through different aspects of sampling and/or sample preparation. It is used to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value. There are various types of blanks: equipment blank, field blank, instrument blank, method blank, and reagent blank.

Blank Spike - See Laboratory Fortified Blank.

Blind QC Check Samples - Samples whose analyte concentrations are not known to the analyst. That the sample is a QC check sample may or may not be known to the analyst.

Calibration - The set of operations that establish, under specified conditions, the relationship between values indicated by the measuring instrument and the corresponding known value of the property being measured.

Calibration Blank - A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogate analytes.

Calibration Check Standard - See Check Standard.

Calibration Curve – The graphical relationship between the known values and the instrument responses for a series of calibration standards.

Calibration Standard - A solution of known concentration used in the calibration of an analytical instrument.

Chain of Custody Form- A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses.

Check Standard - A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process.

Clean Water Act - Public Law PL 92-500. Found at 40 CFR 100-140 and 400-470. The act regulates the discharge of pollutants into surface waters.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - The enabling legislation (42 USC 9601 - 9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 USC 9601 et seq.), to eliminate the health and environmental threats posed by hazardous waste sites.

Continuing Calibration Blank (CCB) – See Check Standard.

Continuing Calibration Standard - See Check Standard.

Continuing Calibration Verification (CCV) - See Check Standard.

Control Limits - A range within which specified measurement results must fall to be compliant.

Control Standard - See Check Standard.

Corrective Action (CA) - An action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Data Quality Objectives (DQO) - An integrated set of specifications that define data quality requirements and the intended use of the data.

Demonstration of Capability (DOC) - A procedure to establish the ability of the analyst to generate data of acceptable quality.

Detectability – For radiochemical analysis, detectability as a Lower Limit Detection (LLD) or Minimum Detection Concentration (MDC), is assessed based on the requirements of 40 CFR 141.25(c) and is a sample-specific determination. The equation is specific for each method and noted in the method SOP.

Detection Limit - See Practical Quantitation Limit and Method Detection Limit. Reporting of detection in radiochemistry is based on specific formulas identified in individual procedures. Single activity point standards are used for efficiency calibration. When required, multiple energy emitters are used for energy calibration.

Document Control - The act of ensuring that documents and revisions are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate (DUP) - A second aliquot of a sample that is treated the same as the original sample to determine the precision of the method.

Duplicate Sample - See Duplicate.

Fortified Sample - See Matrix Spike.

Holding Times (Maximum Allowable Holding Times) - The maximum time that samples may be held prior to analysis and still be considered valid or not compromised.

Initial Calibration Verification (ICV) - A sample of known concentration, from a source other than that of the calibration standards, analyzed following calibration to demonstrate validity of the calibration.

Instrument Blank - See Calibration Blank.

Internal Standard – A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Laboratory Control Sample (LCS) – A sample with a known concentration prepared and/or analyzed as a measure of accuracy for the method.

Laboratory Fortified Blank (LFB) – An aliquot of reagent water to which known quantities of specific compounds are added and which is analyzed as a measure of method recovery.

Laboratory Inter-comparison Sample - A performance evaluation sample analyzed by numerous laboratories. Acceptance criteria are often based statistically on the analysis results.

Limit of Detection (LOD) - For chemical analysis, the LOD is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory-dependent.

Limit of Quantitation (LOQ) – For chemical analysis, the LOQ is an estimate of the minimum amount of a substance that can be reported with a specified degree of confidence. An LOQ is an evaluation of precision and bias.

LIMS - Laboratory Information Management System.

Matrix – The substrate of a test sample.

Matrix Spike - (MS) – An aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the methods recovery efficiency.

Matrix Spike Duplicate (MSD) – A second aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the method's recovery efficiency and the precision of the method.

Maximum Contaminant Level (MCL) – Regulatory action levels for a contaminant of concern.

Method Blank (MBLK)- A clean sample processed simultaneously with, and under the same conditions as, samples being tested for an analyte of interest through all steps of the analytical procedure.

Method Detection Limit (MDL) - A measure of the limit of detection for an analytical method determined according to the procedure given in 40 CFR Part 136 Appendix B.
Method Validation - The confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled (NELAC 2003) (MARLAP 2004 for radiochemical methods).

NELAC - National Environmental Laboratory Accreditation Conference.

NELAP - National Environmental Laboratory Accreditation Program.

NPDES - National Pollutant Discharge Elimination System- A discharge permit system authorized under the Clean Water Act.

Performance Evaluation (PE) Sample - A sample with a composition unknown to the analyst that is provided to test whether the analyst/laboratory can produce analytical results within specified limits.

Practical Quantitation Limit (PQL) – The lowest concentration or amount of the target analyte that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value.

Precision - The degree to which a set of observations or measurements of the same property conform to themselves.

Preservation - Refrigeration and/or reagents added at the time of sample collection to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing (PT) Sample - A sample with a composition unknown to the analyst which is provided to test whether the analyst/laboratory can produce analytical results within specified limits.

Quality Assurance – An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP) - A formal document describing the detailed quality control procedures pertaining to a specific project. For environmental clean-up projects, this is typically produced by an engineering firm with references to include a laboratory's Quality Assurance Manual.

Quality Control – The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Control Sample – A sample used to assess the performance of all, or a portion, of the measurement system.

Replicate - See Duplicate.

Reporting Limit (RL) –. The lowest level of concentration reported for an analyte.

Resource Conservation and Recovery Act (RCRA) - The enabling legislation under 42 USC 321 et seq. (1976) that gives EPA the authority to control hazardous waste.

Safe Drinking Water Act (SDWA) - The enabling legislation, 42 USC 300f et seq. (1974), which requires the USEPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample (SAMP) - A portion of material to be analyzed.

Spiked Sample – See Matrix Spike.

Standardization - See Calibration.

Standard Operating Procedure (SOP) - A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

TNI – The NELAC Institute

Traceability – The property of a result of a measurement whereby it can be related to appropriate standards.

Trip Blank - One type of Field Blank. An aliquot of analyte-free water or solvent transported to the field in a sealed container and returned to the laboratory with the sample containers.

Acronyms and Abbreviations

AA	-	Accrediting Authority
AB	-	Accrediting Body
ANSI	-	American National Standards Institute
AOAC	-	The Scientific Association Dedicated to Analytical Excellence
APHA	-	American Public Health Association
ASQC	-	American Society for Quality Control
ASTM	-	American Society for Testing and Materials
Bq	-	Becquerel
BLK	-	Blank
Bg	-	Background
°C	-	Degrees Celsius
Cal	-	Calibration
CAS	-	Chemical Abstract Service
CCB	-	Continuing Calibration Blank
CCV	-	Continuing Calibration Verification
COC	-	Chain of Custody
DOC	-	Demonstration of Capability
DO	-	Dissolved Oxygen
DQO	-	Data Quality Objectives
DMRQA	-	NPDES Discharge Monitoring Report Quality Assurance
DUP	-	Duplicate
ELI	-	Energy Laboratories, Inc.
EPA	-	Environmental Protection Agency
FDA	-	Food and Drug Administration
g/L	-	Grams per Liter
GC	-	Gas Chromatography
GC-MS	-	Gas Chromatography-Mass Spectrometry
ICP-AES	-	Inductively Coupled Plasma Atomic Emission Spectrophotometry
ICP-MS	-	Inductively Coupled Plasma-Mass Spectrometry
ICV	-	Initial Calibration Verification
ISO	-	International Organization for Standardization
LCS	-	Laboratory Control Sample
LFB	-	Laboratory Fortified Blank
LIMS	-	Laboratory Information Management System
LLD	-	Low Limit Detection
LOD	-	Limit of Detection
LOQ	-	Limit of Quantitation
MDC	-	Minimum Detection Concentration
MDL	-	Method Detection Limit
MBLK	-	Method Blank
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
NIOSH	-	National Institute for Occupational Safety and Health
NIST	-	National Institute of Standards and Technology
NPDES	-	National Pollutant Discharge Elimination System
OSHA	-	Occupational Safety and Health Administration
pCi/L	-	Picocuries per Liter
PT	-	Proficiency Testing
QA/QC	-	Quality Assurance / Quality Control
QS	-	Quality Systems
QAM	-	Quality Assurance Manual
QAPP	-	Quality Assurance Project Plan

RDL	-	Required Detection Level
RCRA	-	Resource Conservation and Recovery Act
RL	-	Reporting Limit
RPD	-	Relative Percent Difference
RSD	-	Relative Standard Deviation
SOP	-	Standard Operating Procedure
SPK	-	Spike
Std	-	Standard
SVOC	-	Semi-Volatile Organic Compound
TNI	-	The NELAC Institute
ug/L	-	Micrograms Per Liter
UV/VIS	-	Ultraviolet/Visible Spectroscopy
VOC	-	Volatile Organic Compound
WET	-	Whole Effluent Toxicity

APPENDIX A

Quality Systems Controlled Documents

Quality Systems Controlled Documents

- Quality Assurance Manual
- Radiation Safety Manual
- Laboratory SOPs
    - Organization and Personnel (10-Series)
    - General Facility Operations (20-Series)
    - General Laboratory Procedures (30-Series)
    - Equipment Use and Maintenance (40-Series)
    - Analytical Methods (50-Series)
- Laboratory Notebooks (Quality Assurance Department)
- Qualifications Manual (Corporate Document)
- Energy Laboratories Technical Services and Fee Schedule (Controlled by Corporate Marketing Department)
- Employee Policies and Procedures Package (Controlled by Corporate Human Resource Department)
- Corporate Safety Policies and Programs (Controlled by Corporate Safety Officer)

APPENDIX B

QUALITY ASSURANCE / QUALITY CONTROL SPECIFICATIONS

**These are general QA/QC parameters. The table must be tailored for each specific method, as not all sample types, frequency or acceptance criteria may apply. Where frequency, acceptance criteria or comments have multiple options separated by "OR", please choose only one of the options. Use the verbiage and formatting of this table wherever possible. **

Method QA/QC Parameters **Method Name** **Method Number**				
QA SAMPLE/ SAMP TYPE CODE	**FREQUENCY**	**ACCEPTANCE CRITERIA**	**CORRECTIVE ACTION**	**COMMENTS**
Instrument Calibration	Daily OR Monthly OR Every 6 months After maintenance or when needed due to peak shifts or QC failures.	r ≥ 0.995 Also includes visual interpretation for quadratic or higher order calibration fit types.	1) Prepare/Purchase new standards 2) Recalibrate 3) Perform instrument maintenance	Establishes calibration curve over a range of analyte concentrations to quantify analytes of interest. Minimum 3 calibration points and a blank (depending on method) required.
Linear Calibration/Dynamic Range (LCR/LDR)	Initially, then every 6 months. Or with major changes in equipment. Or as required by method.	Residuals (Percent Recovery of standards) recommended being within CCV limits.	1) Evaluate alternate non-linear calibration models, especially for lowest and highest calibration points.	LCR/LDR is the linear portion of a calibration curve. See the ELI LDR procedure on the wiki.
Linear Dynamic Range (LDR) For metals methods only.	Initially, then every 6 months.	%Rec = 90-110	1) Re-establish/verify LDR 2) Dilute samples within the calibration range.	Sets the upper limits of the calibration range. Must include at least 3 points, with one outside the upper range of the curve.
Retention Time (RT) window position establishment	Initially with instrument set up. Recommend verifying annually.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	1) For shifting retention times, adjust according to initial CCV (mid-range). 2) Follow method requirements.	Calculated for each analyte.
Retention Time (RT) window width	Initially with instrument set up. Recommend verifying annually.	IC: RT width is ±3 times standard deviation for each analyte RT from the 24-hour period. GC and HPLC: RT width is ±3 times standard deviation for each analyte RT from the 72-hour period. GC/MS: RT of each reported analyte within ± 0.06 RT units.	1) For shifting retention times, adjust according to initial CCV (mid-range). 2) Follow method requirements.	Calculated for each analyte.
Initial Calibration Verification (ICV)	Immediately following calibration, daily when used as Analytical Sequence LCS for analyses without Prep.	%Rec = 90-110 (Limits may be set statistically depending on method.)	1) Repour and rerun. 2) Prepare fresh calibration standards and/or ICV. 3) Recalibrate and rerun.	Evaluates calibration accuracy and method performance. Must be prepared from second source standard.

Method QA/QC Parameters
Method Name
Method Number

QA SAMPLE/ SAMP TYPE CODE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Initial Calibration Blank (ICB/MBLK)	Immediately follows ICV	< Lowest reporting limit	1) Prepare fresh blank 2) Re-pour blanks, recalibrate, and rerun.	Evaluates calibration accuracy, reagent/ glassware contamination, and instrument carryover.
Continuing Calibration Verification (CCV)	Run every 10 samples and at end of run. (Methods with internal standards do not require and ending CCV.)	%Rec = 90-110 (Limits may be set statistically depending on method.)	1) Remake and rerun. 2) Recalibrate and rerun samples since last valid CCV	Evaluates instrument drift throughout analytical sequence. Typically uses midpoint calibration standard.
Continuing Calibration Blank (CCB)	Run after every CCV. (Run every 10 samples and at the end of run)	< Lowest reporting limit	1) Check for high conc. sample. 2) Prepare fresh blank. 3) Rerun samples since last valid CCB.	Evaluates baseline drift, contamination in the analytical system, and analyte carryover.
Instrument Blank	Daily prior to sample analysis.	< Lowest reporting limit	1) Repour and rerun. 2) Perform instrument maintenance	Evaluates baseline drift, contamination in the analytical system, and analyte carryover. The method blank may be substituted; not required for methods with CCB criteria. Generally necessary for organics methods. Not necessarily imported to Omega.
Method Blank (MBLK)	1/preparation batch	<Lowest reporting limit	1) Re-digest samples from batch, or 2) Qualify sample data	Evaluates overall method including possible contamination in reagents and glassware utilized in preparatory batch.
Laboratory Control Sample (LCS)	1/preparation batch	Reference material specified limits or laboratory statistical limits of +/- 3 standard deviations.	1) Repeat analyses once 2) Correct problem 3) Re-extract and re-analyze all samples associated with LCS	Evaluates overall method accuracy/bias for the Preparatory Batch. Must be second source. If prepared the same as MS/MSD will evaluate the spiking technique.
Laboratory Fortified Blank (LFB)	1/daily sequence	%Rec = 90-110 (Limits may be set statistically depending on method.)	1) Re-prep and rerun. 2) Recalibrate and rerun.	Evaluates spiking technique. Can be primary or secondary source depending on the method. LCS or ICV are preferred QC Types.
Duplicate Sample (DUP)	1/10 samples OR 1/20 samples	% RPD ≤ 5 OR 10 OR 20 or < PQL OR < 2X PQL (Appropriate limits must be evaluated for each method.)	1) Rerun sample pair, evaluate for sample homogeneity or 2) Report with qualifiers***	Evaluates method precision. MSD duplicate analyses preferred on some methods.

Method QA/QC Parameters
Method Name
Method Number

QA SAMPLE/ SAMP TYPE CODE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	COMMENTS
Matrix Spike (MS/MSD)	1/10 samples OR 1/20 samples	Water %Rec = 90-110, %RPD ≤ 20 Soil Statistical Limits OR Soil Post Digestion Spike %Rec= 80-120 %RPD ≤ 20	LCS OR LFB OR ICV must be passing 1) If matrix interference suspected report as found, or 2) Re-analyze and re-spike if no matrix interference suspected, or 3) Use "A" qualifier for sample amount > 4X spike level.	Evaluates effect of matrix on method performance. MSD also evaluates method precision.
Post Digestion Spike (PDS/PDSD)	1/10 samples	Soil Statistical Limits OR Soil Post Digestion Spike %Rec= 80-120 %RPD ≤ 20	LCS OR LFB OR ICV must be passing 1) If matrix interference suspected report as found, or 2) Re-analyze and re-spike if no matrix interference suspected, or 3) Use "A" qualifier for sample amount > 4X spike level.	Evaluates effect of matrix on method performance. PDSD also evaluates method precision. Use the same solution and concentration as LFB.
External PE Samples	Biannual WS and/or WP and internal blind and double blind samples.	PT sample defined acceptance limits (Must pass 2 out of last 3 PT studies.)	1) Complete corrective action report 2) Repeat with another make-up study (for failure of 2 out of 3)	External review of analytical method accuracy.
MDL Studies	Bi-annually OR Annually per method requirement or whenever method changes might affect sensitivity.	<PQL, Spike Level < 10X MDL	1) Repeat if obvious problem occurs 2) Adjust reporting limit to > MDL	Evaluates overall method detection limits in clean sample matrix. Actual samples may have higher MDL.
LOD Verification	Bi-annually OR Annually per method MDL requirement following each MDL Study	Positive Result, S/N greater than 3 (above typical Method Blank performance)	1) Examine method or preparatory steps, 2) Verify MDL study, 3) Repeat analysis 4) Consult QA	Spike at 2-3X calculated MDL for single analyte test. OR Spike at 1-4X MDL for multiple analyte tests.
Control Charting and Proof of Competency	Annual statistical review of method.	Data statistically within control limits.	1) Trend Analysis/ Method Review 2) Correct method/instrument problem.	For statistical process control.
Batch Definition	Water = Each daily analytical sequence Prepped Samples = Each batch of 20 samples/matrix or when there is a change of reagents, whichever is more frequent.	Must pass all method QC criteria	Re-analyze batch or qualify results	A group of samples and associated QC

*** DUP Qualifier (Canned Comment) for use when values are low and the % RPD criteria does not apply.
Since the difference between the analytical result for the sample and its duplicate is less than the reporting limit, the RPD variance is not considered significant.

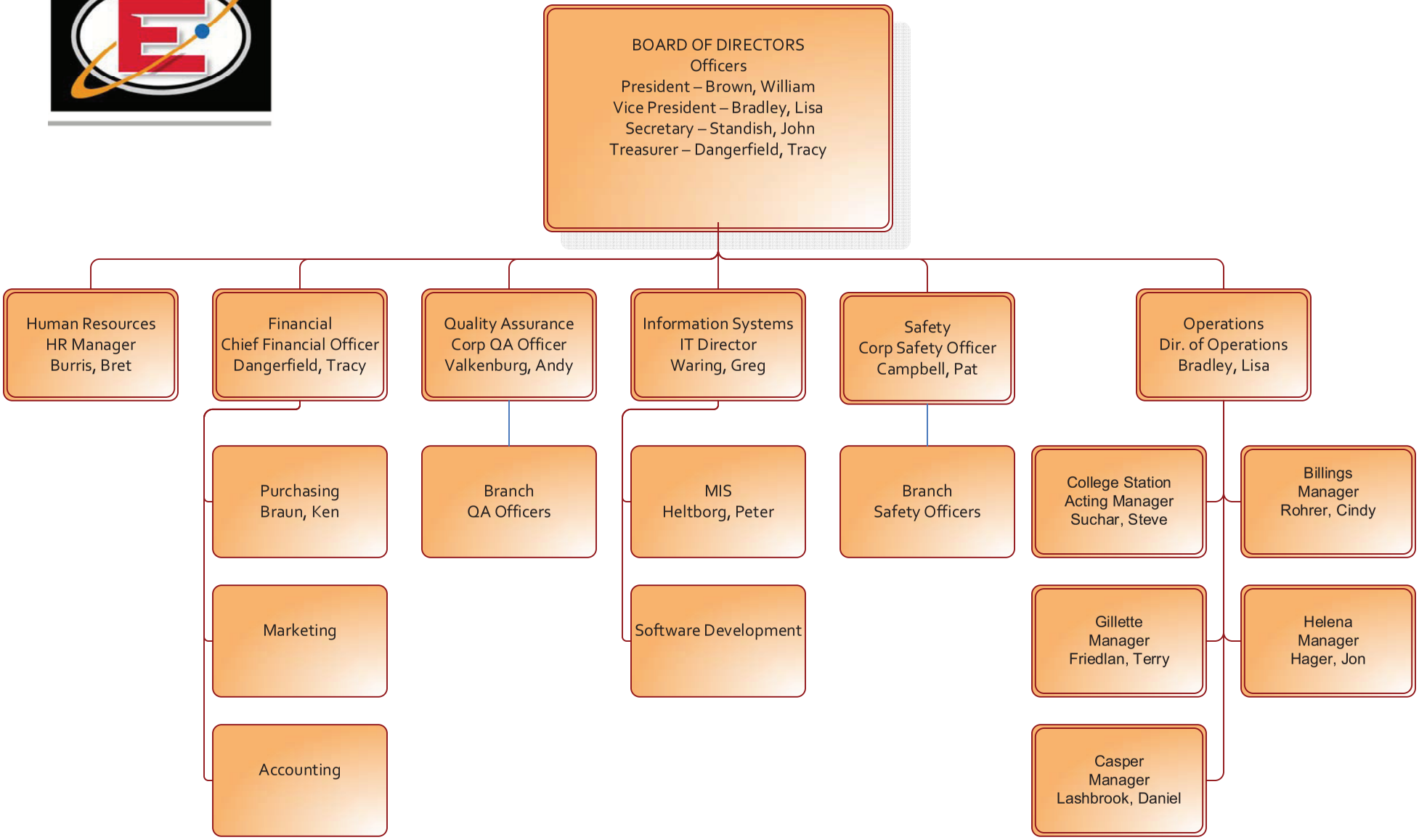
APPENDIX C

ORGANIZATIONAL CHARTS

Corporate Organizational Chart

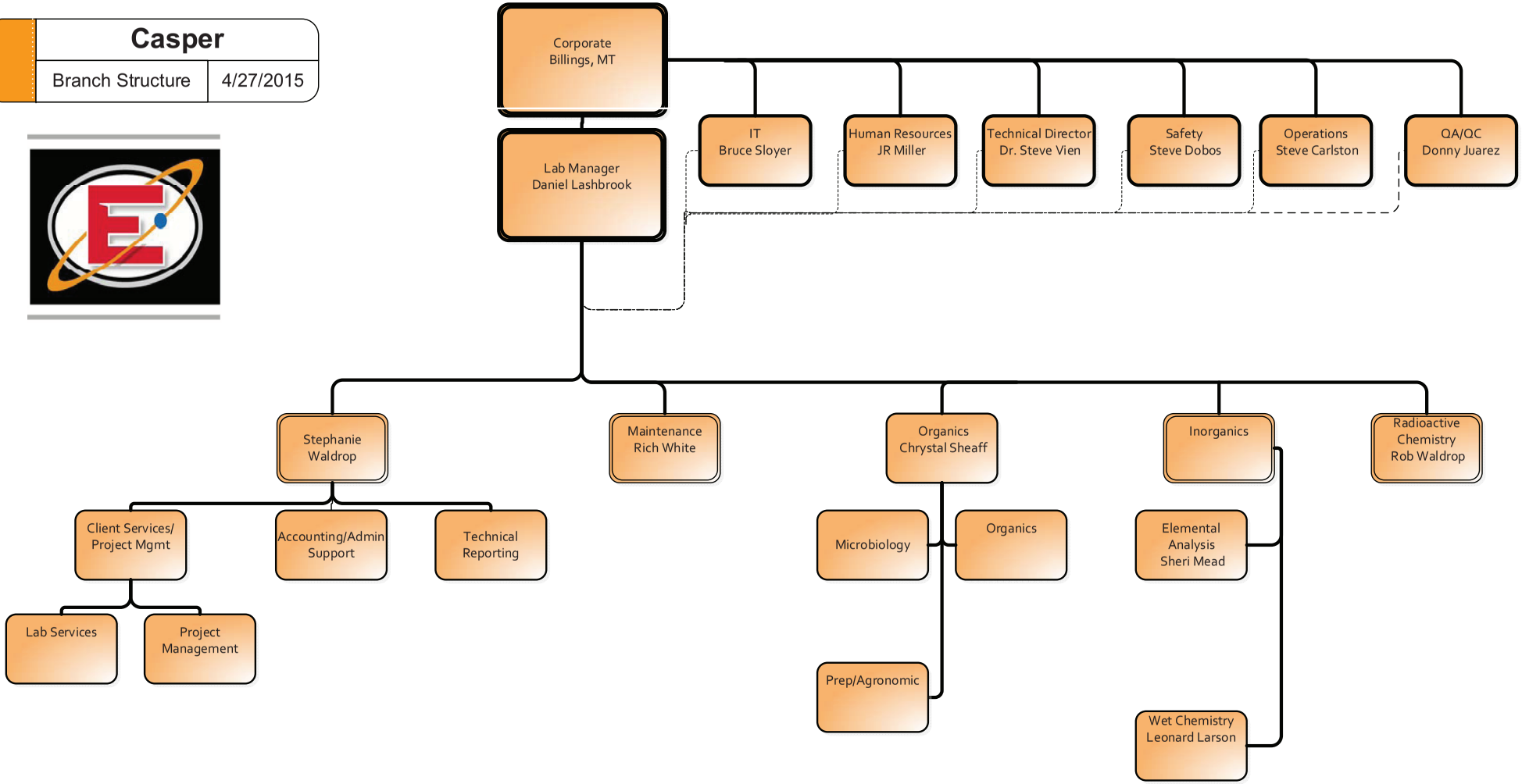
Casper Branch Lab Organizational Chart

Energy Laboratories / Corporate Structure



Casper

Branch Structure | 4/27/2015



APPENDIX D

CURRICULA VITAE OF KEY LABORATORY PERSONNEL

WILLIAM T. BROWN

President

Responsible for corporate direction and operations of Energy Laboratories, Inc.

Experience: Thirty plus years of experience in environmental laboratory operations including lab manager, supervisor of organic analysis and senior organic chemist. Experienced in Gas Chromatography, Gas Chromatography/Mass Spectrometry (GC/MS), sample preparation and extraction, ion chromatography and chromatography data systems.

Education
Bachelor of Science in Fish and Wildlife, Montana State University, Bozeman, Montana, 1977

Professional Experience
1986 to present, President - Energy Laboratories, Inc

1981 - 1987, Manager - Energy Laboratories, Inc., Branch Laboratory, Gillette, Wyoming. Responsible for routine analysis and quality control of water, natural gas, and petroleum products. Involved in field on site sampling and testing, meter calibrations, and supervision of branch laboratory staff.

1979 - 1981, Laboratory Technician - Energy Laboratories, Inc., Billings, Montana. Responsible for the natural gas and petroleum products department of the lab including field natural gas testing. Also involved with various work in water and soil analysis including formal training in ion chromatography.

1977 - 1979, Fisheries Biologist - Water and Forests Department of the Government of Niger, Africa. While in the Peace Corps, responsible for developing fisheries management programs in a specific region including monitoring water quality by on-site testing.

LISA A BRADLEY PH.D.

Vice President/ Director of Corporate Laboratory Operations

Responsible for development and oversight of technical operations for Energy Laboratories, Inc.

Experience: Interim laboratory manager, supervisor of inorganic analysis, supervisor of elemental analysis, senior elemental analyst, research assistant, laboratory environmental technician.
Experienced in atomic absorption spectroscopy (AA), inductively coupled plasma optical emission (ICPOES), and mass spectrometry (ICP-MS).

Education
Ph.D., Analytical Chemistry, Indiana University - Bloomington, Indiana, 1996
Bachelor of Science, Chemistry, Montana State University, Bozeman, Montana, 1990

Professional Experience
2007-Present, Director of Corporate Technical Operations- Energy Laboratories, Inc., Billings, MT.
2008- Interim Laboratory Manager- Energy Laboratories, Inc., Casper, WY: Supervision of the Casper laboratory.

2005-2008, Supervisor, Inorganics Dept.- Energy Laboratories, Inc., Billings, MT: Responsible for supervision and management of inorganics laboratory.

2000-2005-Supervisor, Metals Dept- Energy Laboratories, Inc., Billings, MT: Supervised metals department; performed chemical analyses using laboratory instrumentation.

1996- 2000, Analytical Chemist - Energy Laboratories, Inc., Billings, Montana: Performed atomic absorption spectroscopy (AA), inductively coupled plasma optical emission (ICP-OES), and mass spectrometry (ICP-MS) analyses.
October 1990-1995, Research Assistant/Department of Chemistry - Indiana University, Bloomington, Indiana.
August, 1990-December, 1992, Associate Instructor of Chemistry - Indiana University, Bloomington, Indiana.

1989, Laboratory Technician - Intermountain Laboratory, Bozeman, Montana.

1986-1990, Undergraduate Research Assistant - Montana State University, Bozeman, Montana

TRACY A. DANGERFIELD, CPA, MBA

Treasurer and Chief Financial Officer

Experienced in business leadership, management and strategic development. Extensive background in accounting, finance and organizational development.

Education

Master of Business Administration, University of Montana, Missoula, MT 2013
Certified Public Accountant, 1992
Bachelor of Science, Business Administration, Minor in Accounting, Eastern Montana College, Billings, MT 1989

Professional Experience

1989-Present, Chief Financial Officer-Energy Laboratories, Inc., Billings, Montana.
Responsible for initiating, developing, and directing administrative operations including finance, human resources, taxation and marketing. Involved with growing Energy Laboratories, Inc. (ELI) from 20 employees to over 225, quadrupling revenues, and expanding to six locations throughout the Rocky Mountain Region. Steered the implementation of an Employee Stock Ownership Plan, transacted the ensuing 30% purchase of ELI, and continues to serve as Plan Trustee.

1985 -1989 Office Management-Energy Laboratories, Inc., Billings, Montana.
Responsible for daily office operations and management of staff.

CORNELIUS A. VALKENBURG PH.D.

Senior Analytical Chemist/Quality Assurance Officer

Education

Ph.D., Analytical Chemistry, Montana State University, Bozeman, Montana, 1987
Bachelor of Arts, Biology with minor in Chemistry, Carroll College, Helena, Montana, 1979

Professional Experience

1992- Present, Analytical Chemist/Quality Assurance Officer - Energy Laboratories, Inc., Billings, Montana. Corporate Quality Assurance Officer responsible for the Quality Assurance monitoring of laboratory operations. Performs method development, prepares and updates standard operating procedures, performs technical training, and involved with special projects. Manages laboratory solvent recycling program.
1989 - 1992, Senior Organic Analytical Chemist - ICF Kaiser Engineers, Las Vegas, Nevada. Provide supervisory and technical support in the design, preparation, analysis, and multi-laboratory certification of analytical method performance evaluation materials used to evaluate current and proposed EPA organic analytical procedures. Also review proposed EPA methods contracts for technical accuracy. Secondary duties as Laboratory Safety Officer.
1987 - 1989, Senior Scientist - Lockheed Engineering and Sciences Company, Environmental Programs (Organic Chemistry Section), Las Vegas, Nevada. Responsible for research and development projects as applied to improved methods for the analysis of EPA priority pollutants. Areas of study include: liquid-liquid extractions, solid-phase extraction, soil leachability modeling (TCLP), chemical derivatives for gas and liquid chromatography, production of performance evaluation materials, gas chromatographic methods, supercritical fluid chromatography and extraction, and laboratory automation.
1981 - 1987, Ph.D. Candidate, Graduate Research, Assistant - Montana State University, Department of Chemistry, Bozeman, Montana. Research in gas chromatographic detector design, modification, and characterization by computer modeling. Teaching of undergraduate laboratories in the areas of inorganic, organic, and analytical chemistry.
1981 - 1981, Research and Development Chemist - Falls Chemicals, Great Falls, Montana. Methods development for the analysis of raw materials and formulated products used or produced by Falls Chemicals. Performed optimization studies for plant chemical processes.
1980 - 1981, Research Technician - Oregon Graduate Center, Beaverton, Oregon. Synthesis and purification of polyamine dueterated analogues for their use as internal standards in mass spectrometry.
1978 - 1979, Field Technician and Student Researcher - State of Montana Water Quality Bureau and Carroll College, Helena, Montana. Evaluate the effects of subsurface drainage on saline seep areas.
Summer 1978, Lab Technician - American Chemet Corporation, East Helena, Montana. Quality control for the manufacture of CuO and CuO2, and the trace analysis of Pb. Methods used were wet chemistry, electrochemistry, and atomic absorption.

Technical Training

Technical Writing, University of Nevada, Las Vegas, Nevada, 1988
Emergency Medical Training, Hillsboro Medical Hospital, 1981
Mass Spectrometry, Oregon Graduate Center, 1981
Dale Carnegie Management Training, Billings, Montana, 1996
Dale Carnegie Graduate Assistant Training, Billings, Montana 1997

Professional Organizations

American Chemical Society

Daniel Lashbrook

Education

University of North Florida, Jacksonville, FL, Bachelor of Science, Interdisciplinary Science Degree, *August 2005-June 2007*

North Carolina State University, Raleigh, NC, 49 Semester Hours toward Bachelor of Science Degree in Chemistry. *August 1995-January 1999*

Western Piedmont Community College, Morganton NC, Associate of Arts Degree, *January 1994-June 1995*

PROFESSIONAL EXPERIENCE

2014 – Present

Laboratory Manager, Multi-faceted, efficient & reliable analytical application professional with 10+ years of experience supporting executives, sales and business development managers to improve internal operations for creation of viable revenue streams. Proven proficiency in implementing automation and advanced technology covering a broad scope from Gravimetric Systems to Liquid Chromatography Triple Quad Mass Spectrometry in order to develop 7+ revenue streams for analytical service companies. Diversified skill sets covering application development, product line development, instrument and electronics specialist, client relations, technical writing, team building and project management. Demonstrated expertise in consolidating the mergers and acquisitions of laboratory operations into existing business models and company culture.

2013 – 2014

Technical Director/Corporate Operations Specialist, *Microbac Laboratories, Central Pennsylvania Division, Pennsylvania*. Managed the consolidation of laboratory operations from the acquisition of BMWi Laboratories, increasing the annual revenue from $5million to $17million. Instrumental in increasing laboratory capacity by infusing $1.5million capital expense in new analytical equipment and instrument upgrades. Developed, recommended and implemented laboratory goals, objectives, policies, procedures and administrative systems. Oversaw the development and implementation of analytical processes and testing procedures. Developed and managed an annual budget. Forecasted laboratory needs, allocated and monitored the human resource, physical assets, and financial resources of the laboratory. Monitored the purchases and expenditures to insure proper allocation of the budget. I led cross-functional teams that were involved in all stages of laboratory operations from sample receipt to delivery of final data while improving turn around time. Revised the entire set of laboratory SOPs to ensure DEP/EPA compliance. Instrumental in reducing audit findings by implementing necessary regulatory practices in the laboratory as well as improving a corrective action/preventative action system with Quality Assurance.

2012 – 2013 **Technical Director**, **Semi Volatile Organic Manager,** *Pace Analytical Services, Inc., Ormond Beach, Florida*. Responsible for scientific and managerial work in directing laboratory production, automation, and planning. Instrumental in coordinating the work of professionals engaged in conducting the chemical analysis of samples for the drinking water, environmental, and UCMR3 programs. Principle LCMSMS Chemist skilled in method development and revenue stream addition for laboratory production. Directly increased laboratory revenue 5% per year by implementing new methodology including EPA 537, EPA 539, and EPA 331 while continuing to develop long term plans for the technological development of future laboratory operations. Direction was received from senior management for the professional management of established goals and objectives. Possess extensive knowledge of policies, practices, and procedures applicable to specific regulatory programs.

2011 – 2012 **Semi Volatile Organic Manaager,** *Pace Analytical Services, Inc., Ormond Beach, Florida.* Responsibilities included analysis of samples for semi-volatile organics. Instrumentation included HPLC with post column derivitization unit, various HP/Agilent/Varian Gas Chromatographs equipped with ECD's and FID's and various HP Mass Spectrometers to include automated injectors, trays, and controllers. Duties also included routine maintenance, optimization of instrument performance, data production, documentation and review. Proficient in EPA Methods 504.1, 515.2, 531.1, 537, 539, 547, 549.2, 552.2, 525.2, 8011, 8151, 8270, 625 and FLPRO by 8015.

2010 – 2011 **Technical Manager, Volatile Organic Manager**, *Columbia Analytical Services, Inc., Jacksonville, Florida.* Supervised and managed personnel, operations, quality systems, and process improvement while scheduling workload in production area. Objectives of assigned duties were for the expansion of the Volatile Laboratory's capacity, methodology and technical depth. At the request of the Business Development Manager, developed the RSK-175 Method for dissolved gases in groundwater in order to monitor the effectiveness of remediation activities for additional analytical capabilities. Proficient in EPA 8260, 624, 524.2, NCASI 94.01, 99.01, Thermal Desorption for graphic packaging, and 8015 GRO.

2009 – 2010 **Department Manager, Semi Volatile Organic Laboratory**, *Columbia Analytical Services, Inc., Jacksonville, Florida,* Management of budget, operations, personnel and workload in instrument production area as well as extractions. Implemented business plan for Crude Oil Fingerprinting and Biomarker Method Development to support the analytical needs of NOAA to accommodate the Deep Water Horizon Oil Spill. Instrumental in the implementation and monitoring of quality systems and process controls in order to increase capacity and efficiency.

2006 – 2009 **Scientist I, Semi Volatile Organic Laboratory**, *Columbia Analytical Services, Inc., Jacksonville, Florida,* Responsibilities included analysis of samples for semi-volatile organics. Instrumentation included various HP

Gas Chromatographs equipped with ECD's and FID's to include automated injectors, trays, and controllers. Duties included the analysis of samples using Gas Chromatographs equipped with various HP mass spectrometers, routine maintenance, optimization of instrument performance, data documentation and review, and report production. Demonstrated proficiency in EPA 8015 DRO, FLPRO, 8011/504.1, 8081, 8082, 608, 8270C/D, 8270 SIM, 625, and TX-1005. Orchestrated the Method Development for MADEP EPH (Extractable Petroleum Hydrocarbons)/VPH (Volatile Petroleum Hydrocarbons) after the development of the Massachusetts guidance document known as the Compendium of Analytical Methods (CAM).

2004 – 2006 **Technical Manager I, Inorganic Laboratory**, *Columbia Analytical Services, Inc., Jacksonville, Florida.* Responsible for managing all aspects of the Inorganic Laboratory to include Wet Chemistry, General Chemistry, Microbiology, and Metals. Duties include staff training, work distribution, data quality and review, process improvement, method development and general instrument maintenance. Additional duties included the supervision of data processors and the operation of ion chromatography, continuous flow analysis, ICP-AES, ICP-MS, GFAA, and FAA.

2002 – 2003 **Analyst II, General Chemistry Laboratory**, *Columbia Analytical Services, Inc., Jacksonville, FL*. Department responsibilities included performance of general chemistry and metals analysis. Department methods include metals, microbiology, BOD, COD, pH, ion selective electrodes, solids, colorimetric, and titrimetric techniques, UV/VIS spectroscopy, ion chromatography, and flow injection analysis. Performed extensive troubleshooting and repair of instruments. Work in the department required routine instrument maintenance and calibration, data review, compliance documentation, and report production.

TRAINING

Excellent computer skills, including Tracefinder, Excalibur, Enviroquant, Chemstation, Mass Hunter, Target, LIMS (StarLIMS,, Epic Horizon, and Promium) Windows Office Suite, Fortran, beginning C++, HTML and CGI/PERL Scripting.
Write hyperlinked Excel sheets for DOC, LOD, LOQ, and DOC tracking.
Experience with Excel Macro writing.
Ability to perform in depth technical maintenance and repairs, to include electronic boards and circuits, on Gas Chromatographs and Mass Spectrometers.

AFFILIATIONS

Member of the National Environmental Laboratory Accreditation Committee Institute (NELAC).
Member of Phi Theta Kappa International Scholastic Order of Excellence.
Recipient of 2006 and 2007 Annual Model of Excellence Award from Columbia Analytical Services
Attended University of Florida TREEO Center for Training, Research and Education for Environmental Occupations, *Gainesville, FL, 2004*

Steve H. Vien

EDUCATION Iowa State University, Biochemistry, B.S. 1981
Kansas State University, Analytical Chemistry, Ph.D. 1988

SPECIALITIES Wet Chemical Methods, Chromatography, Molecular Spectroscopy, and Atomic Spectroscopy. Problem (product, process, and method) solving and troubleshooting, analytical method development, analytical technology, production and process consultations.

PROFESSIONAL EXPERIENCE

2012 – Present ***ENERGY LABORATORIES, INC., Casper, Wyoming***
Technical Director – Provide technical leadership and assistance to the Casper branch. Work with the analytical staff to provide assistance in understanding analytical methods and learning the chemistry involved. Troubleshooting of analytical methodologies, developing solutions of analytical issues. Develop and provide technical training for personnel. Provide assistance with writing and review of technical documents, including Standard Operating Procedures, manuals and presentations. Assistance with data validation.

2003 – 2003 ***SGS LAB, Houston, Texas***
Chemist – Applied wet chemical methods, GC, UV-Vis, and ICP to provide analytical supports for petrochemical and environmental industries.

1988 - 2002 ***DOW CHEMICAL, Freeport, Texas***
Project Leader - Managed an analytical lab of 6 Chemists and Technicians to provide analytical supports, troubleshooting, method development, product and process developments for inorganic, organic, polymer, metal productions, as well as wastewater treatment operations. Reviewed analytical reports, SOP's, monthly reports and conducted annual performance reviews of the group. Managed the GLP, QA/QC, Safety and Waste Disposal programs for the laboratory. Served as the Analytical technology focal point for Chlor-Alkali production, and Process Sampling Team.

1981 - 1983 ***STERLING DRUGS, INC., McPherson, Kansas***
QC Chemist – Applying wet chemical, GC, UV-Vis, AA, and IR methods to determine pharmaceutical products to be sure that specifications were met. Investigated returned/tampered products with physical and chemical methods. Maintained the GLP program, trained new chemists/technicians and wrote standard operating procedures.

AFFILIATIONS American Chemical Society

Steven E. Carlston

EDUCATION University of Northern Colorado, Greeley, Colorado
B.A., Chemistry, with Physics minor, 1980

SPECIALITIES Gas Chromatography; Resource Conservation and Recovery Act (RCRA) and Toxic Characteristics Leaching Procedure (TCLP) Programs; Quality Assurance/Quality Control Program (QA/QC).

PROFESSIONAL EXPERIENCE

2014- Present ***ENERGY LABORATORIES, INC., Casper, Wyoming***
Senior Project Specialist – Developing and Implementing the tools and Processes for the analysis of company data streams.

2011 – 2014 ***ENERGY LABORATORIES, INC., Casper, Wyoming***
Branch Manager – Responsible for collecting and analyzing data, establishing, planning and implementing business objectives, directing staff, recommending actions; tracking and evaluating results.

2008 - 2009 Interim QA Director - Responsible for Quality Assurance programs, QA/QC documentation, training records, PE studies and SOPs. Perform technical data review prior to releasing final data reports.

2005 - 2008 IT Department Supervisor - Responsible for: all programs, internal applications, commercial LIMS (Omega) system, Operating Systems, servers and PC support activities.
Provided specific support to Radiochemistry Department for commercial software and hardware procurement

1988 - 2005 Organic Chemistry Department Supervisor - Responsible for: Supervision and performance of analyses for the Gas Chromatography and Hazardous Waste Departments, backup analyst for crude oil, radiochemistry, and soils analysis during peak activity periods.

1979 - 1988 ***NAVY DRUG SCREENING LABORATORY, Oakland, California***
Quality Control Coordinator and Chemist - Prepared QA/QC blind samples; tracked and reported results of RIA and GC/MS analyses; trained personnel; and suggested and implemented changes to laboratory Standard Operating Procedures. As a chemist, performed extraction, derivatization, and GC/MS analysis of drugs of abuse. Responsible for the technical maintenance of nine GC/MS instruments.

TRANSCONTEC, Golden, Colorado
Chemist - Organized the Environmental Analysis Laboratory which specialized in the detection and remediation of radon contamination.

NEWPARK RESOURCES, INC., Denver, Colorado
Chemical Engineer - Prepared and presented fluid system proposals.

Field-tested and adjusted chemical properties of fluid tested and adjusted chemical properties of fluid systems. Responsible for the laboratory testing of new fluid formulations prior to and during initial field-testing.

TRAINING

Control Data Corporation, Denver, Colorado
Certificate in Computer Programming and Operations, 1987
American Chemical Society, Philadelphia, Pennsylvania
Certificate in Gas Chromatography, 1989

AFFILIATIONS

American Chemical Society
Society of Petroleum Engineers
American Petroleum Institute
Wyoming State Committee on Pesticides in Groundwater

Donny Juarez

EDUCATION

Casper College: 30+ credit hours toward Chemistry Major.*
Casper, Wyoming

Wheatland High School - Date of Graduation: May, 1991
Wheatland, Wyoming

PROFESSIONAL EXPERIENCE

June 2014 – Present **Quality Assurance Manager**, **Energy Laboratories, Inc., Casper, Wyoming**
Maintains laboratory certifications, quality assurance and control criteria. Responsible for annual employee ethics training. Maintains employees training folders. Manages Quality Systems of laboratory including annual reviews of Standard Operating Procedures, QA Manual and employee training folders. Technically reviews data and reports. Well-versed in NELAC, EPA, SW-846, Clean Water Act, and Safe Drinking Water Act regulations and guidelines.

2012 – May 2014 **Quality Assurance Assistant, Energy Laboratories, Inc., Casper, Wyoming**
Assisted in management of quality and client service standards, implemented and maintained quality initiatives, and assessed quality system performance. Was actively involved with peer auditing of branch laboratories and assisted with the development of internal test method assessments.

2006 – 2012 **Soils and Semi-Volatile Organics Dept. Supervisor, Energy Laboratories, Inc., Casper, Wyoming**
Performed supervisory duties pertaining to the Agronomic Soils and Semi Volatile Organics Departments. Responsibilities included; prioritization of sample analyses, sample scheduling, ordering, data review and report generation. Managed sample loads, maintained quality assurance and control criteria, and performed method development and improvements.

1995 – 2006 **Semi-Volatile Organic and Agronomic Soils Analyst, Energy Laboratories, Inc., Casper, Wyoming**
Responsibilities included analysis of samples for semi-volatile organics using Gas Chromatographs, routine maintenance, optimization of instrument performance, data documentation and review, and report generation. Instrumentation included various HP Gas Chromatographs equipped with FIDs to include automated injectors, trays, and controllers. Proficient in analytical and preparation methods including EPA 8015B DRO, 3510, 3550, 1010A, and 1664. As Soil Analyst, responsibilities included analysis, and data review for agronomic and mining samples utilizing various agronomic testing methods.

SPECIAL TRAINING

Supervisor Interaction Management Training, 2009 Energy Laboratories, Inc.
Lean Training, 2012 Manufacturing-Works
Environmental Laboratory Assessment - Basic Assessor Training – TNI Standard

Steven M. Dobos

EDUCATION University of Montana, Missoula, Montana
B.S., Geology, 1980

SPECIALITIES Atomic Absorption (AA), Inductively Coupled Argon Plasma (ICAP), Heated Graphite Furnace (HGA), Gaseous Hydride, Wet Bench Chemistry, and Hazardous Waste.

PROFESSIONAL EXPERIENCE

2011 – Present ***ENERGY LABORATORIES, INC., Casper, Wyoming***
Safety Officer and Radiation Safety Officer - This position is responsible for ensuring compliance with the Company's proactive safety, and hazardous waste management programs. The individual must provide day-to-day support and guidance to staff and management in order to ensure the laboratory is operated within Federal, State and local regulations. Presents effective employee training on safety; documents training dates.

Works as Casper Radiation Safety Officer (RSO) to assure compliance with the radiation safety plan and U.S. Nuclear Regulatory Commission (USNRC) license requirements. Conducts periodic safety audits and performs a variety of routine and complex administrative practices as they may obtain to the laboratory. Performs or assists with accident investigations as needed. Insures that processes take necessary corrective action to prevent future incidents. Communicates recommendations to all concerned parties promptly. Workers Compensation reporting, administration and handling of work place injuries.

2011 – 2012 Technical Director/Senior Project Manager – Responsible for client reporting and data quality review of water analyses. Developed test methods and trained laboratory staff.

2010 – 2012 Senior Project Manager/Client Services Supervisor – Responsible for client reporting and review of results. Supervisor of Project Managers.

1986 – 2010 Inorganic and trace metals Laboratory Supervisor - Primary responsibilities include trace metal analysis and hazardous waste consultation. Project management and administrative input for special projects and operations.

1985 - 1986 ***WESTERN ENVIRONMENTAL SERVICES AND TESTING, Casper, Wyoming***
Laboratory Technician - Soil analysis and air quality stack testing.

CORE LABORATORIES, INC., Casper, Wyoming
Crude oil analysis and gas chromatography.

PROJECT MANAGEMENT EXPERIENCE

Texas Water Development Board (TWDB)
Nevada Mining Clientele
- Newmont Mining Company
- Queenstake Resources USA Inc
- Placer Dome US Inc / Bald Mountain Mine
- Anglo Gold Nevada Corp

Drinking water clients

TRAINING

2012 OSHA Hazardous Material
2012 MSHA Mine Hazardous Training
2012 Radiation Safety Officer Training 40 hours
Perkin Elmer School - ICP Operations
OSHA 8 Hour Hazardous Materials, Annual Refresher
American Chemical Society, Short Course on *Effective Management of Scientists and the Technical Staff*.
Wyoming Association of Municipalities *Current Water Policy Issues, Subtitle D*, Regulations Workshop
Spiegel and McDiarmid Municipal Environmental Compliance Course

AFFILIATIONS

American Society of Mining Engineers
American Water Works Association
Wyoming Solid Waste Management Association
Wyoming Non-point Source Organization
Casper Public Utilities Advisory Board Member

Stephanie Waldrop

EDUCATION May 1999 B.S. Chemical Engineering
University of New Mexico – Albuquerque

PROFESSIONAL EXPERIENCE

2014 – Present ***ENERGY LABORATORIES, INC., Casper, WY***
Client Services Manager - Oversee the operation of the project management, reporting, invoicing, and shipping/receiving departments. Responsible for leading team meetings, training, scheduling, conflict resolution, and assisting with any needed tasks. Communicate with clients regarding the interpretation of analytical data, testing requests, and other requests or complaints. Prepare Consumer Confidence Reports for drinking water clients for EPA submittal. Familiar with EPA DW rules and assist clients with questions regarding DW testing. Responsible for the submittal of drinking water data to the EPA via the SDWIS program. Project lead for a multi department team that identifies and improves upon processes that affect the overall laboratory turnaround time. Have implemented changes that have improved the efficiency of the laboratory. Create report packages, including Level IV data packages, revisions, specialized sample history tracking sheets, and other custom reports. Member of a Supervisor Focus Team that is responsible for the overall operation of the laboratory.

2008 – 2014 ***ENERGY LABORATORIES, INC., Casper, WY***
Reporting Supervisor - Responsible for ensuring quality analytical reports are prepared from laboratory data by overseeing staff in the reporting department. Provide training to reporting staff concerning the interpretation of analytical data and the preparation of specialized client reports.

2007 – 2007 ***ASSAIGAI ANALYTICAL LABORATORIES, Albuquerque, NM***
Technical Director - Provide technical direction for group leaders and staff. Responsible for the analysis, evaluation, review, and validation of data generated by all laboratory departments. Responsible for monitoring and meeting all analytical hold times and deadlines, scheduling, reviewing and updating quarterly and yearly tests (IDL and MDL studies) for all departments. Assist Laboratory Operations Manager with special projects and completion of CLP data packages. Assist staff with overall maintenance and trouble-shooting of instruments. Provide technical expertise and resolve technical problems.

2006 – 2007 ***ASSAIGAI ANALYTICAL LABORATORIES, Albuquerque, NM***
Semi-Volatile Organics Group Leader - Supervise all aspects of the Semi-Volatile Organic Department, including analytical, extraction, QA/QC and record-keeping procedures as applicable to this department. Responsible for the scheduling and delegation of work, inventory, instrument maintenance, and training new analysts.

2004 – 2006 ***ASSAIGAI ANALYTICAL LABORATORIES, Albuquerque, NM***
Semi-Volatile Organic Analyst - Analyzed water and soil samples by Gas Chromatography, Gas Chromatography/Mass Spectrometry, and HPLC using EPA approved methods. Evaluated sample data and generated reports and data packages using the Laboratory Information Management System (LIMS).Performed EPA approved extraction methods to prepare a variety of water and solid matrices for organic compound analysis.

1999 – 2003 **Environmental Technology & Engineering Center (ETEC)*, Albuquerque, NM***
Senior Research Associate - Designed, constructed and operated experimental apparatuses related to the development of environmentally friendly technologies. Operated and maintained gas chromatograph, ASTM E-681 gas flammability test apparatus, pH meter, and other general laboratory equipment. Responsible for chemical inventory, laboratory organization, laboratory equipment maintenance, and the development of standard laboratory operating procedures. Prepared and reviewed reports and proposals, calculated and documented all test results. Products developed include a low-cost, non-flammable ethylene oxide sterilant blend for use in hospitals and industry, a non-flammable cleaning solvent, and many other non-flammable gas mixtures.

1998 – 1999 **Sandia National Laboratories*, Albuquerque, NM***
Student Intern Environmental Restoration Chemistry Laboratory - Performed wet chemical and gas chromatograph/mass spectroscopy analysis of soil and water samples by EPA methods. Responsible for sample receipt and log-in, inventory maintenance, laboratory cleanup and safety, and data entry.

Trainings
EIT (Engineer In Training) Certificate – Received 1999
Interaction Management Training, Completed June 2012
Intense Innovation Training, Completed June 2012

ROBERT WALDROP

Education
Biology

08/13 – Present, University of Wyoming at Casper, Casper, WY Major:

01/12 - 05/14, Casper College, Casper, WY **Degree:** Associates of Science in Biology
08/05 – 5/07, Central New Mexico College, Albuquerque, NM Major: Economics
01/04 – 09/04, Pima Medical Institute, Albuquerque, NM Certificate: Pharmacy Technician
08/87–05/91, Estancia High School, Estancia, NM Diploma: May 1991

Specialties

Gas Chromatography, Gas Chromatography/Mass Spectrometry; Inter-coupled Plasma,
Inter-coupled Plasma /Mass Spectrometry, Cold Vapor Atomic Absorption, Cold Vapor
Atomic Fluorescence, High Performance Liquid Chromatography, Alpha Spectrometry,
Gamma Spectrometry, Gas Proportional Counter, Liquid Scintillation Counter, Resource
Conservation and Recovery Act (RCRA) and Toxic Characteristics Leaching Procedure
(TCLP) Programs; Quality Assurance/Quality Control Program (QA/QC), Analytic Data
Evaluation, Organizing Workflow and Sample Management.

PROFESSIONAL EXPERIENCE

2013 – Present **ENERGY LABORATORIES, INC., Casper, WY**
Radiochemistry Supervisor Responsible for Evaluate data produced by analysts. Check and maintain data balances between analyte tests. Prepare data packages for final reporting. Make procedural decisions based on available data and background. Implement corrective actions and perform root cause analysis when needed. Address client questions and concerns about samples tested.

2008 - 2013 **ENERGY LABORATORIES, INC., Casper, WY**
Metals Supervisor Responsible for scheduling, Analyze water, soil, air, and waste samples for Mercury, Selenium, and Arsenic using CVAA and HPLC under EPA approved methods. Analyze samples for trace metals by ICP and ICP-MS using EPA approved methods. Analyze samples for pesticides using HPLC.
Developing laboratory method for analytical use based on EPA and Standard Methods. Evaluate data produced by analysts. Check and maintain data balances between analyte tests. Prepare data packages for final reporting. Make procedural decisions based on available data and background. Implement corrective actions and perform root cause

analysis when needed. Address client questions and concerns about samples tested.

2007 - 2008 **ENERGY LABORATORIES, INC., Casper, WY**
Analyst - Analyze water, soil, air, and waste samples for Mercury, Selenium, and Arsenic using CVAA and HPLC under EPA approved methods. Analyze samples for trace metals by ICP and ICP-MS using EPA approved methods.

2006 - 2007 **ASSAIGAI ANALYTICAL LABORATORIES, INC., Albuquerque, NM**
Chemical Analyst -Analyze water, soil, air, and waste samples for organic compounds using EPA 8021, 8015, 8260, 624, 524.2 and Texas 1005 methods using GCMS and GC instruments. Analyze water, soil, air, and waste samples for Mercury, Selenium, and Arsenic using CVAA and HPLC under EPA approved methods.

2004 - 2006 **UNM Hospital, Albuquerque, NM**
Pharmacy Technician - Assist pharmacist with daily operations. Enter doctors' orders, fill patient medication orders, and answer questions about medications. Compound medications – create new medication mixtures, forms of medications not available from the manufacturer. Prepare intravenous solution by adding medication to diluents. Maintain narcotic logs according to DEA Standards. Update and modify patient medication records to reflect current status

TRAINING Interaction Management Training, 2008

AFFILIATIONS Rocky Mountain Water Quality Association (RMWQA)
American Society for Mass Spectrometry (ASMS)
National Pharmacy Technician Association (NPTA)
American Pharmacists Association (APhA)

Leonard Larson

EDUCATION: High school graduate, 1989.

SPECIALITIES: Analysis of Anions by EPA 300.0. Analysis of Nitrate+Nitrite and Ammonia by EPA 353.2 and SM4500NH_3 G.

PROFESSIONAL EXPERIENCE

2010 – Present ***ENERGY LABORATORIES, INC.,*** **Casper, WY**
Wet Chemistry Supervisor. Supervise water laboratory Employees, QA data.

2006 – 2010 ***ENERGY LABORATORIES, INC.,*** **Casper, WY**
Wet lab Analyst - Utilizing Ion Chromatography for analysis of anions. Analysis of Nitrate+Nitrite and Ammonia by EPA 353.2 and SM4500NH_3 G.

1999 – 2006 ***STANDARD LABORATORIES,*** **Casper, WY**
Coal prep technician.

1991 – 1997 ***BLACK HILLS BENTONITE, ,*** **Casper, WY**
Plant Operator – responsible for the operation of a bentonite production plant, superviseda a crew of up to eight employees.

TRAINING Interaction Management Training 2012

Dr. Chrystal N. Sheaff

EDUCATION

University of Idaho, Moscow, ID
Ph.D., Chemistry, 2008

Black Hills State University, Spearfish, SD
B.S., Chemistry and Biology, 2004

PROFESSIONAL EXPERIENCE

2015- Present

ENERGY LABORATORIES, INC., Casper, Wyoming
Organics Department Manager – Supervise the daily operation and management of the volatiles, semi-volatiles, HPLC, soil, and microbiology departments. Leads staff training sessions within the department as well as across departments. Responsible for maintaining quality control/assurance compliance within the department. Technical reviewer of standard operating procedures.

2012 – 2014

ENERGY LABORATORIES, INC., Casper, Wyoming
Chemist – Performed HPLC analysis for determination of pesticides and herbicides in drinking water. Performed analysis for gasoline range organics using a purge and trap system. Perform instrument maintenance and repair on HPLC and GC-PID/FID. Responsible for sample management; including, turn-around-times, sample disposal, and waste disposal. Writer, editor, and reviewer of standard operating procedures.

2008 - 2012

ALTURAS ANALYTICS, INC., MOSCOW, IDAHO
Scientist – Performed sample analysis on various biological matrices using HPLC-MS/MS. Developed analytical methods to support drug discovery under regulatory criteria. Followed SOPs, method protocols, analytical test methods, and EPA regulations. Performed troubleshooting, repairs, and maintenance on HPLC-MS/MS instruments.

2004 - 2008

UNIVERSITY OF IDAHO, INC., MOSCOW, IDAHO
Research Assistant – Researched fluorescent methods to detect and identify explosives, determine effectiveness of catalytic hydrogenation, and determining uranium extraction from aqueous solutions. Used synchronous spectroscopy, derivative spectroscopy and excitation-emission matrices (EEM) to identify explosives bases on their impurities and associated tagging agents.

2004 - 2006

UNIVERSITY OF IDAHO, INC., MOSCOW, IDAHO
Teaching Assistant – Taught laboratory classes for General Chemistry and Quantitative Analysis. Tutored chemistry students across all disciplines. Instructed recitation classes and review sessions.

TRAINING

GLPs for Study Directors-West Coast Quality Control Training-2011.

Sheri M. Mead

Education	Casper College: Nursing major. Casper, WY Hillsdale College: Pre-med major. Hillsdale, MI Kelly Walsh High School: Honors diploma, May 1993. Casper, WY

PROFESSIONAL EXPERIENCE

Jan. 2015-present

Metals Department Supervisor, Energy Laboratories, Inc., Casper, WY
Oversee daily operations of CVAA, ICP, ICPMS preparation, analysis and reporting. Troubleshoot technical problems. Evaluate and report data. Ensure all compliance standards are met and maintained. Revise and review SOPs and other technical documents. Coordinate with project management to meet client needs. Join corporate metals supervisors in process improvements. Investigate system failures and apply solutions.

2013-2015

Report Proofing Specialist, Energy Laboratories, Inc., Casper, WY
Completed daily checks to ensure state and federal regulations were followed and internal quality assurance measures met specifications. Performed and checked calculations and whether data results matched with historical data and site logic. Reported and invoiced data packages. Prepared annual consumer confidence reports that public water systems distribute to water users. Reviewed incoming work orders for accuracy prior to analysis.

2008-2013

Lead Metals Analyst, Energy Laboratories, Inc., Casper, WY
Performed ICPMS analysis on Agilent 7500 and Agilent CX collision cell instruments. Evaluated data produced by peers. Worked with supervisor to devise a structured cross training program. Mentored peers on issues from technical assistance and data integrity to ethical issues. Responsible for hosting audits of the department by peer, state, federal, commercial and regulatory auditors, and maintaining high standards to meet method requirements. Also served as a member of a team hiring panel to complete screening and technical interviews of potential employees.

2004-2008

ICPMS Analyst, Energy Laboratories, Inc., Casper, WY
Operated ICPMS Agilent 4500 and 7500. Implemented paperless data production, reviewed and revised SOPs. Supported organic department as back-up analyst for sample prep and methods 547, 549, 531 by HPLC.

2003-2007

CVAA Analyst, Energy Laboratories, Inc., Casper, WY
Operated CVAA equipment for mercury, arsenic and selenium analysis. Co-developed a procedure for arsenic speciation pairing CVAA with HPLC. Devised approved method modification to meet special client request for low level mercury. Responsible for metals department water and soils digests 200.2, 3010,

3050. Supported soils department prep for lime, texture, pH, conductivity, various extractions. Trained and experienced as secondary TOC operator.

2002-2003 **Wet Lab Analyst, Energy Laboratories, Inc., Casper, WY**
Performed bench testing for color, foam, odor, TSS, TDS, TVS, turbidity, turbimetric sulfate, chlorine residual. Supported microbiology as a back-up analyst for COD, BOD, DO, fecal coliform, coliform, IRB, SRB, and HPC.

2001-2002 **Radiochemistry Analyst, Energy Laboratories, Inc., Casper, WY**
Performed analysis for fluorimetric uranium, radium 226 and radium 228. Assisted department manager with control charting, data reduction, and data entry.

2001 **Shipping, Energy Laboratories, Inc., Casper, WY**
Prepared and shipped bottle orders. Maintained supplies. Managed sample storage and disposal. Supported login department with checking in clients and logging in work orders.

1993-1994 **Laboratory Technician, Hillsdale College, Hillsdale, MI**
Assisted with grafting, pollination, planting and experiments in botany lab. Maintained supplies, cleaned, and sustained live specimens in rodent labs for psychology and biology departments. Compiled and delivered data for *Sigma Zeta* Honor Society publication.

SPECIAL TRAINING

Lean Training, 2012 Manufacturing-Works.
Supervisor Interaction Management Training, 2009 Development Dimensions International.
Winter Conference on Plasma Spectrochemistry, 2010 Ft. Myers, FL.
ICP-MS Analysis Training. 2005 Agilent Technologies, Wilmington, DE.
Low level mercury conference, 2004 Rocky Mountain Water Quality Analysts Association, Boulder, CO.
Monthly lab technique, instrumentation, ethics and data quality classes/conferences, 2001-present Energy Laboratories, Inc.

APPENDIX E

EQUIPMENT AND METHODS LIST

ENERGY LABORATORIES, INC – CASPER, WYOMING

Equipment	Quantity	Methods
Gas Chromatograph-FID with auto sampler	2	8015 DRO, TPH
Gas Chromatograph-PID/FID with purge and trap & auto sampler	2	8015 GRO, 8021 MBTEXN
Gas Chromatograph-Dual ECD with auto sampler	1	504.1
Gas Chromatograph-Mass Spectrometer with purge and trap & auto sampler	3	524.2, 624, 8260B
Closed Cup Flashpoint Analyzer	2	SW1010
Atomic Absorption Fluorescence Spectrophotometer with cold vapor apparatus	1	7470A, 7471A, SM 3112B, 245.7
Atomic Absorption Spectrophotometer with flame apparatus	1	SM 3114B
Inductively Coupled Argon Plasma Spectrophotometer	2	200.7, 6010B
Inductively Coupled Argon Plasma Spectrophotometer-Mass Spectrometer	2	200.8, 6020A
Quick Trace Mercury Analyzer - Cold Vapor Atomic Absorption Analyzer	1	245.1, 7470, 7471, SM3112B, 3114B
Ion Chromatograph	2	300.0
Conductivity and pH	1	A2510B, A4500-H B
Turbidimeter	2	Turbidity, A4500-SO4
Auto Titrator / ISE	1	SM 2320B, A4500-F C, A2510B, A4500-H B
Manual Solid-Phase Extractor	1	1664A
Spectrophotometer	2	Hach 8000, SM4500-NO2 B, 420.1, A3500-Cr B
Autoanalyzer (FIA)	2	353.2, A4500-NH3
TOC Analyzer	3	A5310 B, A5310 C, SW9060
Liquid Chromatography (HPLC)	2	549.2, 531.1, 547, 632, 8316
Liquid Scintillation Counter	2	906.0, ASTM D 5072 92, 909.0M
Alpha / Beta Gas Proportional Counters Detectors	6 69	900.0, 900.1, 903.0, 905.0, RA-05
Gamma Ray Spectrometers (2 HPGe, 3 NaI(TI))	5	901.1
Alpha Spectrometers Detectors	2 40	907.0
BOD/DO Analyzer	2	5210B
TCLP Extractor/Rotator	4	1311
Microscope	1	Microbiology
(*Serial numbers and associated support equipment are located in the ELI-Casper's LIMS database).		

ATTACHMENT 1

RECORD OF REVIEW/REVISION

ATTACHMENT 1
RECORD OF REVIEW/REVISION
CASPER, WYOMING
Quality Assurance Manual

Date of Review/ Revision	Revision Number	Performed By	QA Manager Approval Initials/Date	Action (Review with no changes/ Detailed modifications)
02-2-2011	**7.15.2010.1**	**J. Judge**	**J. Judge 2-2-11**	**Edit TOC, Update Organization Chart, Add Leonard Larson to Curricula Vitae (Remove Judy Larson). Update Certifications.**
11/15/11	9/20/11	J. Judge /A. Valkenburg	J. Judge 9-22-11	Replaced Dave Poelstra with Steve Carlston as interim Branch Manager. Updated Org. charts. Replaced "EPA" with "USEPA". INTRO Section: Moved ELI commitment section to Introduction, removed Quality Policy Statement, moved "Relationship between Mgmt…and Quality System" paragraph to Ch 4 (Personnel Requirements). Added Client specific DQO information, Moved information @ "Written SOPs available at laboratory" to Ch1-Method QC Specifications. Ch1: Replaced "SOPs" with "Chapter 13 of this manual" includes recommended preventative maintenance…Added to Method QC Specifications Paragraph, "ELI SOPs are considered confidential proprietary information and ELI does not provide copies of SOPs off ELI premises." Moved "For radiochemical analyses, each method undergoes Method Validation as outlined in EPA's specific method and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), Chapter 6. " and "The required detection level (RDL) for radiochemical analyses of drinking water samples is calculated based on the requirements in 40 CFR 141.2~~7~~5(c), which is a sample specific determination. The equation is specific for each method and noted in the method-specific SOP." Updated ELI MDL SOP reference. CH 4: Added "and laboratory experience/training appropriate to the procedures they are performing" to analysts. Added electronic signature info to Approved signatories section. CH 5: Added: To ensure that drinking water analysis for radiochemistry are met, the requirements for sample handling, preservation, and instrumentation for radiochemical analysis are included in ELI SOP, "Sample Receipt, Log-In and Labeling". (For additional information, refer to "Manual for the Certification of Laboratories Analyzing Drinking Water, Table VI-2: Sample Handling, Preservation, and Instrumentation, EPA 5th Edition, January 2005)". Ch 7: Added to laboratory stock/working stds: "are

Date of Review/ Revision	Revision Number	Performed By	QA Manager Approval Initials/Date	Action (Review with no changes/ Detailed modifications)
				derived from ISO 17025 and/or 9001 (or equivalent-certified)" commercially available. Removed "for drinking water samples" from MDL are determined according to EPA guidelines… and added (except for the few methods that are not amenable to MDLs)." Replaced MDL with "practical quantitation limits". Removed "General method detection limits are given in Appendix D". Ch 8: Added information @Record of Review/Revision page included on SOPs. Removed from Laboratory Notebooks, "Laboratory notebooks are controlled with unique identifiers. They are indexed and maintained at a commercial storage facility when completed". Added to Reporting section, "Clients are able to access their electronic files through ELI's secure website @ https://energysource.energylab.com/. CH 10: Removed, " Balances are checked monthly against a second set of NIST traceable ASTM Type I weights." Replaced "periodically" with annually for when SOPs are reviewed. CH 11: Replaced ELI's website "global compliance" with "Alert". CH 13: Added, "Repairs and maintenance are accomplished in-house by experienced laboratory personnel. Other than consumable equipment items, an inventory of spare parts is not maintained. Spare parts are available from outside vendors on an as needed basis. (To ensure method capability, some methods have more than one instrument available)." References Section: Added ASTM D7282-06 Radiochem reference. Appendices: Added General Radiochemistry QC elements. Removed David Poelstra from Curricula Vitae.
11/15/11	9/20/2011	J. Judge/ J. Erickson	J.Judge 11/15/11	Title Page: Changed Branch Technical Director to Steve Dobos. Introduction Section: Added information on the procedure for all new work acquired by lab. Chapter 4, Personnel Requirements: Added "refer to ELI SOP Method Deviations for details regarding the specific process for any lab deviations. Appendix E: Added "Technical Director" to Steve Dobos Curricula Vitae.
11/8/12	11/8/12	J.Judge /J. Erickson	J.Judge 11/08/12	Title Page: Added Steve V. as technical director. **CH 5:** Added "Aqueous" to Samples for microbiological analysis." Added, "Solid samples are collected in pre-sterilized 120mL plastic bottles for microbial testing without preservation. "**CH 12:** Updated Equipment list. **Attachments:** Updated Org charts, NELAP/NELAC, EPA, RadChem Certificates. Curricula Vitea: Removed Randy Ogden and Donny J. Added Steve Vien, Kerri Schroeder and James Ritchie, updated Steve Dobos.
7-26-13	7/26/13	J Judge	J Judge 7-26-13	New P.O. Box Number front page. Update ELI Org Chart Added annual ethics training Chapter11. Edited last paragraph Chapter 11, Corrective Action regarding deviations from method. Update Chapter12

Date of Review/ Revision	Revision Number	Performed By	QA Manager Approval Initials/Date	Action (Review with no changes/ Detailed modifications)
				Update Chapter 13 – Compressed gasses change set at 200 PSI Chapter 14, added newest SW846 version Update Appendix C Update Appendix D Remove John Standish, add Lisa Bradley Remove Dave Blaida Update Rob Waldrop Add Chuck Patterson Update NELAP & EPA Certifications
3-7-14	3-7-14	J Judge	J Judge 3-7-14	Major Update – Entire QAM is now based on Billings Corporate QAM.
5/15/2015	5/15/2015	D Juarez	D Juarez 5/15/2015	Updated Laboratory Manager and Quality Assurance Officer Changed all reference to “Branch Manager” to “Laboratory Manager” Removed all reference to the Laboratory Policy SOP Removed all reference to the Roles and Responsibilities SOP Removed reference to Rapid City Lab Updated the Table of Contents Removed Appendix A and renamed Appendix B, C, D, E and F to A, B, C, D and E Updated the Introduction Section Updated Chapter 4 Updated Chapter 6 Updated Chapter 7 Updated Chapter 8 Updated Chapter 11 Major update Chapter 12 moved equipment list the Appendix E Updated Chapter 15 Updated all Appendices Removed Attachment 2 Multiple grammatical corrections See redline document for all changes Added Management of Change Chapter

Anatek Labs, Inc.

Quality Assurance Plan

1282 Alturas Drive
Moscow, ID 83843
(208) 883-2839

504 E Sprague Ave. #D
Spokane, WA 99202
(509) 838-3999

Revision No. 10

Effective Date: 12 Nov 2012

Approvals:

Mike Pearson
Lab Director

_____ Date:_____

Kathy Sattler
Lab Manager, Spokane

_____Date:_____

John Coddington
Lab Manager, Moscow

_____ Date:_____

Gene Solomon
QA Officer

_____ Date:_____

Todd Taruscio
Technical Director, Moscow

_____ Date:_____

Erin Linskey
Technical Director, Moscow

_____ Date:_____

Melissa Lewis
QA Officer/Technical Director, Spokane

_____ Date:_____

Signature Page (1)

Anatek Labs, Inc.

The undersigned have read this Quality Assurance Plan and understand the requirements set forth in it. By signing this document, these individuals acknowledge their responsibility to follow the procedures outlined. The annual review of this manual is mandatory for all employees and will be construed as training for all matters contained within.

Mike Pearson _____ Initials: _____ Date: _____
Lab Director

Gene Solomon _____ Initials: _____ Date: _____
QA Officer

John Coddington _____ Initials: _____ Date: _____
Lab Manager, Moscow

Kathy Sattler _____ Initials:_____ Date:_____
Lab Manager, Spokane

Melissa Lewis _____ Initials:_____ Date:_____
QA Officer, Spokane

Name: (Please Print)	Signature:	Initials:	Date:

Signature Page (2)

Anatek Labs, Inc.

The undersigned have read this Quality Assurance Plan and understand the requirements set forth in it. By signing this document, these individuals acknowledge their responsibility to follow the procedures outlined. The annual review of this manual is mandatory for all employees and will be construed as training for all matters contained within.

Name: (Please Print)	Signature:	Initials:	Date:

Table of Contents

Introduction **7**
Quality Assurance Policy Statement **7**
Policy on Waste, Fraud and Abuse **7**
Data Integrity, Fraud Prevention & Detection **7**
Code of Ethics/Conduct **7**
Confidentiality Policy Statement **8**
Customer Service **8**
New Work Requests and Contracts **8**
Quality Assurance Program Management and Implementation **8**
QA Committee 8
QA Officer 8
Laboratory Organization, Responsibilities and Personnel Qualifications **9**
Laboratory Director 9
Laboratory Manager 9
QA Officer 10
Inorganic Supervisor 10
Microbiology Supervisor 10
Chemistry Supervisor 10
Technical Staff (Chemists, Lab Technicians, etc.) 11
Staff 12
Facilities, Equipment and Services **12**
Sample Procedures **13**
(Sample Collection, Storage, Handling and Acceptability) **13**
Collection 13
Sample Containers 13
Preservation Methods 13
Transportation 13
Hand Delivery 13
Shipped Samples 13
Sample Acceptability 13
Sample Logging and Tracking **14**
Logging 14
Tracking 15
Sample Custody and Legal Defensibility **15**
Collection 15
Calibration Procedures and Frequency **16**
Temperature Control Devices 16
Analytical Balances 16
Water Purification System 16
Analytical Instrumentation 16
Services and Supplies 16
Analytical Procedures **16**
Data Generation – Data Reduction, Validation and Reporting **17**
Data Reduction 17
Uncertainty of Measurement 17
Verification / Validation 17

Timely Reporting 17
Reporting Results 17
Notification of MCL Violations 17
Internal Quality Control 17
Precision 18
Accuracy 18
Completeness 18
Standard Operating Procedures (SOPs) and Laboratory Notebooks 18
Deviation from Standard Operating Procedures 19
Modified Procedures 19
Analytical Batch 19
Method Blank (a.k.a. Laboratory Reagent Blank) 19
Calibration Blanks 20
Continuing Calibration Blanks 20
Calibration Standards 20
Initial (or Independent) Calibration Verification Standards 20
Continuing Calibration Verification Standards (CCV) 20
Internal Standards 20
Surrogates 20
Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix) 20
Laboratory Duplicates and Duplicate Matrix Spikes 21
Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks or Quality Control Samples) 21
Interference Check Samples 21
Post Digestion Spikes 21
Source and Preparation of Standard Reference Materials 22
Method Detection Limits 22
Control Charting 22
Glassware Washing 22
Temperature Record Keeping 23
Balance Audit 23
Policy on Manual Integration 23
Integration Procedure and Review 23
System and Performance Audits 24
Management System Reviews (MSRs) 24
Technical System Audits (TSAs) 24
Performance Evaluation (PE) 25
Data Quality Audits (DQAs) 25
IT Systems Auditing 25
Corrective Action 25
Preventative Action 26
Training & Personnel Qualifications 26
Subcontracting of Laboratory Services 26
Preventive Maintenance 26
Waste Disposal 27
Quality Document Control 27
Termination or Transfer of Business 27

Tables, Figures, and Appendices in separate document
(located at http://www.anateklabs.com/Content/Documents/Tables,%20Figures%20&%20Appendices.pdf)
In lieu of page numbers, click the links in the PDF document

Tables .....

1a Analytical Equipment Utilized at Anatek Labs, Moscow .....
1b Analytical Equipment Utilized at Anatek, Labs, Spokane .....
2 Summary of Analytical Parameters, Method, Sample Containers, Preservation Methods, Holding Times and Estimated Working time .....

Figures .....

1 Anatek Labs Organizational Chart.....
2 Anatek Labs, Moscow Personnel.....
3 Anatek Labs, Moscow Floor Plan.....
4 Anatek Labs, Spokane Personnel.....
5 Anatek Labs, Spokane Floor Plan.....

Appendices .....

A Index of Standard Operating Procedures .....
B Example of Sample Submission Form.....
C Quick Reference for Chemical Safety .....
D Laboratory Staff Resumes / Qualifications.....
E Current State Certifications.....
F Backup, Fault Tolerance, Disaster Recovery and Data Archive of Mission-critical Information Storage and Services.....
G Control Chart Information .....
H Method Detection Limit.....
I Calibration Methods and Equations.....

Introduction

Anatek Labs, Inc. is a private, full service, multi-state certified analytical laboratory. We are committed to providing the highest quality environmental, agricultural, residential, and industrial testing services in a timely and cost-effective manner. We have established quality systems to ensure the quality and integrity of our work, and we are committed to enacting these quality measures and ensuring compliance with applicable TNI standards.

Anatek Labs, Inc. has integrated many Quality Assurance (QA) practices into its measurement activities. These QA practices are designed to generate high quality data in an efficient and cost effective manner. Anatek Labs, Inc. has a laboratory-wide Quality Assurance (QA) Program designed to assess and monitor the ongoing quality of the testing performed in its facilities. Its purpose is to identify and correct problems as they occur and, if possible, to determine in advance potential problem areas and institute measures for their resolution. The Quality Assurance Committee will oversee all QA activities to assure the accurate, reliable and prompt reporting of testing results. This document describes Anatek Labs, Inc.'s Quality Assurance Plan as it relates to operations within the laboratory. While this document strives to be inclusive, much of the Anatek Labs, Inc. quality plan is incorporated in the laboratory and method SOPs referenced in the Appendix.

This QA Plan addresses all the minimum required elements described in the Guidelines and Specifications for Preparing Quality Assurance Program Plans (QAMS-004 / 80), Interim Guidelines and Specifications For Preparing Quality Assurance Project Plans (QAMS-005 / 80) and Guidance on Preparation of Laboratory Quality Assurance Plans (EPA 910 / 9-92-0332).

Quality Assurance Policy Statement

It is the policy of Anatek Labs, Inc. that there shall be sufficient Quality Assurance activities conducted to ensure that all data generated and processed will be scientifically valid and of known and documented quality. In addition, the use of all aspects of this quality system will continually improve the effectiveness of the laboratory and the quality system. All data generated by Anatek Labs, Inc., unless acknowledged and authorized by the submitting party, will be of known precision and accuracy and legally defensible. Quality assurance activities are designed in the most cost-effective fashion possible without compromising data quality objectives. The laboratory staff adheres to the requirements and specifications stated in this Quality Assurance Plan. All data reported meets the applicable requirements for The NELAC Institute, EPA and/or any State specific methods used. For specific method requirements refer to SOPs, current EPA methods, the most current edition of Standard Methods, and/or state specific methods.

Policy on Waste, Fraud and Abuse

Under no circumstances is the willful act or fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to management for appropriate corrective action. Reported acts will be assessed on an individual basis, resulting actions will be consistent with Anatek Labs, Inc. policies and could result in dismissal.

Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented and appropriate remedies and punitive measures will be taken toward those individuals responsible.

Data Integrity, Fraud Prevention & Detection

Anatek Labs, Inc. actively works to insure that the data it produces is of the highest quality and legally defensible. The data integrity system includes data integrity training for all new employees and annual refresher training for all employees, signed data integrity documentation, and in-depth monitoring and review of data. At a minimum, 10% of all data packets generated are reviewed by the QAU or laboratory supervisors. If discrepancies are found management is notified. Blind samples are prepared as needed to check for fraud. If an employee is found to have committed a fraudulent act they will be dismissed.

Code of Ethics/Conduct

The Anatek Organization is a team and each team member is expected to maintain a certain level of professionalism. Employees are expected to perform their duties with excellence, and to contribute to an environment where their co-workers can efficiently perform their duties and maintain focus on the overall benefit of the Anatek team. The

penalties for violating the Code of Ethics can range from verbal reprimands to loss of position. No person at Anatek Labs, Inc. will in any way be put under undue pressure, financial or other, to complete their assigned tasks.

Confidentiality Policy Statement

All client information at Anatek Labs, Inc. is considered confidential. No information will be given out without the express verbal or written permission of the client. All reports generated will be held in the strictest of confidence and issued only to the client. The exceptions to this policy would be those mandated by law (e.g., positive *E. coli* in public water systems that are required to be reported to State Regulatory Agencies). All employees of Anatek Labs, Inc. will at all times adhere to this policy.

Customer Service

Anatek Labs, Inc. reputation has been built upon service to the customer. The laboratory is always willing to communicate and cooperate with customers to ensure their requirements are met, provided confidentiality to other customers can be ensured. Feedback from customers, including complaints, is used to improve laboratory operations and services.

New Work Requests and Contracts

It is the policy of Anatek Labs, Inc. to never turn away customer requests. The lab is constantly expanding its abilities by seeking new certifications, purchasing new equipment, and hiring quality personnel. New work requests are reviewed to ensure that the lab has the appropriate facilities, resources, and expertise to perform the analyses required.

Most of the work contracted to Anatek Labs, Inc. is for regulated projects analyzed by accredited methods. Specialty projects are reviewed and established by the Lab Director, Lab Manager, and/or Technical Directors, and the technical, legal, and financial considerations are established via correspondence and contracts, and reviewed as necessary. Project–related documentation (e-mail, contracts, quotes, etc.) is maintained (and reviewed as necessary) by the Lab Manager and/or Lab Director.

If Anatek Labs is unable to perform a particular analysis we will find a certified lab to subcontract the job. The above policy is at the discretion of the Lab Director and is subject to change.

Quality Assurance Program Management and Implementation

Overall responsibility for quality assurance lies with the Laboratory Director. The primary QA management of the laboratory rests with the Laboratory Manager. To provide technical assistance to the Laboratory Manager, a QA Officer is appointed by the Laboratory Director. The QA Officer is granted sufficient resources to ensure the proper execution of the QA Plan and to recommend and implement specific QA policies and procedures. A Quality Assurance Committee exists to further facilitate adherence and development of QA policies and procedures.

QA Committee

The Quality Assurance Committee is comprised of the QA Officer, Laboratory Manager, Laboratory Director, and Laboratory Supervisors. The QA Committee is responsible for overseeing lab-wide QA Plan implementation and addressing QA complaints or concerns brought to its attention from internal or external sources. The QA Committee directs the efforts of the QA Officer and enforces any necessary corrective actions. The QA Committee shall convene if needed to assess and/or address lab-wide QA concerns and any actions taken by the QA Officer. Any QA complaints or problems that are received from outside the laboratory will be referred to the committee in order to resolve such issues.

QA Officer

The QA Officer is appointed by the Laboratory Director to oversee specific QA policy and procedure development, implementation, and adherence of Anatek Labs, Inc. The QA Officer is responsible for auditing internal operations and ensuring compliance with QA criteria established by this QA Plan and other documented policies and procedures. The QA Officer assesses all QA systems on an annual basis. Results of all findings are documented

and corrective action recommendations, if any, are submitted to the QA Committee, Laboratory Manager and affected staff members.

The QA Officer is responsible for documentation and evaluation of specific policies and procedures. Standard Operating Procedures are kept on file documenting specific procedures employed to ensure the validity and acceptability of data generated at Anatek Labs. Materials purchased for Quality Control purposes are received with a Certificate of Authenticity from the manufacturer. Certificates are kept on file for review if necessary. The QA Officer is responsible for coordinating and reporting for all performance evaluation samples, maintaining and updating certifications and accreditations, and monitoring corrective actions.

Laboratory Organization, Responsibilities and Personnel Qualifications

All employees maintain a copy of all training certificates and diplomas on file with certificates of capability for each method they perform. Organizational charts for Anatek Labs, Inc. are shown in the Appendices.

Laboratory Director

The Laboratory Director is responsible for overall technical direction and business leadership of Anatek Labs, Inc. The Laboratory Director is responsible for the implementation and evolution of QA policy and SOPs within the laboratory, based on the current market, technological advances in equipment, and methods.

The Laboratory Director is responsible for assuring that the provisions of this QA Plan are met, and that adequate resources are available for technical operations and quality systems oversight.

The Laboratory Director is a direct liaison to the Corporation's Board of Directors (BOD) and must attend a BOD meeting at least once a year, or as necessary to discuss equipment purchases, managerial changes, contracts, and major SOP and QA changes.

All Laboratory Managers, Technical Directors, and Systems Managers report directly to the Laboratory Director.

The Laboratory Director is required to attend managerial and/or staff meetings at which the topic of QA is discussed. These meetings will be held as often as necessary or at the direction of the Laboratory Director.

The Laboratory Director may serve as Laboratory Manager, Technical Director, Systems Manager, and/or Analyst if these positions are not filled for any reason.

The Laboratory Director must have a minimum BS in a science or engineering field and 5 years of managerial experience in an environmental laboratory or an equivalent combination of education and experience.

Laboratory Manager

The Laboratory Manager is responsible for overseeing the daily operations of Anatek Labs, Inc. The Laboratory Manager, in conjunction with the Technical Director(s), is responsible for coordinating the activities within the laboratory with the overall goal of efficiently producing high quality data in a reasonable time. The Laboratory Manager is responsible for monitoring the validity of the analyses performed and data generated and for monitoring standards of performance in quality control and quality assurance.

The Laboratory Manager reports directly to the Laboratory Director and may act as Interim Director during extended absence of the Laboratory Director.

Additionally, the Laboratory Manager will provide technical support to customers and coordinate project to meet specific customer needs.

The Laboratory Manager is responsible for the maintenance of standards and materials in accordance with the QA Plan, to ensure uninterrupted operation of the laboratory.

All Section Managers and Analysts not reporting to the Technical Director(s) report directly to the Laboratory Manager.

In events where employee scheduling or current workload is such that new work cannot be incorporated without missing holding times or data quality objectives, the Laboratory Manager has authority to refuse samples, modify employee scheduling, or re-schedule projects.

The Laboratory Manager, in coordination with the Section Managers, QC/QA Managers, and Technical Director, is responsible for determining in which QA Proficiency Programs the laboratory will participate, and which accreditations the laboratory will pursue. It is the responsibility of the Laboratory Manager to ensure that the laboratory sections perform the tasks necessary to complete the proficiency testing required to maintaining certification and accreditation

The Laboratory Manager will attend managerial and/or staff meetings at which the topic of QA is discussed.

The Laboratory Manager can act as Analyst, Section Manager, or Technical Director if, for any reason, the positions are not filled.

The Laboratory Manager is responsible for all human resource decisions within the laboratory except for employees reporting directly to the Technical Director or Laboratory Director.

If the Laboratory Manager is to be absent for more than 15 days, the Technical Director (or other supervisor) will serve as the temporary Laboratory Manager.

The Laboratory Manager must have a minimum BS in a science or engineering field and 5 years of managerial experience in an accredited environmental laboratory, or an equivalent combination of education and experience.

QA Officer

The QA Officer is a member of Anatek Labs, Inc. QA Committee and is designated by the Laboratory Director. The QA Officer serves as the focal point for QA/QC and is responsible for the oversight and/or review of quality control data. The QA Officer functions independently from laboratory operations (answering directly to the Lab Director), and is able to evaluate data objectively without managerial influence. The QA Officer is responsible for conducting internal audits, and for notifying management of any deficiencies in the quality system, and for monitoring corrective actions. The QA Officer is responsible for maintaining the currency of this QA Plan., and will help develop, implement, and maintain Standard Operating Procedures appropriate to the procedures employed within Anatek Labs, Inc. The QA Officer is responsible for ensuring all applicable regulatory agency requirements are met.

The QA Officer must have a minimum BS in a science or engineering field and two years experience in QA/QC or an equivalent combination of education and experience.

Inorganic Supervisor

The Inorganic Supervisor is responsible for training, overseeing and assisting Inorganic Technical Staff in their daily duties. The Inorganic Supervisor assures adherence to Standard Operating Procedures and Quality Assurance activities. The Inorganic Supervisor should be a Chemist II or III.

The Inorganic Supervisor must have a minimum BS in a science or engineering field and 2 years of laboratory experience, or an equivalent combination of education and experience.

Microbiology Supervisor

The Microbiology Supervisor is responsible for quality microbiological results by maintaining the laboratory microbiology program and services within the framework of the lab QA guidelines. He/She is responsible for maintaining certifications and training/supervising the microbiology technicians.

Microbiology Supervisor must have at least two years experience performing microbiological analysis in an environmental laboratory.

Chemistry Supervisor

The Chemistry Supervisor is responsible for overseeing and assisting Chemistry Technical Staff in their daily duties. The Chemistry Supervisor assures adherence to Standard Operating Procedures and Quality Assurance activities. The Chemistry Supervisor should be a Chemist III.

The Chemistry Supervisor must have a minimum BS in a science or engineering field and 2 years of Laboratory experience, or an equivalent combination of education and experience.

Technical Staff (Chemists, Lab Technicians, etc.)

Technical Director

The company Technical Director(s) is responsible for providing scientific leadership and vision. The Technical Director will manage and coordinate activities of laboratory departments as designated by the Laboratory Director. The Technical Director will work with the Laboratory Manager to ensure that all lab QA/QC practices are being satisfied in order to produce data that exceeds the quality objectives of the QA Plan, specific customers or projects, and regulatory requirements.

The Technical Director will provide technical support to laboratory staff and investigate new areas of interest to the company by utilizing methods development and technical advancements. The Technical Director will be available as needed to fill in for Chemist(s) in the event of absence or job opening.

The Technical Director will be the primary contact for specified customers and provide project management and advice to those customers. Additionally, the Technical Director will prepare final customer reports as needed.

The Technical Director will be responsible for non-routine instrument maintenance and troubleshooting and, if needed, obtain outside technical assistance for equipment maintenance or repairs as necessary.

The Technical Director must have at least 5 years of applicable laboratory experience and a minimum of a BS in a science or engineering field.

Chemist (I, II, III)

The Chemist is responsible for the analysis of samples and the generation of high quality data in accordance with the laboratory SOPs and QA/QC guidelines in a reasonable time as prescribed by laboratory standard turnaround schedules or as directed by the Laboratory Director or Laboratory Manager.

The Chemist is responsible for making sure all data generated by him/her is entered into the appropriate database in the correct manner and that raw data packs are signed and archived properly.

The Chemist reports daily to the Laboratory Manager and will inform the Lab Manager as to the material needs of the laboratory, specifically pertaining to analyses performed by the Chemist.

Additional duties of the Chemist may include, but not be limited to, preparation of samples for analysis, maintenance of lab equipment, and providing technical assistance to lower-level laboratory staff. The Senior Chemist in the laboratory may be asked to perform supervisory duties as related to operational aspects of the laboratory. In the event that this is required for any reason, these supervisory duties will be assigned by the Lab Manager and/or Lab Director. The Chemist may perform all of the duties of Laboratory Technician.

The position of Chemist is a full time or part time hourly position and may be divided into three levels, Chemist I, II, and III. Chemist I must have the equivalent of a Bachelors degree in Chemistry or a closely related science. Additionally, Chemist II must have at least 2 years of environmental or closely related lab experience. Chemist III must have a Bachelors degree plus 5 years of environmental or closely related lab experience.

Laboratory Technician/Microbiology Technician

The Laboratory Technician (chemistry or microbiology) is responsible for providing support in the form of sample analyses, sample preparation, and general lab maintenance. This may include tasks such as filling out daily maintenance logs, chemical inventories, and laboratory cleaning (glassware, etc).

The Laboratory Technician reports to the Laboratory Manager or the Microbiology Supervisor in the case of Microbiology Technician.

The Laboratory Technician may be divided into three levels, Technician I, II and III. Lab Technician I must have a high school diploma or GED. Lab Technician II must have at least 1 year of experience in an environmental lab or equivalent secondary education. Lab Technician III must have a bachelor's degree in chemistry or closely related science or equivalent work experience.

Staff

Systems Administrator

The Systems Administrator is responsible for overseeing all information systems infrastructure. Infrastructure is defined as all hardware including computer workstations, servers and IT support equipment plus all laboratory equipment that interfaces with the network or database as well as all software and applications resident on the system.

The Systems Administrator reports directly to the Laboratory Director. The Systems Administrator must have a minimum BS in a computer science or information technology field or an equivalent combination of education and experience.

Customer Service Manager

The Office Administrator is responsible for all phases of customer service including but not limited to answering telephones, assisting customers with Anatek Labs forms, distributing sample kits, and receiving samples from walk-in customers.

The Office Administrator is responsible for: invoicing customers, processing payments, invoices and packing slips, paying A/P invoices, payroll, payroll taxes, federal and state taxes, issuance of purchase orders, and deposits.

The Office Administrator is responsible for all Human Resource management including insurance and 401K.

The Customer Service Manager must have a minimum AA in Business Administration, Accounting or other relevant field and 5 years experience in office administration/supervision or an equivalent amount of education and experience.

Bookkeeper

The Bookkeeper is responsible for: invoicing customers, processing payments, invoices and packing slips, paying A/P invoices, payroll, payroll taxes, federal and state taxes, issuance of purchase orders, and deposits.

The Bookkeeper is responsible for all Human Resource management including insurance and 401K.

Sample Custodian, Shipping/Receiving

The Sample Custodian is responsible for the log-in and tracking of all samples throughout the laboratory. The sample custodian is additionally responsible for tracking of all samples sent to sub labs. All shipping and receiving is done/monitored by the sample custodian, to include sampling kits, trip blanks and prepreserved sample battles. The sample custodian takes customer orders and insures that incoming samples are correct. If a discrepancy is noted the sample custodian will contact the customer to resolve any questions or problems. The sample custodian is an integral part of the customer service team.

The Sample Custodian must have a high school diploma or equivalent.

Facilities, Equipment and Services

Anatek Labs, Inc. was founded in 1992. Anatek Labs, Inc. is a full service environmental testing laboratory serving the Inland Empire and the Pacific Northwest.

A listing of major analytical equipment used at Anatek Labs, Inc. can be found in Tables 1a & 1b of the Appendices this document.

Sample Procedures
(Sample Collection, Storage, Handling and Acceptability)

All samples sent to Anatek Labs, Inc. are received, logged in and distributed by the Sample Custodian. Samples that are unsatisfactory are not analyzed unless authorized by the customer. Any such sample will be noted on the Chain of Custody form and with a qualifying statement on the final report noting unsatisfactory sample submission. Corrective measures to ensure proper specimen collection and/or handling on future sample sets will be supplied to the customer(s).

Collection

Samples must adhere to requirements for container, preservation and holding times described in Table 2. For a complete summary of sample containers, Preservation Methods and Holding Times; see Table 2. Consult the Standard Operating Procedure, EPA SW-846 Manual on Test Methods for Evaluating Solid Waste, the Federal Register on EPA Test Methods Determining Contaminants in municipal and industrial wastes, Standard Methods or other appropriate documentation for specific instructions on sample collection.

Sample Containers

Most sampling containers are supplied to the customer by the laboratory. Containers are generally used only once and discarded. Some analytical methods utilize containers of a type that is conducive to recycling. In these cases, containers are cleaned according to Standard Operating Procedures to ensure cleanliness. Samples must not be exposed to interfering materials. Consult the laboratory for the proper container material and size for a specific analysis or project. If the samples are collected and stored for transport in inappropriate types of containers, the Laboratory may not be able to accurately quantify the amount of the desired components. In this case resampling may be required.

Preservation Methods

All samples should be preserved according to the type of matrix, analysis required and data objectives. If the samples are not properly preserved the analytical results may be inaccurate due to loss by volatilization and/or degradation. Anatek Labs, Inc. provides sample containers with appropriate preservatives already in the container, when possible. Table 2 contains information on appropriate preservation methods.

Transportation

Samples should be transported to the laboratory by the fastest means possible.

Hand Delivery

Personal delivery is preferred, as it is the most secure. A Chain-of-Custody record must accompany the transfer of the sample with the identification information if results will potentially be used as evidentiary. The field sampler is responsible for the proper packaging and dispatch of their samples. This responsibility includes sample preservation and the completion of all necessary documents concerning custody.

Shipped Samples

A sealed container should be used to ship samples via a common carrier. Samples within these containers should also be properly sealed, identified and accompanied by appropriate paperwork such as a Chain-of-Custody record or a test request form. The Laboratory will retain all bills of lading for use to supplement the accompanying Chain-of-Custody documentation.

Sample Acceptability

Samples received after holding times have expired, in inappropriate containers, or lacking appropriate preservative measures are generally not accepted for testing. Occasionally, a customer will request that a sample be processed even if it is received in an unacceptable condition. In such a case, testing will only proceed after the customer has provided written or verbal acknowledgement of the unacceptable status of the sample and authorized continued testing. Further, a comment, narrative, or explanation of possible negative effects of unacceptable sample submission is placed on the report or attached as a more detailed description.

Sample Logging and Tracking

Standard Operating Procedures have been established for the receiving of samples into the laboratory (SOPs ALI-02 & ALI-18). These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received. Documentation of all sample storage is maintained in order to preserve the integrity of the samples.

Samples delivered to the lab are received by a designated Sample Custodian(s). Verification of sample integrity by the Sample Custodian includes the following activities:

- Assessment of custody seal presence/absence, location and signature
- Temperature of sample containers upon receipt
- Chain-of-Custody documents properly completed (entries in ink, signature present, etc.)
- Sample containers checked for integrity (broken, leaking, etc.)
- Sample is clearly marked and dated (bottle labels complete with required information)
- Appropriate containers (size, type) are received for the requested analyses
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.)
- Assessment of proper sample preservation (if inadequate, corrective action is employed)
- VOC containers are inspected for the presence/absence of bubbles (No assessment of proper preservation is performed for VOC containers at time of receipt; preservation is checked after analysis to avoid loss of sample)

Any anomalies or discrepancies observed during the initial assessment are recorded on the chain of custody documents and/or in the LIMS sample tracking software. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When a satisfactory resolution has been reached by coordination with the client, the log-in process may commence and analysis may begin. Any changes on documentation resulting from these discussions are documented and authorized directly by the customer. During the log-in process, each sample is given a unique laboratory code and an analysis request form is generated. The analysis request contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates and analysis due dates and other pertinent information.

Facility security and access is important in maintaining the integrity of samples received at Anatek Labs, Inc. Access to the laboratory is limited to authorized personnel except for the sample receipt area that is manned during business hours.

Samples are stored appropriate to the analysis requested until they undergo analysis. Anatek Labs, Inc. stores samples in one of many refrigerators, freezers or other storage locations, depending on the type of analysis and the matrix of the sample. Anatek Labs, Inc. has several refrigerators for storage of samples. These refrigerators are segregated by matrix type (soil or water) and method of analysis. Drinking water, wastewater and soil samples are segregated and placed in separate refrigerators. The samples are further separated into dedicated refrigerated storage of VOC samples. A walk-in refrigerator is used for sample archival. An additional freezer provides additional frozen storage capacity for miscellaneous samples. The temperature of each sample storage unit used at Anatek Labs, Inc. is monitored daily during operations and the data recorded in a file for future reference.

Samples and sample extracts are retained for up to six weeks then disposed of unless other arrangements have been made in advance. All samples are either returned to the client or disposed of according to approved disposal practices.

Logging

Samples are assigned a unique laboratory identification number. All samples are assigned a number with the following format: YYMMDDZZZ-XXX
Where:

YY = year (12=2012)
MM = month (02=February)
DD = day of the month
ZZZ = sample batch (for that log-in day)
XX = sample number

For example, 120101001-001 would be the first sample of the first batch of samples received on January 1, 2011.

Tracking

Samples are tracked by their individual log-in numbers. As testing is completed the LIMS is updated and the data archived.

Sample Custody and Legal Defensibility

Anatek Labs, Inc. routinely tests samples used as legal evidence. A primary consideration for the legal credibility of analytical data is the ability to demonstrate that samples were obtained, reached the laboratory and analyzed without improper alteration or contamination. Samples whose testing results may become evidentiary utilize Chain-of-Custody protocol where evidence of sample collection, shipment, laboratory receipt and laboratory custody until disposal are documented. Chain-of-Custody forms document how physical custody of a particular sample is maintained, how custody is transferred and the identity of individuals responsible for sample collection, shipping, receipt, analysis, storage and disposal. Chain-of-Custody protocol is not automatically initiated due to the accompaniment of a Chain-of-Custody form. In most instances, Chain-of-Custody forms function only as a sample receipt form and initiate normal, standard sample handling procedures. Formal Chain-of-Custody protocol must be initiated at the specific request of the sample submitter.

The Sample Custodian is responsible for receiving Chain-of-Custody linked samples. Upon receipt of these samples, the Sample Custodian immediately inspects the documentation and the samples to ensure the integrity of the sample shipping container, sample bottles, custody seals and cooler temperature upon receipt. Samples received in broken or leaking containers are noted on the Chain-of-Custody form and specific instructions for the lab are then requested of the submitter. If discrepancies between accompanying documentation and information on labels or sample containers exist, clarification is requested from the submitting party in writing and a notation is placed on the Chain-of-Custody form explaining the discrepancy.

After receipt in the laboratory, samples are logged into the internal tracking system. Samples are stored in appropriate refrigerators according to matrix until analyzed. After analysis samples are stored for up to six weeks in designated areas in the walk-in refrigerator.

Collection

All samples should be collected using standard field sampling techniques. The sample container should be labeled with the following information:

1. Date and time of collection
2. Source of sample
3. Preservative used (if any)
4. Name of person collecting sample
5. Sample ID and project name

When appropriate, the container should be sealed so that it cannot be opened without disrupting the seal. Gummed tape or another type of sealant is recommended. The person collecting the sample should date and initial the seal, particularly across the junction of the tape to ensure a tamper-proof seal.

Pertinent data concerning each sample should be entered into a field log book. This information may be used to refresh the memory in the event that the collector is summoned as a witness.

The sample should be kept in the custody of the collector or a designated custodian. A sample is in a person's custody if:

1. It is in one's physical possession, or
2. It is in one's view after being in one's physical possession, or
3. It has been placed into a locked area to which the custodian retains the key.

Calibration Procedures and Frequency

All equipment and instruments used at Anatek Labs, Inc. are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Personnel who have been properly trained in these procedures perform operation and calibration. Documentation of calibration information is maintained in data archives (see SOP ALI-14, Data Archiving) or Instrument Activity Logs (IALs). Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below. More information is contained in laboratory SOPs.

Temperature Control Devices

Temperatures are monitored and recorded for all of our temperature-regulating devices including ovens, incubators and refrigerators when in use. Record files are kept which contain recorded temperatures, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. All thermometers are checked annually against a National Institute of Standards and Technology (NIST) certified thermometer.

Analytical Balances

Analytical balances are serviced on an annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on an annual basis. The calibration of each analytical balance is checked daily with Class S or S-1 weights. As needed, the balances are recalibrated using the manufacturer's recommended operating procedures. Records are kept that contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks.

Water Purification System

There are a variety of water purification systems used at Anatek Labs, Inc. A filtration system is in place to provide deionized water throughout the Laboratory. The system is monitored and provides a purity of at least 1 MΩ (up to approximately 18 MΩ). When purity falls below 1 MΩ, the system is serviced by Culligan (Moscow) or King Soft Water (Spokane) and new filters are installed. Additionally there is a filter system that provides 18 MΩ purity water. The specifications, preventative maintenance schedules and other information for particular water purification systems are explained in detail in the applicable Standard Operating Procedure.

Analytical Instrumentation

Each instrument utilized at Anatek Labs, Inc. is calibrated against traceable standards. Standard Operating Procedures are used to document the procedure for ensuring traceability of stock reference materials. Standard Operating Procedures also specify specific instrument settings, calibration concentrations and frequency, instrument linear ranges, specific required QA/QC measures and a number of other related technical issues.

Services and Supplies

Anatek Labs, Inc. purchases services and supplies from reputable vendors, and ensures that supplies meet or exceed standards established in the analytical methods.

Analytical Procedures

Analytical Standard Operating Procedures are based upon methods appearing in a variety of publications. Most commonly, procedures are adopted from EPA publications, "Methods and Guidance for Analysis of Water," "Test Methods for Evaluating Solid Waste: SW-846" 3rd edition, or "Standard Methods for the Examination of Water and Wastewater" 21st edition. Refer to the Appendices for a listing of the test procedures utilized at Anatek Labs, Inc.

Data Generation – Data Reduction, Validation and Reporting

Data Reduction

Test results are calculated manually and electronically as specified in the method-specific SOP and SOP ALI-05. Formulae are contained in the manual testing procedures and algorithms are contained in software controlled procedures. All data and calculations are verified by the analyst and posted to summary reports or the computer system for review by the Laboratory Manager.

Uncertainty of Measurement

Anatek Labs attempts, when possible, to identify all the components of measurement uncertainty, and estimate uncertainty of measurements. For most analyses, this is accomplished by following well-recognized and established test methods, and meeting method and SOP-specified quality control measures (blanks, CCVs, matrix spikes, etc.) To reduce the uncertainty of measurement, results are generally not reported below the lower limit of quantitation or above the upper limit of quantitation. If results outside these ranges must be reported, qualifiers, flags, or explanations are used to identify the increased quantitative uncertainty.

Verification / Validation

Some procedures utilize additional visual confirmation and validation of values obtained electronically in the form of strip charts or other printouts. Where possible verification is made using interrelated analytes, i.e., the concentration of one analyte theoretically cannot exceed the concentration of another. Validation in gas chromatography is accomplished through the use of two dissimilar columns or the use of one or more compound specific detectors.

Data quality indicators such as blank results, duplicate reproducibility (precision), matrix spike and quality control sample recoveries (accuracy), and known sample or project histories are checked to verify result validity. Refer to the individual method SOPs for acceptability criteria.

Timely Reporting

Samples are typically tested consecutively as received unless holding times or special arrangements require expedited testing schedules. All testing is scheduled so that accepted holding times can be met.

Reporting Results

The analyst generating the test results posts them to manual worksheets, the computer tracking system, and/or summary reports depending upon the analysis. A final report is generated after all testing for a particular sample is completed and the Laboratory Manager reviews, signs, and dates the reports for distribution to the customer and any regulatory agency requiring copies.

Notification of MCL Violations

If analysis of a drinking water sample indicates nitrate, coliform or E. coli results in excess of Maximum Contaminant Levels (MCLs), the client and the appropriate regulatory agency or agencies shall be notified with 48 hours of the end of the analytical run. For other results exceeding the MCL, notification shall take place within 24 hours or the next business day after validation of the sample result. This notification may be by phone, fax, or e-mail, depending upon the requirements of the regulatory agency.

Internal Quality Control

An Internal Quality Control program has been designed to ensure systematic in-house production of high quality analytical data. The objectives of this program are:

1. To provide a measure of the precision of analytical methods;

2. To maintain a continuing assessment of the accuracy, precision and completeness of individual analyses performed in the laboratory;
3. To identify methods that are weak and provide a source of research problems to overcome these deficiencies and weaknesses;
4. To detect training needs within the analytical group;
5. To provide a permanent record of instrument performance as a basis for validating data and projecting repair and replacement needs;
6. To upgrade the overall quality of laboratory performance.

Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability or random error in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: ***repeatability*** – the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions and, ***reproducibility*** - the random error associated with measurements made by different test operators in different laboratories, using the same method but different equipment to analyze identical samples of test material. At Anatek Labs, Inc. our "within batch" precision is measured through the use of replicate samples of QC analyses and is expressed as the relative percent difference (RPD) between replicate measurements. The "Batch to Batch" precision is calculated from the variance observed in results from analysis of standard solutions of laboratory control samples from multiple analytical batches.

Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of standard reference materials, standard solutions, and laboratory-fortified blanks. In addition, laboratory-fortified (matrix spike) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (%Rec.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Anatek Labs, Inc. utilizes several quality control samples and independent calibration verification standards. Because bias can be positive or negative and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For the purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. Anatek Labs, Inc.'s objective for completeness is 100%.

The specific types, frequencies and processes for quality control sample analysis are described in detail in method-specific standard operating procedures. These sample types and frequencies are described below. In addition, a number of other quality control processes that may impact analytical results are also described below.

Standard Operating Procedures (SOPs) and Laboratory Notebooks

Anatek Labs, Inc. maintains a database of SOPs for use in both technical and administrative functions. SOPs are written following the format and content requirements described in the SOP for preparation of SOPs (ALI-01). Each SOP has been reviewed and approved by a minimum of two authorities, the Laboratory Manager and the QA Officer. All SOPs undergo a documented annual review to make sure current practices are described. The QA Officer maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently prepared version of SOP is being used for guidance and instruction. The QA Manual, SOPs, standards preparation logbooks, run logbooks, etc., are all considered crucial to consistent operations at Anatek Labs, Inc. and all analysts are instructed on the proper usage of each. Anatek Labs, Inc. maintains a current file, accessible to all laboratory staff, of the promulgated methodology used to perform analyses as well as this QA Plan and applicable Standard Operating Procedures. (For specific IAL procedures refer to SOP ALI-15.)

Deviation from Standard Operating Procedures

Anatek Labs, Inc. recognizes that occasionally a modification to a Standard Operating Procedure may be necessary. In such cases, a written record of the deviation is retained with the sample data and if the deviation affects the data integrity an appropriate data qualifier comment is noted on the analytical report. An example of this would include a special preparative step or procedure not normally performed but perhaps mandated by special matrix concerns.

Modified Procedures

Anatek Labs, Inc. strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that Anatek Labs, Inc. has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples, are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

1. The number of (field) samples in a batch is not to exceed that specified in the Standard Operating Procedure for the procedure being employed.
2. All (field) samples in a batch are typically of the same matrix.
3. The QC samples to be processed with the (field) samples typically include:
    a. Method Blank (aka Laboratory Reagent Blank)
    Function: Determination of Laboratory contamination
    b. Laboratory Control Sample (aka Laboratory Fortified Blank)
    Function: Assessment of method performance
    c. Matrix Spiked (field) Sample-when sufficient sample is supplied (aka Laboratory Fortified Sample Matrix)
    Function: Assessment of matrix problems
    d. Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample – when sufficient sample is supplied (aka Laboratory Duplicate)
    Function: Assessment of batch precision
4. A single lot of reagents is used to process the batch of samples.
5. Each operation within the analysis is performed by a single analyst/technician/chemist or by a team of analysts/technicians/chemists.
6. (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic compounds, it begins when the samples are extracted.
7. The QC samples are to be analyzed in conjunction with the associated field samples prepared with them.
8. Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.
9. Specific project, program or method SOP requirements may be exceptions to these definitions. If project, program or method SOP requirements are more stringent than these laboratory minimum requirements, then the project, program or method SOP requirements will take precedence.

Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is either analyte-free water or analyte-free soil (when available), subjected to the entire analytical process. When analyte-free soil is not available, anhydrous sodium sulfate, organic-free sand or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Reporting Limit (MRL) or, if required, less than the Method Detection Limit (MDL) for the analyte(s) being tested, otherwise,

corrective action must be taken. At least one method blank is included with the analysis of every analytical batch as stated in the method Standard Operating Procedure.

Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve.

Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of analyte-free water, reagent, or solvents that are analyzed in order to verify the system is contamination-free when continuing calibration standards are analyzed. The frequency of CCB analysis is either once every ten (10) samples or as indicated by the method, whichever is greater.

Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions that are, in turn, prepared from stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used. Refer to Anatek Labs, Inc. SOP ALI-08 for policies regarding standards.

Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed after calibration with newly-prepared standard(s) but prior to sample analysis, in order to verify the validity of the standards used in the calibration. Once it is determined that there is no systematic error in preparation of the calibration standard(s), they are considered valid standards and may be used for subsequent calibrations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards. ICVs are also analyzed in accordance with method-specific requirements.

Continuing Calibration Verification Standards (CCV)

Continuing Calibration Verification Standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is indicated in the method Standard Operating Procedure.

Internal Standards

Internal Standards consist of known amounts of specific compounds that are added to each sample following sample preparation or extraction. Internal standards are generally used for procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects. The integrated area of the internal standard compared to the continuing calibration check standard should vary by no more than the limits specified in each method.

Surrogates

Surrogates are organic compounds that are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards and samples (including duplicate, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate and recovery is a measurement of the overall method performance. The percent recovery must meet the limits set forth in the SOP or determined from control charting.

Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are field samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch in exactly the same manner as

routine samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

Percent Recovery = ((S – A) x 100) / T

Where:
S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

Matrix spiked samples are prepared and analyzed at the levels and frequency noted in the Standard Operating Procedure for the particular analysis.

Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate sample aliquot or a matrix spiked sample and duplicate matrix spiked sample (MS/MSD) are analyzed. The relative percent difference between duplicate analyses or between an MS and MSD is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

Relative Percent Difference = (S1 – S2) x 100 / S_{avg}

Where S1 and S2 = the observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and S_{avg} = the average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Duplicates or MS/MSD analyses are performed at the level and frequency outlined in the Standard Operating Procedure for the analysis being performed.

Duplicates or MS/MSD's are selected on the basis of volume or matrix. Samples with enough volume are selected unless a matrix problem is suspected in which case a sample with enough volume and an appropriate matrix is selected.

Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks or Quality Control Samples)

The laboratory control sample (LCS) is an aliquot of analyte-free matrix to which known amounts of the target analyte(s) is (are) added. A standard reference material of known matrix type, containing certified amounts of target analytes, may also be used as a LCS. The LCS sample is prepared and analyzed in the same analytical batch and in exactly the same manner as the other routine samples. Stock solutions used for LCS's are purchased or prepared independently of calibration standards. The percent recovery (%Rec) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. Acceptance criteria for LCS analyses are obtained through the use of control charts. A LCS is prepared and analyzed at a minimum frequency specified in the Standard Operating Procedure for the specific method being employed. If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, occasionally a duplicate LCS will be prepared and analyzed.

Interference Check Samples

An interference check sample (ICS) is a solution containing interfering elements of known concentration that can be analyzed to verify background and inter-element correction factors in metals analyses.

Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum

concentration above the instrument detection limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

Source and Preparation of Standard Reference Materials

All analytical measurements generated at Anatek Labs, Inc. are performed using materials and/or processes that are traceable to a Standard Reference Material. Standard Operating Procedures are utilized to trace all quantitative and qualitative determinations to certified reference materials. All metrology equipment (analytical balances, thermometers, etc.) is calibrated using materials traceable to the National Institute of Standards and Technology (NIST) and maintained on a schedule to ensure accuracy.

All Sampling containers provided to the client by the laboratory are assured to be free of interfering contaminants by:

1. The container is purchased as pre-cleaned (Level 1) with certificates of analysis available for each bottle type; or
2. The container is cleaned by the laboratory using Standard Operating Procedures; or
3. The specific bottle type and manufacturer has been proven through study to be free of interfering materials; and/or
4. A blank is prepared with a surrogate bottle using laboratory reagent water at the time of sample collection to provide information on possible interferences or contamination resulting from the sample container.

Consumable materials routinely purchased by the laboratory (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. Consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem. Services, Inc., Absolute Standards, Aldrich Chemical Co., J.T. Baker, Spex, E.M. Science, Fisher Scientific, etc. are examples of the vendors used by Anatek Labs, Inc. All reference materials that are received are recorded by the technical staff in the appropriate logbook(s) and are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e., vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. In addition, the date that the standard is received in the laboratory is marked on the container. When the material container is opened for use the first time, the date of opening is recorded on the container. Stock solutions and/or calibration standard solutions are prepared fresh as often as necessary according to Standard Operating Procedures. After preparation, all standard solutions are properly labeled as to analyte concentration, solvent, date, preparatory analyst and expiration date; these entries are also recorded in the appropriate logbook(s). Prior to introduction into the analytical system / process, all in-house prepared reference materials are verified with a second, independent source of the material. Once the reference material has been verified to be accurate, it may then be used for instrument calibration and subsequent quantitative purposes. In addition, an independent source of reference material is also used to check the calibration standards for signs of deterioration (i.e., Control or QC samples).

Method Detection Limits

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Method detection limits are determined for most analyses performed at Anatek Labs, Inc. Refer to Appendix I for specific information on the development of MDLs.

Control Charting

The generation of control charts is routinely performed at Anatek Labs, Inc. Refer to Appendix H for specific information on the generation and use of control charts.

Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at Anatek Labs, Inc. undergoes a rigorous cleansing procedure prior to every usage. Refer to SOP ALI-03 and method specific SOPs for specific glassware cleaning procedures.

Temperature Record Keeping

A number of recording devices (thermometers) are utilized to track the acceptable performance of a number of crucial instruments. The following are instruments that are documented daily (during operations) and the associated acceptable average temperature limits:

Sample Archive	$0 – 4^0C$
Drinking Water Storage	$0 – 6^0C$
Drinking Water VOC Storage	$0 – 6^0C$
Non Drinking Water Storage	$0 – 6^0C$
Waste Water VOC Storage	$0 – 6^0C$

Balance Audit

Verification of balance accuracy is essential for providing accurate mass determinations. All balances are checked daily with Class S weights. Accuracy of measurement must be 99.9% or better. If determinations are outside the acceptance range, corrective actions are taken. Out of specification balances are removed from service until maintenance can be completed. The result of this determination is kept in the Daily Maintenance Log.

Policy on Manual Integration

Automated integration data reduction software currently available is generally accurate when performing peak integration. However, instances occur where the instrument software does not yield the proper integration and the analytical data is inaccurate. Some examples include, but are not limited to, peak splitting, coeluting interferences, peak detection failure, peak tailing, and failure to separate peaks. Accurate measurements require an analyst to review peak integration and evaluate if adjustments need to be made.

Manual integration is never appropriate when performed solely for the purpose of meeting method QC criteria or compliance requirements, avoiding rework or instrument maintenance. Inappropriate manual integrations include peak shaving, peak enhancement, and baseline manipulation.

Violation of this policy is subject to disciplinary action up to and including termination of employment.

Integration Procedure and Review

All data are generated and reduced following the procedures specified in the methods and/or SOPs. Chromatograms are evaluated for chromatography performance criteria, including:

Baseline noise (3 to 1 signal to noise ratio)
Peak resolution
Peak tailing (good column performance should produce symmetrical peaks with minimum tailing for most compounds)
Peak splitting
Co-elutions
Negative spikes in baselines

Corrective action must be taken when the chromatography has deteriorated. Corrective actions include:

Trimming head of column
Guard column replacement
Cleaning detectors and/or ion source
Cleaning injector ports, replacing ferrule, liner, gold seal or washer
Identifying leaks
Replacing the column
Changing trap
Change suppressor
Change eluent

Change regenerant for IC systems

The analyst must review all automatic integrations for all parameters in the method. This review must include:

Relative retention time/retention time shifts
Identification of peaks
Mass spectrum primary ion abundance – secondary ions maximize within one scan of primary ion (for GC/MS analyses)
Peak shape
Interference
Consistency
Verification that baseline is clearly visible
Inspection of auto and manual integration for proper technique and necessity of manual integration

When auto integration is determined to be incorrect (for example, peak splitting, coeluting interferences, peak detection failure, peak tailing, and failure to separate peaks), the peak(s) must be manual integrated to correct the area response. Integration must be consistent throughout the analytical run for samples, QC samples, blanks, and calibration standards.

Quality control will include reviewing chromatograms and verifying that manual integrations, when performed, are appropriate and analytically sound.

System and Performance Audits

Laboratory Evaluations and Audits are to be conducted under the authorization of the QA Committee and all findings and recommendations are submitted to the QA Committee for decisive action. System Audit requests are generated internally and externally. Internal audits are generally scheduled at the frequency noted under the type of review, however concerns brought to the attention of the QA Committee may necessitate an unscheduled systemic review at the discretion of the QA Committee. External audit requests are referred to the QA Committee for authorization and scheduling of external auditors to review systems.

The following evaluations are performed at Anatek Labs, Inc.:

Management System Reviews (MSRs)

MSRs are external audits conducted at Anatek Labs, Inc. Idaho Dept. of Health Bureau of Laboratories audits Anatek Labs, Inc. to assess the adequacy of the overall QA Plan. FL DOH (for NELAP) and ID Bureau of Laboratories perform rigorous on-site inspections of Anatek Labs, Inc.'s QA Plan, adequacy of facilities, Quality Control Records, Performance Evaluations, Standard Operating Procedures and Analyst abilities, and submit audit reports to Anatek Labs, Inc. These reports and any corrective actions plans are maintained at Anatek Labs, Inc. Washington Department of Ecology does a complete inspection as well for WA Waste Water Certification. Anatek Labs, Inc. also makes the facilities available for customer or regulatory agency inspection of Management Systems as well. Anatek Labs, Inc.'s QA Committee reviews all MSR reports and recommendations. If reports indicate the necessity for corrective action, the QA Committee or its designee will prepare and implement a Corrective Action Plan. The Corrective Action Plan will itemize the specific action necessary to correct the deficiency and define the time frames and responsible parties for implementation and follow-up.

Technical System Audits (TSAs)

TSAs are both internal and external audits conducted at Anatek Labs, Inc. Florida Dept. of Health (NELAP), Idaho Dept. of Health and WA Dept. of Ecology evaluate Anatek Labs, Inc.'s technical systems. The above listed agencies review calibration records, sampling and measurement procedures, general lab cleanliness, support systems, equipment and facilities, maintenance and repair records, control charts and general operation of the lab. The inspecting agencies prepare audit reports to Anatek Labs, Inc. and these reports and all responses and corrective action plans are maintained at Anatek Labs, Inc. Additionally, Anatek Labs, Inc. staff performs internal TSAs annually. The QA Officer performs an annual inspection of Standard Operating Procedures, quality systems, calibration and maintenance records, and employee training records. TSA audit reports are prepared by the external

auditor or QA Officer and given to the QA Committee or the analyst as appropriate (reference SOP ALI-16). If a report indicates the necessity for corrective action a Corrective Action Plan will be prepared and implemented according to SOP ALI-07. The Corrective Action Plan will itemize the specific action necessary to correct the deficiency and define the time frames and responsible parties for implementation and follow-up. The results from all corrective action plans will be compiled and forwarded to management and/or the QA Committee as necessary.

Performance Evaluation (PE)

PE's are performed according to regulatory requirements for NELAP and the various testing regimens employed at Anatek Labs, Inc. Anatek Labs, Inc. participates in at least two Water Supply (WS), two Water Pollution (WP) and two solids/soils (RCRA) Performance Evaluations annually. All PE Sample materials are procured from a NIST/NVLAP approved provider. Acceptable results for each analyte and method used to perform regulatory testing are demonstrated semi-annually. In the event that an unacceptable result is received for a particular analyte, corrective actions are employed. Blind studies may be initiated by the lab to verify performance. Additionally double-blind studies may be conducted at Anatek Labs, Inc. when initiated by customers.

Data Quality Audits (DQAs)

Peer review of acceptable blank results, QA/QC sample recovery, matrix spike and matrix spike duplicate recoveries, reproducibility of duplicate samples, and verification of sample calculations are performed on approximately 10% of analytical batches. Any errors or deviations from acceptable criteria are noted and data is returned to the generating analyst for correction. In the event that QA/QC criteria for a particular sample or batch of samples cannot be met, all associated sample reports are noted that QA/QC criteria were not met and may include other relevant discussions. If numerous problems are found with a particular method or analyst, more data packets will be reviewed.

IT Systems Auditing

IT Systems Auditing of Anatek Labs, Inc. is conducted both internally and externally. The external auditing is conducted by IDOH, WA DOE and FL DOH. The agencies review Anatek Labs, Inc.'s IT SOPs, IT documentation, access security and backup/restore plans during their inspections. Internal audits are performed at least once a year by Anatek Labs, Inc.'s QAU with assistance from IT personnel. The internal audits will inspect the network security, network throughput performance, server storage available, backup/restore plan testing and general documentation of the IT systems. An IT systems auditing report is prepared by the external auditor or QA Officer and given to the QA Committee. If a report indicates that corrective actions are necessary, a Corrective Action Plan will be prepare and implemented by IT personnel. The Corrective Action Plan shall specifically address the areas of deficiency and the actions to be taken.

Corrective Action

Corrective Action is a function of the laboratory as a whole and is dependent on the nature of the problem. In general, corrective action may take several forms. Corrective action due to a performance or system audit report is initiated by the QA Committee and will result in a formal Corrective Active Plan. The QA Officer, Laboratory Manager, laboratory analyst or external customer may also initiate corrective actions.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with an appropriate data qualifier. Failure to meet established analytical controls prompts corrective action. Corrective action may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the Laboratory Manager, area supervisors, or the QA Officer may examine and pursue alternative solutions. Resumption of work subsequent to extensive corrective action (i.e., outside the scope of the method or SOP) shall be determined by the Lab Manager or area supervisor. In addition, an assessment will be made in order to ascertain if contact with the client is necessary.

Customer complaints will be directed to the Laboratory Manager, QA Manager, and/or section supervisors. Every reasonable effort should be made to address (and correct, if necessary) customer complaints. If the lab is found to be at fault, a corrective action form should be initiated and completed.

Preventative Action

Anatek Labs, Inc. and its personnel always strive to improve the laboratory procedures, including analysis, record-keeping, and customer service. Preventative action is a proactive process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints. When improvement opportunities or preventative actions are identified, action plans will be developed, implemented, and evaluated for effectiveness.

Training & Personnel Qualifications

All personnel involved in any function affecting data quality will have sufficient training and technical expertise to effectively execute their job requirements. The laboratory evaluates all prospective job applicants for scientific knowledge and experience as noted in the job descriptions for the position considered.

In addition to prior work and educational experience, Anatek Labs, Inc. actively encourages its employees to expand and refine their job skills and knowledge through participation in a variety of educational programs. Time off is granted to attend seminars and training sessions put on by instrument manufacturers, regulatory agencies, professional business and scientific organizations, etc. Additionally Anatek Labs, Inc. conducts in-house training on related topics. Anatek Labs, Inc. also encourages continuing education through a tuition reimbursement program.

A record of specialized training received by or given by the staff is kept in the Personnel Training folders.

Subcontracting of Laboratory Services

Analytical services may be subcontracted when the requested analyses are not performed by Anatek Labs, Inc. Further, subcontracting of laboratory services is done only with the knowledge and approval of the client.

The acceptability of subcontracting laboratories is assessed using the following criteria:

1. The subcontracting laboratory is certified for the analysis requested if results are for regulatory purposes;
2. The subcontracting laboratory has an approved/audited Quality Assurance Plan or in the absence of an audit, the subcontracting laboratory has an established reputation for providing quality services;
3. The subcontracting laboratory agrees to perform and provide specific Quality Control measures outlined by the project manager or sample submitter;
4. The subcontracting laboratory agrees to retain records for a period of time no less than outlined by the project manager or sample submitter.

Preventive Maintenance

Preventive maintenance is a crucial element of Anatek Labs, Inc.'s Quality Assurance program. Qualified in-house personnel maintain instruments, such as GC/MS systems, spectrometers, analytical balances and gas and liquid chromatographs. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument activity logbooks (IALs). The IALs contain extensive information about the instruments used at the laboratory.

When an instrument is acquired at the laboratory, the following information is noted in a maintenance notebook specifically associated with the new equipment:

1. The equipment's serial number;
2. Date the equipment was received;
3. Date the equipment was placed into service;
4. Condition of equipment when received (new, used, reconditioned, etc.); and
5. Prior history of damage, malfunctions, modification or repair (if known).

Preventative maintenance procedures, frequencies, etc. are available for each instrument. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase. Responsibility for ensuring that routine maintenance is performed lies with the Laboratory Manager. The Laboratory Manager may perform the maintenance, assign the maintenance task to a qualified bench level analyst or acquire on-site manufacturer repair.

When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem (attempted repairs, etc.) is also recorded in the IAL. Typical logbook entries include the following information:

1. Details and symptoms of the problem;
2. Repairs and/or maintenance performed;
3. Description and/or part number of replaced parts;
4. Source(s) of the replaced parts; and/or
5. The analyst's initials and date.

Waste Disposal

All samples received at Anatek Labs, Inc. remain in the ownership of the submitting party. Unless analysis of the samples demonstrates hazardous/regulated levels of contaminants, liquid samples are routinely disposed of by disposal in the sanitary sewer after adjustment to a pH specified by the local wastewater treatment facility. Solid samples are disposed of using the solid waste sanitation services. Samples demonstrated to be inappropriate (hazardous) to be disposed of by routine means are returned to the client for disposal/treatment at the original sampling location or retained in a manner consistent with mineral acid, solvent or other hazardous materials storage and disposal activities within Anatek Labs, Inc.

All mineral acids, solvents and other hazardous materials used in the daily operation of the laboratory are collected in designated areas until sufficient material is collected for cost-effective disposal at a licensed disposal facility.

Quality Document Control

All Standard Operating Procedures and Quality Assurance Plans are maintained under the control of the QA Officer. The QA Officer is responsible for maintaining all official/authorized versions of all Standard Operating Procedures and Quality Assurance Plans. The official, master version of each Standard Operating Procedure is maintained by the QA Officer. Copies of SOPs are available to analysts and other personnel via PDF links on each computer workstation. This QA Plan is maintained in the possession of the QA Officer and a copy is distributed to the Laboratory Manager. All original signatures are maintained on the QA Officer's master copy. Any copies or versions of these documents that are distributed outside the laboratory will not be controlled and updated during annual reviews.

All instrument activity log books and manuals are maintained by the analysts with the equipment. IALs are periodically inspected by the QA Officer to ensure compliance with standard operating procedures (refer to ALI-15). When full, IALs are archived and retired with the piece of equipment.

Analytical and support records, both electronic and hard-copy, are retained in accordance with Anatek Labs data archiving SOPs.

Termination or Transfer of Business

In the event Anatek Labs goes out of business or ownership is transferred, available clients will be contacted, and customer records will be dealt with according to client instructions and state and regulatory requirements. For those clients who cannot be contacted, customer records will be destroyed in the event the lab goes out of business or transferred in the case of new ownership.

Anatek Labs, Inc.

Quality Assurance Plan
Tables, Figures & Appendices

Items below are linked – click on a heading to proceed to that section

Tables .....

1a Analytical Equipment Utilized at Anatek Labs, Moscow .....
1b Analytical Equipment Utilized at Anatek, Labs, Spokane .....
2 Summary of Analytical Parameters, Method, Sample Containers, Preservation Methods, Holding Times and Estimated Working time .....

Figures .....

1 Anatek Labs, Moscow Organizational Chart .....
2 Anatek Labs, Moscow Personnel .....
3 Anatek Labs, Moscow Floor Plan .....
4 Anatek Labs, Spokane Organizational Chart .....
5 Anatek Labs, Spokane Personnel .....
6 Anatek Labs, Spokane Floor Plan .....

Appendices .....

A Index of Standard Operating Procedures .....
B Examples of Sample Submission Form .....
C Quick Reference for Chemical Safety .....
D Laboratory Staff Resumes / Qualifications .....
E Current State Certifications .....
F Backup, Fault Tolerance, Disaster Recovery and Data Archive of Mission-Critical Information Storage and Services .....
G Control Chart Information .....
H Method Detection Limit .....
I Calibration Methods and Equations .....
J Authorized Signatures .....

Tables

Tables 1a & 1b

Instrument Inventory

Table 1a

Anatek Moscow Equipment List

Type	*Description*	*Manufacturer*	*Model*
API-3000	TRIPLE QUAD MS/MS	PE SCIEX	API-3000
DISCRETE ANALYZER	Spectrophotometer	SYSSTEA	EASY CHEM PLUS
ECD1	GC SYSTEM	HP	HP6890
ECD2	GC SYSTEM	HP	HP6890
FIA	ANALYZER	OI ANALYTICAL	FS 3000
FID1	GC SYSTEM	HP	6890
FID2	GC SYSTEM	AGILENT	6890N
HPLC #2	PCX	PICKERING	PINNACLE PCX
	DIODE ARRAY DETECTOR	SHIMADZU	SPD M20A
	FLUORESCENCE DETECTOR	SHIMADZU	RF20A
ICP	ICP-OES	VARIAN	720-ES
ICP-MS	ICP-MS	AGILENT	G3155A
IC	COMPACT IC	METROHM	761
Mercury Analyzer	Hg Analyzer	CETAC	M8000
MSD2	MSD	AGILENT	5973N
	GC SYSTEM	AGILENT	6890N
OIL & GREASE	EXTRACTOR	HORIZON	3000
SATURN 2100	GC/MS	Varian	2100T
SEMIVOC	GC SYSTEM	AGILENT	6890
	MSD	AGILENT	5973N
VARIAN 1200	GC	VARIAN	CP-3800
	QUADRUPOLE MS/MS	VARIAN	1200
VARIAN 4000	MS/MS	VARIAN	4000
	GC SYSTEM	VARIAN	4000
VOC1	GC	Agilent	6890N
	MS	Agilent	5975

TABLE 1B

Anatek Labs Equipment List - Spokane

Type	Description	Manufacturer	Model
Autoclave		Market Forge Sterilmatic	STM-EL
Balances	410g ± 0.01g	Denver Instruments	XS-410
	160g ± 0.0001g	Denver Instruments	AB-160
	400g ± 0.01g	Denver Instruments	APX-402
	120g ± 0.0001g	Sartorius	SP1245
	120g ± 0.0001g	Mettler Toledo	ML104
Blenders		Osterizer	6706
		Proctor Silex	23005463657171R8
BOD	LBOD 101 Probe	Hach	HQ40d
	Meter	Hach	HQ40d
	Incubator	GCA/Precision Scientific	FREAS 818
BTU	Oxygen Bomb Calorimeter	Parr	1341EB
	Motor Assembly	Parr	A50MEB
Chlorine	Colorimeter	Hach	58700-00
Centrifuge		Fisher Scientific	225
COD	Digestor	HACH	
Coliform		IDEXX Quanti-tray 2X	89-10894-00
Conductivity	Meter	Hach	HQ40d
	Probe	Hach	
DI Water	18MΩ Ultra Analytic	Elga Pure Lab Ultra	
Drying Oven	TDS	Precision Scientific	25EM
	TSS	American Scientific	DX-58
	Radiological	MTI Corporation	WG-20
		VWR/Shel-lab	VWR-1320
	TVS/FDS/VSS	Thermolyne	F48055-60
FIA	Analyzer	Lachet	QUIKCHEM 8500
	Autosampler	Lachet	ASX-520
	Auto Dilutor	Lachet	PDS-200
	Pump	Lachet	RP-150
	TKN Digestor Block	Lachet	BD-46
	Cyanide Distillation System	Lachet	65454
GC/ECD	GC	Hewlett Packard	5890 SERIES II
	Autosampler	Hewlett Packard	7673
GC/ECD	GC	Hewlett Packard	5890 SERIES II PLUS
	Autosampler	Hewlett Packard	7673
GC/FID	GC	Hewlett Packard	5890 SERIES II
	Autosampler	Hewlett Packard	6890
GC/FID	GC	Hewlett Packard	6890 SERIES II
	Autosampler	Hewlett Packard	6890
GC/MS	Purge and Trap	Encon	ENCON EV
	Autosampler	Centurion	CENT272011509
	GC	Hewlett Packard	5890 SERIES II PLUS
	MS		
GC/MS	Purge and Trap	TEKMAR	3000
	Autosampler	Varian Archon	
	GC	Hewlett Packard	5890 SERIES II PLUS
	MS		

Type	Description	Manufacturer	Model
GC/PID/FID	Concentrator Purge and Trap	Hewlett Packard	4430
	Lamp Power Supply	Hewlett Packard	
	Autosampler	TEKMAR	ALS 2016
		TEKMAR	LSC 2000
Gross α and β counter	Windowless Gas Flow Proportional Counter	Protean Instrument	IPC650
Hoods		Genie Scientific	400SLBB
		Genie Scientific	400SLBB
		Kewaunee Scientific	
		LABCON	70198-90
		LABCON	70198-90
		Genie Scientific	500SLBB
IC	Compact IC	Metrohm Peak	761
	Autosampler	Metrohm Peak	788
ICPMS	ICPMS	Agilent	7500cx
	Autosampler	Agilent	ASX-500
	Recirculating Pump	Agilent	6106T / G3292A
Incubator		THERMOLYNE BLUE	B2730-Q
		THERMOLYNE	142325
Media Dispensor		TRITECH Research	POURBOY 4
N-Evap		Organimation	111
pH/Cyanide		Denver Instruments	225
	ATC	ATC	300729.1
	Probe	VWR	SYMPHONY
	Cyanide Probe	ORION	9406BN
	Cyanide Probe	ORION	900200
pH		Hach	HQ40d
	Probe	Hach	HQ40d
Pipettes	0.5-10	VWR EHP	
	0.5-10	VWR	
	10-100	VWR	
	10-100	Mettler Toledo VoluMate	
	20-200	VWR EHP	
	20-200	VWR EHP	
	100-1000	Drummond	
	100-1000	Drummond	
	100-1000	VWR	
	100-1000	Mettler Toledo VoluMate	
	100-1000	Mettler Toledo VoluMate	
	100-1000	Mettler Toledo VoluMate	
	100-1000	Mettler Toledo VoluMate	
	100-1000	Mettler Toledo VoluMate	
	100-1000	Eppendorf Reference	
	500-5000	Mettler Toledo VoluMate	
	1000-5000	VWR EHP	
	1000-5000	VWR	
	1000-10000	VWR	
	1000-10000	VWR	
Refrigerators	WET CHEM FRIDGE 1	Kenmore	253.60722000
	524 FRIGDE		
	VOC FRIDGE	Kenmore	253.60722004
	VOC FREEZER	Kenmore	253.24202102
	STANDARDS FRIDGE	Kenmore	253.60722004
	WET CHEM FRIDGE 2	Kenmore	253.60722007
	ICE PACK FREEZER	Kenmore	WB15021458
	WALK IN REFRIGERATOR		

Type	Description	Manufacturer	Model
Salmonella		SEWARD STOMACHER	400
Sonicator		VIBRA CELL SONICS MATERIALS	VC375
		Branson 2510 Ultrasonic	2510R-MT
Spectrophotometer	Analyzer	HACH	DR/3000
Stirplates		isotemp - Fisher Scientific	
		VWR-Thermolyne Corp	320
		Nuora II Stirrer	SI8525
		SH-3 Stirring/Hot Plate	
		Fischer Scientific Stirrer	
		VWR 375 Stirring/Hot Plate	
Thermometer	Infra Red K	VWR	RS232
TOC		DOHRMANN PHOENIX	8000
TOX	Analyzer	MITSUBISHI MCI MICROCOULOMETER	
	Sample Preparator		TOX-10-A
Turbidimeter		HACH	2100AN
		WTW	TURB355IR
Turbovap II		Zymark	47570/0
UV Light		Spectroline	EA160
Vacuum Pump		GAST	M100GX
Vortexer		Fisher Scientific	12810-1
		VWR	
Waterbath		VWR	1275 PC
Weights	10mg-100g weight set	TROMNER	SN 19151
	10mg weight	Mettler Toledo	11123047

Table 2

Summary of Analytical Parameters, Method, Sample Containers, Preservation Methods, Holding Times and Estimated Working time

Drinking Water (Private and Public) Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
BACTERIOLOGICAL TESTING						
Coliform Presence/Absence	SM 9223B-PA	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	3 working days	Water
Coliform P/A as Count	SM 9223B-PA (Quanti-tray)	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	3 working days	Water
Heterotrophic Plate Counts (HPC)	IDEXX Simplate SM 9251B	Sterile 125 mL HDPE	Sodium Thiosulfate	n/a	7 working days	Water
Iron Bacteria	SM 9240B	125 mL HDPE	n/a	30 hours	7 working days	Water
WA Surface Water Fecal Coliform	SM 9221 E	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
E. coli enumeration	SM 9223B-PA (Quanti-tray)	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
DISINFECTION BY-PRODUCTS						
Total Trihalomethanes (Total THM)	EPA 524.2	3 x 40 mL amber vial	4 mg NH4CL	14 days	10 working days	Water
Trihalomethanes (THMP)	EPA 524.2	3 x 40 mL amber vial	n/a	14 days	10 working days	Water
Haloacetic Acids	SM 6251B	3 x 40 mL amber vial	4 mg NH4CL	14 days	15 working days	Water
Total Organic Carbon (TOC)	SM 5310C	2 x 40 mL amber vial	H2SO4 pH<2	14 days	10 working days	Water
IOC TESTING						
Lead & Copper (Pb/Cu) Rule	EPA 200.8	1 L HDPE	HNO3 Lab Preserves	6 months	10 working days	Water
Anions Nitrate/N, Nitrite/N	EPA 300.0 / SM 4500 NO3F	125 mL HDPE	n/a	48 hours	10 working days	Water
Anions Sulfate, Fluoride, or Chloride	EPA 300.0	125 mL HDPE	n/a	28 days	10 working days	Water
Alkalinity	SM 2320B / EPA 310.1	125 mL HDPE	n/a	14 days	10 working days	Water
Ammonia	SM 4500 NH3	250 mL HDPE	H2SO4 pH<2	28 days	10 working days	Water
Anionic Surfactants	SM 5540 C	250 mL HDPE	n/a	ASAP	10 working days	Water
Chlorine - Total Residual	SM 4500Cl-F	40 mL amber vial	n/a	ASAP	10 working days	Water
Color	SM 2120 B	125 mL HDPE	n/a	ASAP	10 working days	Water
Conductivity	SM 2510 A / EPA 120.1	125 mL HDPE	n/a	ASAP	10 working days	Water
Cyanide	SM 4500-CN E	250 mL HDPE	NaOH pH > 12	ASAP	10 working days	Water
Hardness	SM 2340 B / EPA 200.8	125 mL HDPE	n/a	ASAP	10 working days	Water
Hydrogen Sulfide	SM 4500-S2 F	1 L HDPE	1 Tablet NaOH/L	ASAP	10 working days	Water
Iron	EPA 200.8	125 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
Corrosivity - Langlier	various	1 L HDPE	n/a	ASAP	10 working days	Water
Mercury by CVAA	EPA 245.1	I L HDPE	HNO3 pH < 2	6 months	10 working days	Water
Metals (single metals)	EPA 200.7 / 200.8	125 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
Odor	SM 2150 B	1 L HDPE	n/a	ASAP	10 working days	Water
pH	SM 4500 H / EPA 150.1	125 mL HDPE	n/a	ASAP	10 working days	Water
Silica/Silicon - Dissolved Only	EPA 200.8	125 mL HDPE	n/a	6 months	10 working days	Water
Surfactants	SM 5540 C	1 L amber glass	n/a	14 days	10 working days	Water
TDS	SM 2540 C / EPA 160.1	250 mL HDPE	n/a	7 days	10 working days	Water
Turbidity	SM 2130 B / EPA 180.1	125 mL HDPE	n/a	48 hours	10 working days	Water
Washington Complete IOC	various	2 x 1 L HDPE	NaOH for CN in 1L	48 hours	10 working days	Water
Idaho Complete IOC	various	1 L HDPE	n/a	48 hours	10 working days	Water
Arsenic & Sodium	EPA 200.8 / SM 3111B	125 mL HDPE	n/a	6 months	10 working days	Water
Fluoride	EPA 300.0	125 mL HDPE	n/a	28 days	10 working days	Water
Nitrate	EPA 300.0 / SM 4500 NO3F	125 mL HDPE	n/a	48 hours	10 working days	Water
Nitrate/Nitrite	EPA 300.0 / SM 4500 NO3F	125 mL HDPE	n/a	48 hours	10 working days	Water

Drinking Water (Private and Public) Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Phase II IOC metals	EPA 200.8 / SM 3111B	1 L HDPE	n/a	28 days	10 working days	Water
Phase V IOC	various	1 L HDPE	n/a	6 months	10 working days	Water
Idaho Primary IOC package with cyanide waiver	various	I L HDPE	n/a	28 days	10 working days	Water
Idaho Secondary/Optional IOC package	various	1 L HDPE	n/a	ASAP	10 working days	Water
PRIVATE RESIDENCE TESTING						
Coliform Bacteria	SM 9223B-PA	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	3 working days	Water
Iron Bacteria Presence/Absence	SM 9240B	125 mL HDPE	n/a	30 hours	7 working days	Water
Nitrate	EPA 300.0	125 mL HDPE	n/a	36 hours	7 working days	Water
Fluoride	EPA 300.0	125 mL HDPE	n/a	7 days	7 working days	Water
Private Well List	various	125 mL HDPE	n/a	36 hours	7 working days	Water
Synthetic Organic (SOC) Screen	EPA 525.2	2 x 1 L amber glass	50 mg Sodium Sulfate	14 days	15 working days	Water
Private Herbicide	EPA 515.3	250 mL amber glass	Sodium Thiosulfate	14 days	15 working days	Water
Private Volatiles (VOC)	EPA 524.2	3 x 40 mL amber vial	HCl pH<2	14 days	15 working days	Water
Lead in Paint	EPA 3051 / 6020	10 grams, Ziploc bag	n/a	6 months	10 working days	Water
Asbestos in Insulation or Tile (no vermiculite)	EPA 660	100 grams, Ziploc bag	n/a	6 months	5 working days	Water
Herbicide/ Pesticide Residue in Soil/Compost	EPA 8151 / 8270	4 oz glass	n/a	14 days	15 working days	Water
Petroleum in Soil-HCID WA TPH-HCID	EPA 8015	4 oz glass	n/a	14 days	10 working days	Water
RADIOLOGICAL						
Gross Alpha Radioactivity	EPA 900.0	1 L HDPE	lab preserves	5 days	20 working days	Water
Gross Beta Radioactivity	EPA 900.0	1 L HDPE	lab preserves	5 days	20 working days	Water
Radium 226	EPA 904.0	1 L HDPE	HNO3 pH < 2	6 months	20 working days	Water
Radium 228	EPA 903.0	1 L HDPE	HNO3 pH < 2	6 months	20 working days	Water
Uranium	EPA 200.8	1 L HDPE	lab preserves	6 months	20 working days	Water
Radon 222	SM #20 7500-RN B	1 L HDPE	HNO3 pH < 2	6 months	20 working days	Water
SYNTHETIC ORGANIC TESTING						
Semivolatiles	EPA 525.2	2 x 1 L amber glass	50 mg Sodium Sulfate	14 days	20 working days	Water
EDB/DBCP	EPA 504.1	2 x 40 mL amber vial	3 mg Sodium Thiosulfate	14 days	20 working days	Water
Chlorinated Pesticides/PCBs	EPA 505	1 L amber glass	50 mg Sodium Sulfate	14 days	20 working days	Water
Herbicides Regulated & Unregulated	EPA 515.3	250 mL amber glass	20 mg Sodium Thiosulfate	14 days	20 working days	Water
Carbamates Regulated & Unregulated	EPA 531	40 mL amber vial	4mg Na Thiosulfate, MCAA	28 days	20 working days	Water
Endothall	EPA 548.1	250 mL amber glass	Sodium Thiosulfate	14 days	20 working days	Water
Glyphosate	EPA 547	2 x 40 mL amber vial	Sodium Thiosulfate	14 days	20 working days	Water
Diquat	EPA 549.2	125 mL HDPE	Sodium Thiosulfate	21 days	20 working days	Water
Dioxin (2,3,7,8-TCDD)	EPA 1613	1 L amber glass	n/a	14 days	20 working days	Water
UCMR TESTING						
UCMR List 1	various	2 x 1 L amber glass	various	14 days	20 working days	Water
UCMR List 2	various	2 x 1 L amber glass	various	14 days	20 working days	Water
VOLATILE ORGANICS						
Regulated & Unregulated Full List	EPA 524.2	3 x 40 mL amber vial	HCl pH<2	14 days	10 working days	Water
Single Volatile Compound (e.g. TCE or MTBE)	EPA 524.2	3 x 40 mL amber vial	HCl pH<2	14 days	10 working days	Water

Bacteriological Testing

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Coliform Presence/Absence	SM 9223B-PA	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	3 working days	Water
Coliform P/A as Count	SM 9223B-PA (Quanti-tray)	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	3 working days	Water
E. Coli by MPN/MTF	SM 9221B / SM 9221E	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Fecal Coliform	SM 9221B / SM 9221E	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Fecal Coliform Membrane Filtration	SM 9222D	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
Total & Fecal Coliform	SM 9221B / SM 9221E	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Total, Fecal & E. Coli	SM 9221B / 9221E / EPA 1680/1681	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Total Coliform by MPN/MTF	SM 9221B	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Heterotrophic Plate Counts (HPC)	SM 9215B / Simplate	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
Iron Bacteria	SM 9240B	125 mL HDPE	n/a	30 hours	7 working days	Water
Listeria	AOAC 997.03	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Pseudomonas	SM 9213F	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water
		4 oz glass jar	n/a	30 hours	7 working days	Soil
Salmonella	EPA 1682	1 L Poly	n/a	30 hours	7 working days	Water
		1 Gallon Ziploc Bag	n/a	30 hours	7 working days	Soil
Sulfur Reducing Bacteria	SM 9240C	Sterile 125 mL HDPE	Sodium Thiosulfate	30 hours	7 working days	Water

Waste Water and Soil Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
WET CHEMISTRY / INORGANIC COMPOUNDS						
Alkalinity as CaCo3	SM 2320	250 mL HDPE	n/a	ASAP	10 working days	Water
		n/a	n/a	ASAP	10 working days	Soil
Biochemical Oxygen Demand (BOD)	SM 5210B	1 L HDPE	n/a	30 hours	10 working days	Water
Cations-Anion Balance	EPA 200.8	1 L HDPE	n/a	28 days	10 working days	Water
Cation Exchange Capactiy	EPA 9081	4 oz glass	n/a	28 days	10 working days	Soil
Chemical Oxygen Demand (COD)	EPA 410.4	250 mL HDPE	H2SO4 pH<2	30 hours	10 working days	Water
Color	SM 2120B	250 mL HDPE	n/a	ASAP	10 working days	Water
Dissolved Oxygen	SM 5210B	250 mL glass	No Headspace	ASAP	10 working days	Water
Fats, Oil & Grease (HEM) Fats, Oil & Grease (HEM w/Sil. Gel Clean-up)	EPA 1664	1 L amber glass	HCl pH < 2	14 days	10 working days	Water
	EPA 9070 / 1664	4 oz glass	n/a	14 days	10 working days	Soil
Hardness as CaCO3	EPA 130.2 / SM 2340B	125 mL HDPE	n/a	ASAP	10 working days	Water
Hydrogen Sulfide	SM 4500S	500 mL HDPE	NaOH pH > 10 No Headspace	ASAP	10 working days	Water
pH	EPA 150.1 / 9040	125 mL HDPE	n/a	ASAP	10 working days	Water
	EPA 9045	4 oz glass	n/a	ASAP	10 working days	Soil
Phenolics (Total)	EPA 9067	1 L amber glass	n/a	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Phosphorus (orthophosphate - PO4)	EPA 300.0 / SM 4500 PF	125 mL HDPE	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Phosphorus (Total)	SM 4500PF	125 mL HDPE	H2SO4 pH<2	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Salinity as NaCl	SM 2520B	125 mL HDPE	n/a	28 days	10 working days	Water
Specific Conductance (Conductivity)	EPA 120.1	125 mL HDPE	n/a	ASAP	10 working days	Water
Specific Gravity	ASTM D287	250 mL glass	n/a	n/a	10 working days	Water
Sulfides - Total	EPA 9031	4 oz glass	n/a	14 days	10 working days	Soil
Surfactants (MBAS)	SM 5540C	1 L amber glass	n/a	14 days	10 working days	Water
Tannin & Lignin	SM 5550B	1 L HDPE	n/a	14 days	10 working days	Water
Total Organic Carbon (TOC)	SM 5310C	2 x 40 mL vial	H2SO4 pH<2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Total Organic Halogens (TOX)	EPA 9020	1 L HDPE	H2SO4 pH<2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Turbidity	EPA 180.1	125 mL HDPE	n/a	48 hours	10 working days	Water
Volatile Acids (Total, TVA)	SM 5560C	1 L HDPE	H2SO4 pH<2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil

Waste Water and Soil Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
ANIONS						
Fluoride, Chloride, Sulfate, Bromide	EPA 300.0	125 mL HDPE	n/a	28 days	10 working days	Water
		4 oz glass	n/a	28 days	10 working days	Soil
Nitrate/N, Nitrite/N, Phosphate	EPA 300.0	125 mL HDPE	n/a	48 hours	10 working days	Water
		4 oz glass	n/a	48 hours	10 working days	Soil
CYANIDES						
Total Cyanide	EPA 335.4	1 L HDPE	NaOH pH > 10	14 days	10 working days	Water
Weak Acid Dissociable (WAD) Cyanide	SM 4500 CN-I	1 L HDPE	NaOH pH > 10	14 days	10 working days	Water
Amenable to Chlorination Cyanide	SM 4500 CN-E	1 L HDPE	NaOH pH > 10	14 days	10 working days	Water
Reactive Cyanide	EPA SW 846	1 L HDPE	NaOH pH > 10	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Free Cyanide	SM 4500 CN-E	1 L HDPE	NaOH pH > 10	14 days	10 working days	Water
Total & Amenable Cyanide	EPA 9010A	4 oz glass	n/a	14 days	10 working days	Soil
METALS						
Single Metal Analysis	EPA 6020 / 200.8	125 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil
Mercury Cold Vapor	EPA 245.7 / 7471	500 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil
Trace Mercury	EPA 1631	Teflon	n/a	1 month	1 month	Water
	EPA 245.7 / 7471	Ultra Clean 4 oz glass	n/a	1 month	10 working days	Soil
Low Level Metals (Trace Metals)	EPA 6020 / 200.8	Ultra Clean HDPE	n/a	6 months	1 month	Water
	EPA 1631	Ultra Clean 4 oz glass	n/a	6 months	10 working days	Soil
Silica/Silicon - Dissolved	EPA 6020 / 200.8	250 mL HDPE	n/a	6 months	10 working days	Water
Hexavalent Chromium	ASTM D1687	500 mL HDPE	HNO3 pH < 2	48 hours	10 working days	Water
		4 oz glass	n/a	48 hours	10 working days	Soil
Priority Pollutant Metals (13)	EPA 6020 / 200.8	500 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil
Target Analyte List (TAL) Metals	EPA 6020 / 200.8	500 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil
Total 8 RCRA Metals	EPA 6020 / 200.8	500 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil
Washington Fertilizer Metals List	EPA 6020 / 200.8	500 mL HDPE	HNO3 pH < 2	6 months	10 working days	Water
		4 oz glass	n/a	6 months	10 working days	Soil

Waste Water and Soil Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
NITROGEN						
Nitrite (NO2-N)	EPA 300.0 / SM 4500 NO3 F	125 mL HDPE	n/a	48 hours	10 working days	Water
		4 oz glass	n/a	48 hours	10 working days	Soil
Nitrate (NO3-N)	EPA 300.0 / SM 4500 NO3 F	125 mL HDPE	n/a	48 hours	10 working days	Water
		4 oz glass	n/a	48 hours	10 working days	Soil
Ammonia (NH3/N)	SM 4500 NH3	500 mL HDPE	H2SO4 pH<2	28 days	10 working days	Water
		4 oz glass	n/a	28 days	10 working days	Soil
Organic Nitrogen (TKN - NH3)	SM 4500 NH3	500 mL HDPE	H2SO4 pH<2	28 days	10 working days	Water
	SM 4500 N B / 4500 NH3 C	4 oz glass	n/a	28 days	10 working days	Soil
TKN (Total Kjeldahl Nitrogen)	SM 4500 NH3 / SM 4500 N B	500 mL HDPE	H2SO4 pH<2	28 days	10 working days	Water
		4 oz glass	n/a	28 days	10 working days	Soil
Total Nitrogen (NO2 + NO3 + TKN)	various	500 mL HDPE	n/a	48 hours	10 working days	Water
		4 oz glass	n/a	48 hours	10 working days	Soil
SOLIDS						
Total Dissolved Solids (TDS)	SM 2540 C / EPA 160.1	1 L HDPE	n/a	ASAP	10 working days	Water
Total Solids	SM 2540 B / EPA 160.3	1 L HDPE	n/a	ASAP	10 working days	Water
Total Suspended Solids (TSS)	SM 2540 D / EPA 160.2	1 L HDPE	n/a	ASAP	10 working days	Water
Total Volatile Solids (TVS)	SM 2540 G / EPA 160.4	1 L HDPE	n/a	7 days	10 working days	Water
Volatile Suspended Solids (VSS)	SM 2540 E / EPA 160.4	1 L HDPE	n/a	ASAP	10 working days	
Total Volatile Solids (TVS)	SM 2540 G / EPA 160.4	4 oz glass	n/a	7 days	10 working days	Soil
Percent Solids	SM 2540B	4 oz glass	n/a	n/a	10 working days	Soil
SEMIVOLATILE ORGANICS						
Aldehydes	EPA 8315	250 mL amber glass	n/a	14 days	10 working days	Water
Carbamates/Pesticides	EPA 8318	40 mL amber vial	Sodium Thiosulfate MCAA	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Carbonyl Compounds	EPA 8315	250 mL amber glass	n/a	3 days	10 working days	Water
		4 oz glass	n/a	3 days	10 working days	Soil
Chlorinated Herbicides	EPA 8151	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Chlorophyl A	SM 10200H	1 L amber glass	n/a	7 days	10 working days	Water
Chloropropham	GC/MS/MS	8 oz amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Diphenylamine (DPA)	EPA 641	40 mL amber vial	H2SO4 pH<2	7 days	10 working days	Water
EDB	EPA 8011	250 mL glass	n/a	7 days	10 working days	Water
		4 oz glass No Headspace	n/a	14 days	10 working days	Soil

Waste Water and Soil Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Ethoxyquin	HPLC/MS/MS	40 mL amber vial	n/a	7 days	10 working days	Water
Ethylene Glycol	EPA 8015MOD	1 L amber glass	n/a	7 days	10 working days	Water
Explosives & By-product	EPA 8330	1 L amber glass	n/a	7 days	10 working days	Water
Fluridone	HPLC/HPLC/MS/MS	500 mL HDPE	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Glyphosate	EPA 547	8 oz amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Nitrosamines	EPA 607	1 L amber glass	n/a	7 days	10 working days	Water
Organochlorine Pesticides	EPA 8081 / 8270	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Organophosphorus Pesticides	EPA 8141 / 8270	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
PAHs	EPA 8270	1 L amber glass	n/a	7 days	10 working days	Water
PAHs (Method: GC-MS EPA 8270)		4 oz glass	n/a	14 days	10 working days	Soil
PAHs (Method: HPLC(trace) EPQ8310)		4 oz glass	n/a	14 days	10 working days	Soil
PCBs	EPA 8082	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Pentachlorophenol	EPA 8151	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Pesticide Screen	EPA 8270 MOD	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	7 days	10 working days	Soil
Phenols	EPA 8270C	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Phthalates	EPA 8270	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Semivolatile Organics (Full List)	EPA 8270	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Single SOC (e.g. Atrazine)	EPA 8270	1 L amber glass	n/a	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
SOPP	HPLC/MS/MS	40 mL amber vial	n/a	7 days	10 working days	Water
Triazine Pesticides	EPA 8270	1 L amber glass	n/a	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Thiabendazole (TBZ)	EPA 641	40 mL amber vial	n/a	7 days	10 working days	Water
Volatile Acids	EPA 8015MOD	1 L HDPE	H2SO4 pH<2	7 days	10 working days	Water

Waste Water and Soil Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Volatile Organics						
Single Volatile Compound	EPA 8260	2 x 40 mL amber vial	HCl pH < 2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Volatile Halocarbons/Chlorinated Solvents	EPA 8260	2 x 40 mL amber vial	HCl pH < 2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
Volatile Organics	EPA 8260	2 x 40 mL amber vial	HCl pH < 2	14 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil

Oil & Hazardous Waste Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Asbestos (bulk)	EPA 660	100 grams, Ziploc bag	n/a	n/a	10 working days	Bulk
Asbestos (air)	PCM	100 grams	n/a	n/a	10 working days	Air
Ash	ASTM D482	8 oz amber glass	n/a	14 days	10 working days	Oil
BTU	ASTM D240-92	8 oz amber glass	n/a	7 days	10 working days	Oil
Corrosivity (pH)	EPA 9040	500 mL HDPE	n/a	ASAP	10 working days	Liquid
	EPA 9045	4 oz clear glass	n/a	ASAP	10 working days	Solid
Cyanide - Reactive	SW 846	1 L HDPE	n/a	14 days	10 working days	Liquid
Ethylene Glycol / Propylene Glycol	GC/FID	8 oz amber glass	n/a	14 days	10 working days	Oil
F-List Solvet Scan	EPA 8260 / 8270 / 8015	4 oz clear glass	No Headspeace	14 days	10 working days	Liquid
Flashpoint	EPA 1010	8 oz clear glass	n/a	14 days	10 working days	Liquid
Halogenated Volatiles	EPA 8260 (8010 list)	8 oz amber glass	n/a	14 days	10 working days	Oil
Lead in Air	EPA 6020	Filter	n/a	14 days	10 working days	Air
Lead in Paint	EPA 6020	10 grams, Ziploc bag	n/a	14 days	10 working days	Solid
Paint Filter Test	EPA SW 846	4 oz clear glass	n/a	14 days	10 working days	Liquid
PCBs in Wipes	M4-82-020 / PCM	4 oz clear glass	in Hexane	n/a	10 working days	Wipe
PCBs in Oil	EPA 8082	2 mL vial if PCB only	n/a	14 days	10 working days	Oil
Percent Water	KARL FISCHER TITRATION	8 oz amber glass	n/a	14 days	10 working days	Oil
Specific Gravity	ASTM D287	8 oz amber glass	n/a	n/a	10 working days	Oil
Sulfide - Reactive	SW 846	1L HDPE	n/a	14 days	10 working days	Liquid
Sulfur (Total)	ASTM D2622	8 oz amber glass	n/a	14 days	10 working days	Oil
TCLP Metal (Single Metal)	EPA 6020	1L HDPE	n/a	7 days	10 working days	Liquid
		8 oz amber glass	n/a	7 days	10 working days	Solid
TCLP 8 Metals	EPA 6020	1L HDPE	n/a	7 days	10 working days	Liquid
		8 oz amber glass	n/a	7 days	10 working days	Solid
TCLP Volatiles	EPA 8260	3 x 40 mL amber vials	HCl pH<2	7 days	15 working days	Liquid
		8 oz amber glass	n/a		15 working days	Solid
TCLP Semivolatiles	EPA 8270	1 L glass amber	n/a	7 days	15 working days	Liquid
		8 oz amber glass	n/a		15 working days	Solid
TCLP Pesticides	EPA 8081	1 L glass amber	n/a	7 days	15 working days	Liquid
		8 oz amber glass	n/a		15 working days	Solid
TCLP Herbicides	EPA 8151	1 L glass amber	n/a	7 days	15 working days	Liquid
		8 oz amber glass	n/a		15 working days	Solid
Total 4 Metals (As, Cd, Cr, Pb)	EPA 6020	40 mL VOA vial	n/a	14 days	10 working days	Oil
Total Chlorine (TOX)	EPA 9076	5 mL vial	n/a	14 days	10 working days	Oil
Viscosity	ASTM D445	8 oz amber glass	n/a	14 days	10 working days	Oil

Oil & Hazardous Waste Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
TOTAL TOXIC ORGANICS (TTO)						
Volatile Organics w/acrolein	EPA 624	3 x 40 mL amber vials	HCl pH<2	14 days	15 working days	Water
OC Pesticides/PCB	EPA 608	2 x 1 L amber bottles	n/a	14 days	15 working days	Water
Dioxin 2,3,7,8-TCDD	EPA 1613	1 L glass amber	n/a	14 days	15 working days	Water
BNA	EPA 625	1 L glass amber	n/a	14 days	15 working days	Water

Underground Storage Tank Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
BTEX (Gasoline, JP-4)	EPA 8260	Tedlar Bags	n/a	7 days	10 working days	Air
BTEX (Gasoline, JP-4)	EPA 8021 / 8260	4 oz jar	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water
EDB in Water	EPA 8011	3 x 40 mL amber vial	n/a	14 days	10 working days	Water
Extractable Petroleum Hydrocarbons (EPH)	GC/FID WA DOE	4 oz jar	n/a	14 days	10 working days	Soil
		1 L amber glass	n/a	7 days	10 working days	Water
EPH (No PAH) (Massachusetts)	MA Approved Method	4 oz glass	n/a	14 days	10 working days	Soil
		2 x 1 L amber glass	n/a	7 days	10 working days	Water
PAH	EPA 8270	4 oz glass	n/a	14 days	10 working days	Soil
		1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
PAH (Massachusetts)	EPA 8270	4 oz glass	n/a	14 days	10 working days	Soil
		2 x 1 L amber glass	n/a	7 days	10 working days	Water
PAHs *Fuel Oil #4, JP-5*	EPA 8270	1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
		4 oz glass	n/a	14 days	10 working days	Soil
PAH's + 2-Methylnaphthalene	EPA 8270	4 oz glass	n/a	14 days	10 working days	Soil
		1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
PCBs	EPA 8082	4 oz glass	n/a	14 days	10 working days	Soil
		1 L amber glass	n/a	7 days	10 working days	Water
RBCA Volatiles (Gasoline) BTEX, MTBE, EDC, EDB, Naphthalene	EPA 8260	4 oz glass	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water
TPH-HCID (Hydrocarbon Identification)	EPA 8015 / NWTPH	4 oz jar	n/a	14 days	10 working days	Soil
		1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
TPH-D (Diesel)	EPA 8015 / NWTPH	4 oz jar	n/a	14 days	10 working days	Soil
		1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
TPH-Dx (Diesel & Waste Oil)	EPA 8015 / NWTPH	4 oz jar	n/a	14 days	10 working days	Soil
		1 L amber glass	HCl Acid pH < 2	7 days	10 working days	Water
TPH-G (Gasoline)	EPA 8015 / NWTPH	4 oz jar	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water
TPH-G/BTEX (Gasoline)	EPA 8021 / 8260	4 oz jar	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water
Volatile Petroleum (VPH)	GC/FID/PID WA DOE	4 oz jar	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water
Volatile Halocarbons/8010 list/Chlorinated Solvents	EPA 8260	4 oz glass	n/a	14 days	10 working days	Soil
		3 x 40 mL amber vial	HCl pH < 2	14 days	10 working days	Water
Volatile Organic Compounds (BTEX, MTBE, EDB, EDC, 1,2,4 & 1,3,5-TMB)	EPA 8260	4 oz glass	n/a	7 days	10 working days	Soil
		3 x 40 mL amber vial	HCl Acid pH < 2	14 days	10 working days	Water
VPH (Massachusetts)	MA Approved Method	4 oz glass	n/a	14 days	10 working days	Soil
		2 x 40 mL amber vial	HCl Acid pH < 2	7 days	10 working days	Water

Underground Storage Tank Testing

Anatek Labs, Inc.

Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
NATURAL ATTENUATION PARAMETERS						
Ethylene, Methane, Ethane	GC/FID	60 mL crimp top serum bottle	H2SO4 pH < 2	14 days	10 working days	Water
Carbon Dioxide (GC/FID headspace)	GC/TCD	60 mL crimp top serum bottle	n/a	14 days	10 working days	Water
Carbon Dioxide (SM4500CO2C titration)	SM4500CO2 C / Titration	1 L glass amber (no headspace)	n/a	48 hours	10 working days	Water
Dissolved Fe and Mn	EPA 200.8	125 mL HDPE	n/a	6 months	10 working days	Water
Ions (NO2, NO3, SO4, Cl)	EPA 300.0	125 mL HDPE	n/a	48 hours	10 working days	Water
pH + Alkalinity	SM 2320	500 mL HDPE	n/a	ASAP	10 working days	Water

Radiological Testing

Anatek Labs, Inc.

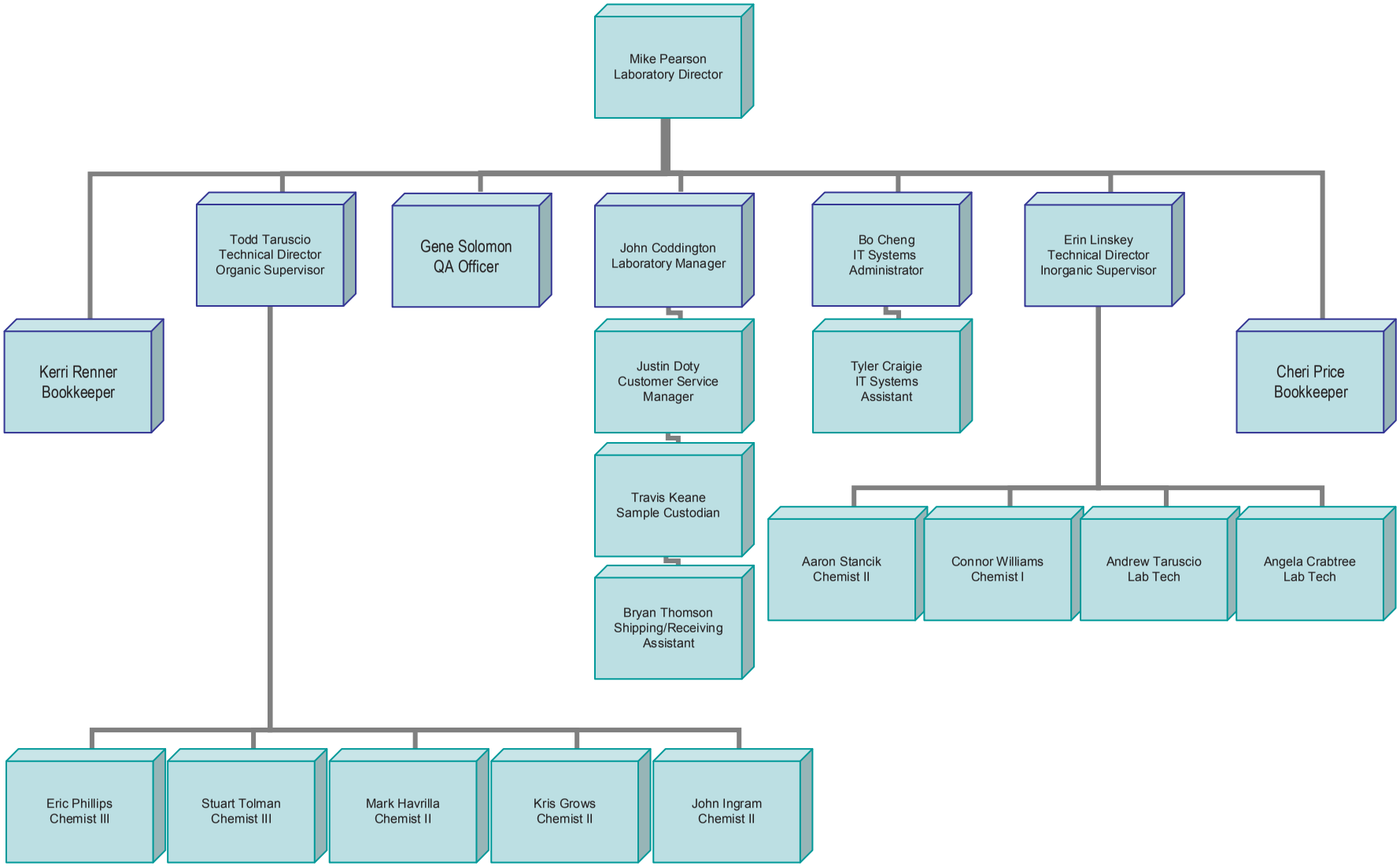
Analytical Parameter	Method	Sampling Container	Preservative	Holding Time	Estimated Time	Matrix
Gross Alpha	EPA 900.0	1 L HDPE	Lab Preserved w/ HNO_3	5 days	20 working days	Water
Gross Beta	EPA 900.0	1 L HDPE	Lab Preserved w/ HNO_3	5 days	20 working days	Water
Gross Alpha & Beta	EPA 900.0	1 L HDPE	Lab Preserved w/ HNO_3	5 days	20 working days	Water

Extraction Methods

Sample Preparation	Method
Digestions	Various
Filtration (0.45mm)	
Sample Compositing	
Acid Digestion	EPA 310 / 3051
Aliphatic/Aromatic Seperation	EPA 3611
Gel-permeation Cleanup	EPA 3640
Liquid-Liquid Extraction	EPA 3520
Microwave Digestion	EPA 3051 / 3015
PCB Cleanup	EPA 3630 MOD
Separatory Funnel Extraction	EPA 3510
PFE (ASE) Extraction	EPA 3545
Ultrasonic Extraction	EPA 3550
Particle Sizing by Sieve	

Figures

Anatek Labs, Inc.
Organizational Chart



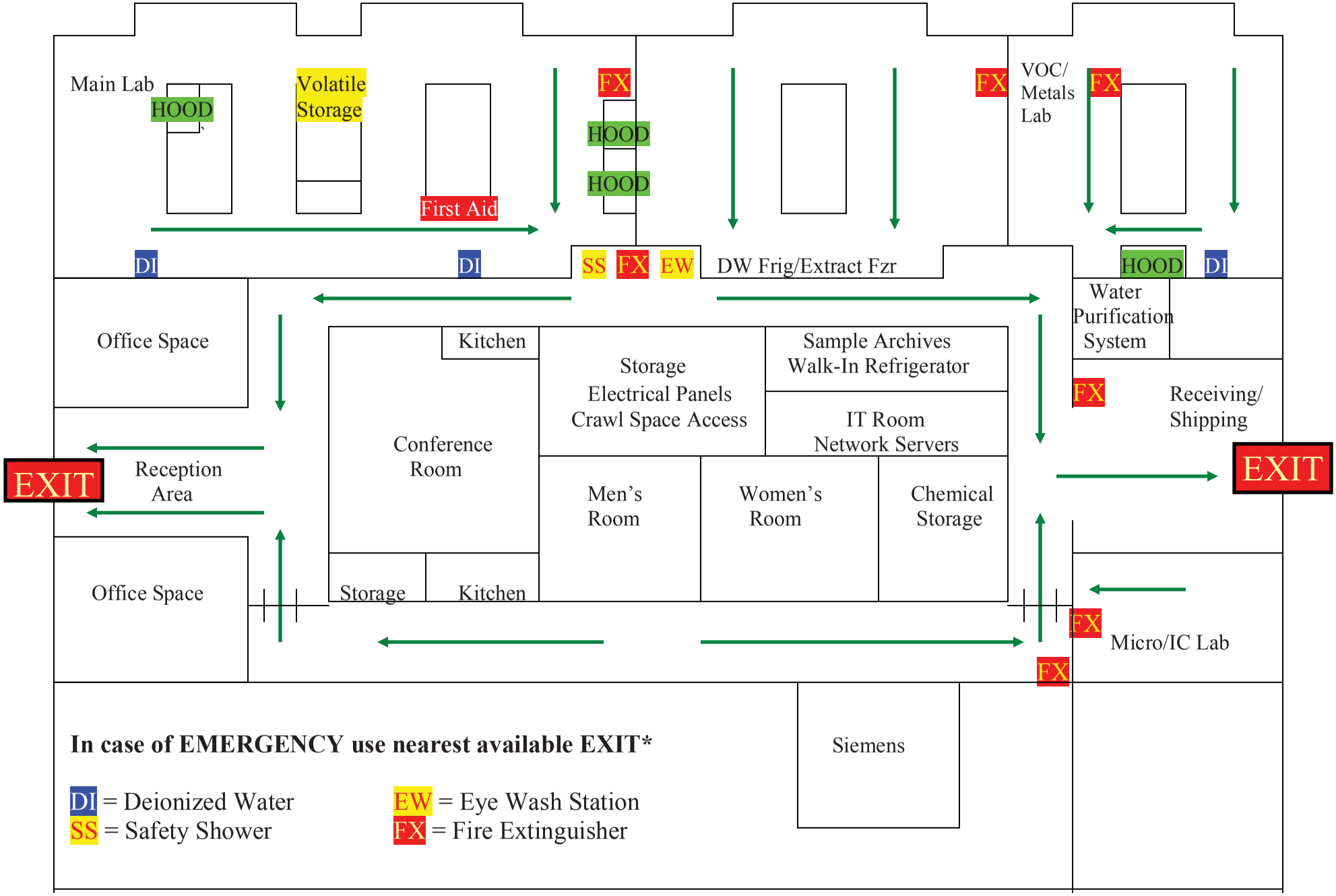
01 March 2014

Figure 2

Anatek Labs, Moscow Personnel

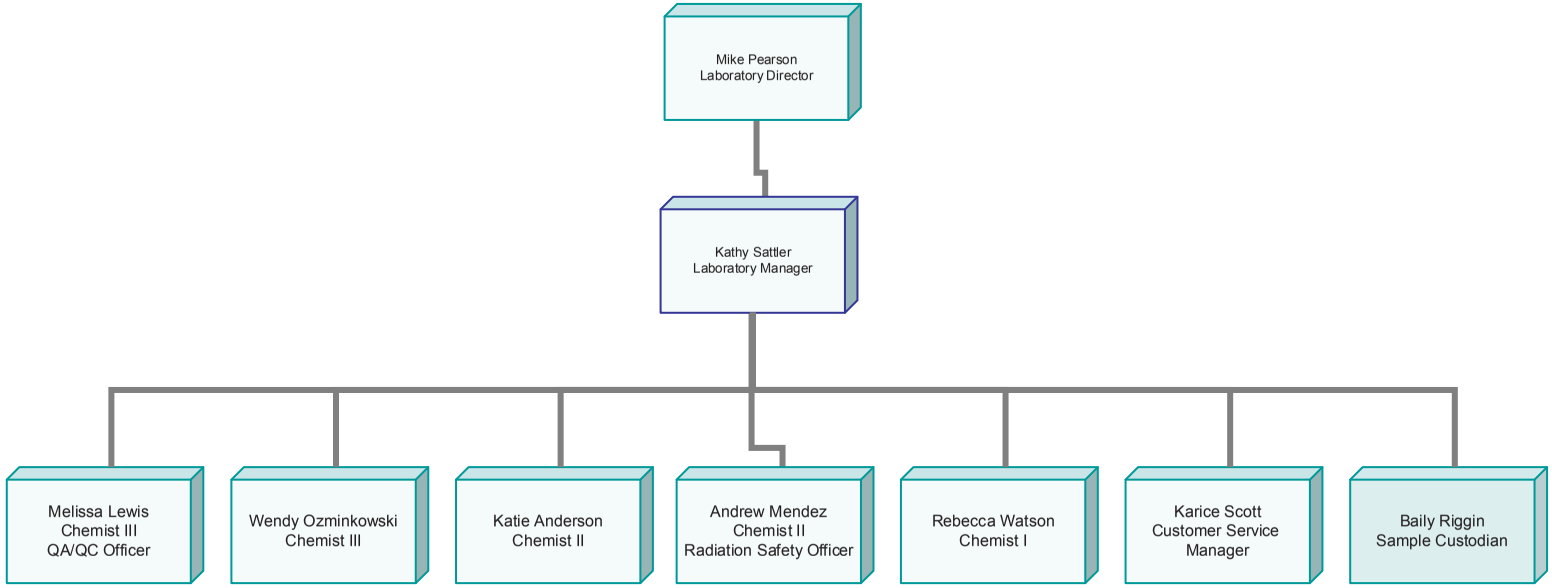
Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S Elec. Eng.
Laboratory Manager	John Coddington	Ph.D. Chemistry
Technical Director - Organics Supervisor	Todd Taruscio	Ph.D. Zoophysiology
Technical Director - Inorganics Supervisor	Erin Linskey	B.S. Biology
Chemist III	Eric Phillips	B.S. Chemistry
Chemist III	Stuart Tolman	M.S. Food Science
Chemist II	Mark Havrilla	B.S. Chemistry
Chemist II	Kris Grows	B.S. Chemistry
Chemist II	John Ingram	M.S. Chemistry/MBA
Chemist II	Aaron Stancik	Ph.D. Chemistry
Chemist I	Connor Williams	B.S. Env. Sci.
Lab Tech	Andrew Taruscio	B.S. Chemistry
Lab Tech	Angela Crabtree	B.S. Chemistry/Microbiology
QA Officer	Gene Solomon	B.A. Economics
Customer Service Manager	Justin Doty	
Sample Custodian	Travis Keane	
Shipping/Receiving Asst.	Bryan Thomson	
Bookkeeper	Cheri Price	
Bookkeeper	Kerri Renner	

Anatek Labs Floor Plan/Safety Plan



Anatek Labs, Inc.

Anatek Labs - Spokane, Inc.
Organizational Chart



01 March 2014

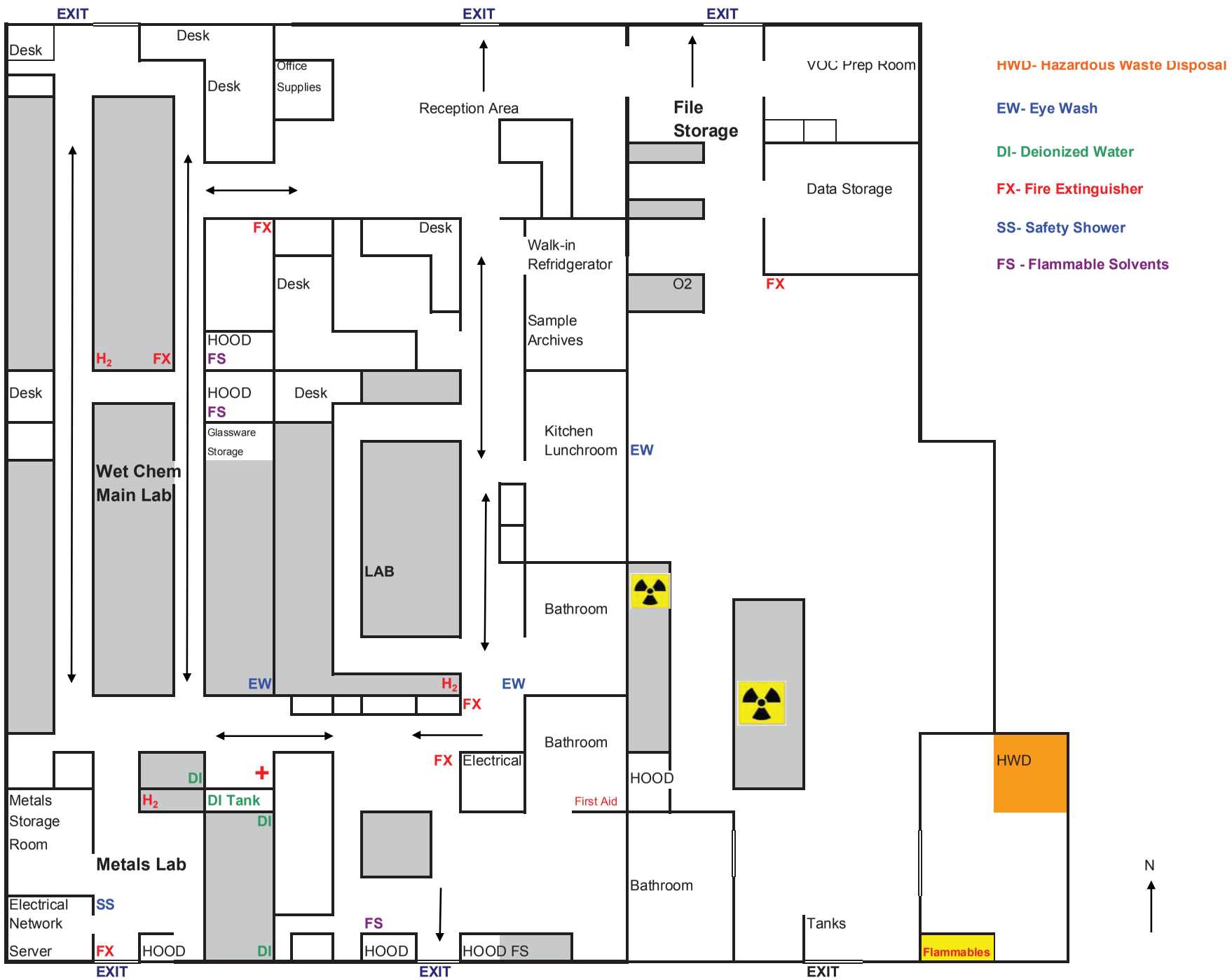
Figure 2

Anatek Labs, Spokane Personnel

Position	Employee	Degree
Laboratory Director	Mike Pearson	B.S Elec. Eng.
Laboratory Manager	Kathy Sattler	B.S. Microbiology
Chemist III/QA Officer	Melissa Lewis	B.S. General Studies/Natural Sciences
Chemist III	Wendy Ozminski	B.S. Chemistry
Chemist II	Katie Anderson	B.S. Chemistry/Biochemistry
Chemist II	Andrew Mendez	B.S. Chemistry
Chemist I	Rebecca Watson	B.S. Biology, Minor Chemistry/Biochem
Customer Service Manager	Karice Scott	
Sample Custodian	Baily Riggin	

Figure 6

Anatek Labs, Spokane Floor Plan and Safety Plan



Anatek Labs, Inc.

Appendices

Anatek Labs, Inc.

Appendix A

Index of Standard Operating Procedures

Moscow Index is followed by Spokane Index

Anatek Labs, Inc.
Standard Operating Procedures

Laboratory Director:
Mike Pearson

1 July 2011

The SOP's contained herein are for the use of Anatek Labs Employees and are not to be removed from the premises without the prior approval of the Lab Director or Lab Manager. Original signed copies are maintained by the QA Officer. Any changes should be submitted to the QA Officer for implementation.

General **(00)**

ALI-01: Preparing and Maintaining Standard Operating Procedures
ALI-02: Sample Login, Handling and Custody
ALI-03: Glassware Cleaning
ALI-04: Waste Disposal
ALI-05: Data Entry
ALI-06: Complaints
ALI-07: Corrective Action Reports
ALI-08: Labeling, Logging and Storage of Standards and Commercial Reagents/Solvents
ALI-09: Instrument Maintenance and Calibration
ALI-10: Laboratory Safety
ALI-11: Data Handling
ALI-12: Laboratory Blind Samples
ALI-13: Personnel Training Records
ALI-14: Data Archiving
ALI-15: Instrument Activities Logbooks & Laboratory Notebooks
ALI-16: Internal Inspections and Reporting
ALI-17: Procedure for QA Audits of Instrument Activity Logs, IDC's & MDL's
ALI-18: Sample Receiving
ALI-19: Calibration and Monitoring of Thermometers
ALI-20: No longer in use
ALI-21: Customer Notification
ALI-22: Training
ALI-23: No longer in use
ALI-24: Performing Records Inspections
ALI-25: Performance of IDCs, MDLs, and PQLs
ALI-26: Data Reporting
ALI-27: IT Systems Documentation

Office Manual **(00)**

ALI-OM-01: Customer Service
ALI-OM-02: Custodial Services
ALI-OM-03: No longer in use
ALI-OM-04: Telephone Systems Procedures

ALI-OM-05: Mail Handling
ALI-OM-06: Purchasing
ALI-OM-07: Shipping
ALI-OM-08: Office Equipment
ALI-OM-09: Accounting
ALI-OM-10: Credit Accounts
ALI-OM-11: Employees

Analytical (000)

Drinking Water (100)

ALI-A-101: EDB/DBCP/1,2,3-TCP Analysis by EPA Method 504.1
ALI-A-102: Haloacetic Acids Analysis by SM 6251B
ALI-A-103: Organochlorine Pesticides and PCB's by EPA Method 505
ALI-A-104: Herbicides Analysis by EPA Method 515.3
ALI-A-105: Volatile Organic Analysis by EPA Method 524.2
ALI-A-106: Semi-volatiles Analysis by EPA Method 525.2
ALI-A-107: Carbamates Analysis by EPA Method 531.1
ALI-A-108: Glyphosate Analysis by EPA Method 547
ALI-A-109: Endothall Analysis by EPA Method 548.1
ALI-A-110: Diquat/Paraquat Analysis by EPA Method 549.2
ALI-A-111: Explosives by GC/MS – EPA Method 529
ALI-A-112: Pesticides and Flame Retardants by GC/MS – EPA Method 527
ALI-A-113: Acetanilide Degradates by LC/MS/MS – EPA Method 535
ALI-A-114: Nitrosamines by GC/MS/MS - EPA Method 521
ALI-A-115: Semi-volatiles Analysis by EPA Method 525.2 – UCMR2 List

Non Drinking Water Organic (200)

ALI-A-201: Pressurized Fluid Extraction By EPA Method 3545
ALI-A-202: Chlorophyl *a* Analysis by SM 10200H
ALI-A-203: Pesticides/PCB's by EPA Method 608/608.2
ALI-A-204: Carbamates/Urea Pesticide Analysis by HPLC-UV by EPA Method 8321B
ALI-A-205: Herbicides by EPA Method 8151A/615
ALI-A-206: Semivolatile Organic Compounds Analysis by GC/MS by EPA Method 625/8270D
ALI-A-207: Volatile Organic Analysis by EPA Method 8260C
ALI-A-208: Volatile Organic Analysis by EPA Method 624
ALI-A-209: Explosives and Explosive By-products by EPA Method 8330B
ALI-A-210: No longer used
ALI-A-211: Organophosphorus Pesticide Analysis by GC/MS by EPA Method 8141A Modified
ALI-A-212: Pesticides/PCB's by EPA Method 8081B/8082A
ALI-A-213: Soil Herbicides by EPA Method 8151A Modified
ALI-A-214: No longer used
ALI-A-215: See SOP ALI-A-340
ALI-A-216: Volatile Organic Analysis by EPA Method 8260B
ALI-A-217: Semivolatile Organic Compounds Analysis by EPA Method 8270C

Inorganic and Wet Chemistry (300)

ALI-A-301: Orthophosphate/Total Phosphorus (SM4500P-F) Flow Injection Analysis
ALI-A-302: No longer in use
ALI-A-303: Phenolics by Manual Colorimetry by EPA Method 420.1/SM5530C

ALI-A-304: Ammonia Nitrogen (SM4500NH3-G) and TKN (SM4500NorgC) by Flow Injection Analysis
ALI-A-305: Cation Exchange Capacity of Soils by EPA Method 9081
ALI-A-306: Residual Chlorine by SM 4500Cl-G
ALI-A-307: No longer in use
ALI-A-308: Weak Acid Dissociable Cyanide by Semi-Automated Colorimetry by 4500-CN-I
ALI-A-309: Total Cyanide by Semi-Automated Colorimetry by EPA Method 335.4/9012B/SM 4500 CN-E
ALI-A-310: pH by EPA Method 150.1 & EPA Method 9045C & SM4500 H^+B
ALI-A-311: Alkalinity by EPA Method 310.1/SM 2320B
ALI-A-312: Conductivity by EPA Method 120.1/SM 2510B
ALI-A-313: Hardness by SM 2340B
ALI-A-314: Trace Metal Analysis by EPA Method 200.8
ALI-A-315: Trace Metal Analysis by EPA Method 6020A
ALI-A-316: Ultra Trace Metal Analysis by EPA Method 1638
ALI-A-317: Sodium Analysis by Flame AA by EPA Method 3111B
ALI-A-318: Trace Mercury Analysis by EPA Method 1631/245.7
ALI-A-319: Nitrate/N and Nitrite/N (SM4500NO3-F & EPA 353.2) Flow Injection Analysis
ALI-A-320: Ions (Nitrate, Nitrite, Chloride, Sulfate, Fluoride, Phosphate) By EPA Method 300.0
ALI-A-321: No longer used
ALI-A-322: Turbidity by EPA Method 180.1
ALI-A-323: TSS by SM 2540-D and TDS by SM 2540-C
ALI-A-324: Color (Platinum-Cobalt Method) by SM 2120B
ALI-A-325: Total Volatile Solids by EPA Method 160.4/SM 2540E
ALI-A-326: Total Volatile Acids by SM 5560 C
ALI-A-327: Anionic Surfactants by Method 5540 C
ALI-A-328: Tannin and Lignin by SM 5550 B
ALI-A-329: No longer used
ALI-A-330: Toxicity Characteristic Leaching Procedure by SW 846 Method 1311
ALI-A-331: Trace Mercury Analysis by EPA Method 245.2
ALI-A-332: Sulfide (SM4500-S2 F) Iodometric Titration
ALI-A-333: Ammonia Nitrogen by SM4500 NH3-G (Discrete Analyzer)
ALI-A-334: Low Level Orthophosphate/Total P by SM4500P-F (Discrete Analyzer)
ALI-A-335: Mid Range Orthophosphate/Total P by SM4500P-F (Discrete Analyzer)
ALI-A-336: TKN by SM4500NorgC (Discrete Analyzer)
ALI-A-337: Synthetic Precipitation Leaching Procedure by SW-846 Method 1312
ALI-A-338: Trace Metals Analysis by EPA Method 200.7
ALI-A-339: Trace Metals Analysis by EPA Method 6010B
ALI-A-340: Perchlorate by EPA Method 331.0 (HPLC/ESI/MS)
ALI-A-341: Perchlorate by EPA Method 6850
ALI-A-342: TOC by SM5310B

UST Petroleum Methods (400)

ALI-A-401 No longer used
ALI-A-402: No longer used
ALI-A-403: No longer used
ALI-A-404: Gasoline Analysis by EPA Method 8015 (Modified)/NW TPHG(X)
ALI-A-405: TPH-D & HCID-NW TPH-D & NW TPH-HCID – EPA 8015B
ALI-A-406: Diesel Range Organics (DRO)
ALI-A-407: Hexane Extractable Material (FOG) by EPA Method 1664A
ALI-A-408: Extractable Petroleum Hydrocarbons (EPH) Massachusetts Method) and Diesel Range Organics (DRO)
ALI-A-409: Extractable Petroleum Hydrocarbons (EPH) (Washington Method)
ALI-A-410: Sulfur Analysis by ASTM D2622

ALI-A-411: Flashpoint by EPA Method 1010
ALI-A-412: C_{10}-C_{32} Hydrocarbons in Soil by 8015AZ

Coliform and Bacteria (500)

ALI-A-501: SM 9223B-MPN (Quanti-tray) Procedure
ALI-A-502: SM 9223B-PA Procedure
ALI-A-503: Heterotrophic Plate Count by Method 9215 B
ALI-A-504: No longer used

Special (600)

ALI-A-601: Quantitation of Clopyralid in Finished Compost
ALI-A-602: Determination of Methamphetamine from Wipe Samples and Other Matrices

Anatek Labs, Inc.
Standard Operating Procedures

Laboratory Director: Mike Pearson
Laboratory Manager: Kathy Sattler

Revised October 15, 2012

The SOP's contained herein are for the use of Anatek Labs employees and are not to be removed from the premises without the prior approval of the Lab Director or Lab Manager. Original signed copies are maintained by the QA Officer. Any changes should be submitted to the QA Officer for implementation.

Office Manual (00)

ALI-OM-01.01	Customer Service
ALI-OM-02.01	Custodial Services
ALI-OM-03.01	Sample Handling Procedures
ALI-OM-04.01	Telephone Systems Procedures
ALI-OM-05.01	Mail Handling
ALI-OM-06.01	Purchasing
ALI-OM-07.01	Shipping
ALI-OM-08.01	Office Equipment
ALI-OM-09.01	Accounting
ALI-OM-10.01	Credit Accounts
ALI-OM-11.01	Employees

General (00)

ALI-01 .02	Preparing and Maintaining Standard Operating Procedures
ALI-02 .03	Sample Login, Handling, and Custody
ALI-03 .01	Glassware Cleaning
ALI-04	Waste Disposal
ALI-05	Data Entry Guidelines
ALI-06	Complaints
ALI-07 .02	Corrective Action Reports
ALI-08	Labeling, Logging and Storage of Standards and Commercial Reagents/Solvents
ALI-09	Instrument Maintenance and Calibrations
ALI-10	Chemical Hygiene Plan
ALI-11	Data Handling

General (00) cont.

ALI-12	Laboratory Blind Sample
ALI-13	Personnel Training Records
ALI-14	Data Archiving
ALI-15	Instrument Activities Logbook
ALI-16	Internal Inspections and Reporting
ALI-17	Procedure for QA Audits of Instrument Activity Logs, IDC's and MDL's
ALI-18	Sample Receiving
ALI-19	Calibration and Monitoring of Thermometers
ALI-20	IDEXX Bottle Volume and Sterility Test
ALI-21	Customer Notification
ALI-22	Training
ALI-23	Shipping and Receiving
ALI-24	Performing Records Inspections
ALI-25.00	Performance of IDCs, MDLs, and PQLs
ALI-26.00	Data Reporting – pending
ALI-27.00	IT Systems Documentation
ALI-28.00	Control Charting – pending
ALI-29.00	PT Reporting – pending
ALI-30.00	Authorized Signatures

Analytical (000)

Organics (100)

ALI-S-101	Volatile Organic Analysis by EPA Method 524.2
ALI-S-102	Volatile Organic Analysis by EPA Method 624.4
ALI-S-103	Volatile Organic Analysis by EPA Method 8260B
ALI-S-104	Total Organic Carbon by SM 5310C
ALI-S-105	Total Organic Halides by EPA Method 9020B
ALI-S-106	Extractable Organic Halides by EPA Method 9023
ALI-S-107	Haloacetic Acids by SM 6251B

Inorganic and Wet Chemistry (200)

ALI-S-201	Total Phosphorus by SM4500-PF
ALI-S-202	Total Residual Chloride by SM4500Cl-G
ALI-S-203	Total Cyanide by SM 4500CN-F
ALI-S-204	pH by EPA Method 150.1
ALI-S-205	Alkalinity (Carbonate & Bicarbonate) by SM 2320 B/EPA 310.1
ALI-S-206	Conductivity by SM 2510 B
ALI-S-207	Hardness by SM 2340 B

Inorganic and Wet Chemistry (200) cont.

ALI-S-208	Anions (NO_3, NO_2, SO_4, Cl, F, PO_4, Br) by EPA Method 300.0
ALI-S-209	Ions (Bromate, Chlorate, Chlorite) by EPA Method 300.0 Part B (Currently not used)
ALI-S-210	Turbidity by EPA Method 180.1
ALI-S-211	TSS (Total Suspended Solids) by EPA Method 160.2/SM 2540 D
ALI-S-212	TDS (Total Dissolved Solids) by EPA Method 160.1/SM 2540 C
ALI-S-213	TS (Total Solids) by EPA Method 160.3
ALI-S-214	BOD/DO/CBOD by SM 5210 B
ALI-S-215	COD by EPA Method 410.4
ALI-S-216	Percent Solids
ALI-S-217	pH (non-aqueous) by EPA Method 9045D
ALI-S-218	Color by SM 2120 B
ALI-S-219	Ammonia Nitrogen by SM 4500 NH3-G
ALI-S-220	Ortho-phosphate by SM 4500-PF
ALI-S-221	Sulfide by SM4500-S^{2-}F
ALI-S-222	Acidity by EPA 310.1 / SM2310-B
ALI-S-223	Sulfite by SM4500-SO_3^{2-}B
ALI-S-224	pH (in Soil and Waste) by EPA Method 9040C
ALI-S-225	Resistivity by ASTMG57A
ALI-S-226	Metals by EPA 200.8
ALI-S-227	Metals by EPA 6020
ALI-S-228	TKN by SM 4500N_{ORG} C
ALI-S-229	Specific Gravity/Density by
ALI-S-230	Chlorine Demand by SM
ALI-S-231	MBAS by SM 5540C
ALI-S-232	Carbon Dioxide
ALI-S-233	Sulfide by SM4500-S^{2-}D
ALI-S-234	CN in DW by SM 4500 CN F / EPA 335.4
ALI-S-235	Total CN by SM 4500 CN N / EPA 335.4

Hazardous Waste/Waste Oil (300)

ALI-S-301	PCB's by EPA Method 8082
ALI-S-302	BTU – Heat of Combustion
ALI-S-303	Total Chlorine by EPA Method 9076

UST Petroleum Methods (400)

ALI-S-401	Gasoline Analysis by NW TPHG(x)
ALI-S-402	BTEX by EPA Method 8021 (Modified)
ALI-S-403	VPH by MADEP-VPH-98-1
ALI-S-404	VPH by WA VPH Method
ALI-S-405	Oxyfuel Analysis by ASTM D 4815
ALI-S-406	Diesel and Lube Oil Analysis by NW-TPHDx & HCID
ALI-S-407	Gasoline Range Organics (GRO) by EPA Method 8015B

Microbiology (500)

ALI-S-501	Total and E. coli by SM 9223B-PA Quanti-Tray
ALI-S-502	Total and E. coli by SM 9223B-PA
ALI-S-503	Archived
ALI-S-504	Multi-tube MPN Total and Fecal coliform SM 9221 B
ALI-S-505	Multi-tube MPN Fecal and E.coli SM 9221 E
ALI-S-506	Multi-tube MPN Fecal and E.coli in soil SM 9221 E
ALI-S-507	Heterotrophic Plate Count by SM 9215 B
ALI-S-508	HPC by SimPlate (unit dose) SM 9221 B
ALI-S-509	HPC by SimPlate (unit dose) SM 9221 B
ALI-S-510	Fecal Coliform Membrane Filtration by SM 9222D
ALI-S-511	Fecal in Biosolids by EPA 1680
ALI-S-512	Salmonella in Biosolids by EPA 1682
ALI-S-513	Fecal Streptococcus and Enterococcus by Multi-Tube Fermentation SM 9230 B

Radionuclides (600)

ALI-S-601	Gross Alpha and Gross Beta by EPA 900.0

Appendix B

Example of Sample Submission Form

Anatek Labs, Inc.

Chain of Custody Record

1282 Alturas Drive, Moscow ID 83843 (208) 883-2839 FAX 882-9246
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999 FAX 838-4433

Anatek
Log-In #

Company Name:	Project Manager:
Address:	Project Name & # :
City: State: Zip:	Email Address :
Phone:	Purchase Order #:
Fax:	Sampler Name & phone:

Turn Around Time & Reporting

Please refer to our normal turn around times at:
http://www.anateklabs.com/services/guidelines/reporting.asp

__Normal
__Next Day*
__2nd Day*
__Other*_____

*All rush order requests must be prior approved.

__Phone
__Mail
__Fax
__Email

Provide Sample Description / List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume	Preservative:									

Note Special Instructions/Comments

Inspection Checklist

Received Intact?	Y	N
Labels & Chain Agree?	Y	N
Containers Sealed?	Y	N
VOC Head Space?	Y	N

Temperature (C): _____

Preservative: _____

Inspected By: _____

Date & Time:

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Appendix C

Quick Reference for Chemical Safety

ACIDS	Hazards	First Aid (Skin)	Fire-Fighting	Spillage
Acetic Acid (CH_3COOH)	Flammable, corrosive	Water spray	CO_2, Powder	Neutralize with weak base
Hydrochloric acid (HCl) (concentrated)	Not combustible, corrosive	Rinse with plenty of water	Any extinguishing agent	Report to supervisor
Hydrochloric acid (HCl) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Hydrofluoric Acid (HF) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Report to supervisor
Hydrofluoric Acid (HF) (diluted 30%<)	Corrosive, not combustible	Rinse with plenty of water	NO hydrous agent	Neutralize with weak base
Nitric Acid (HNO_3) (concentrated)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Report to supervisor
Nitric Acid (HNO_3) (diluted, 50%<)	Corrosive, not combustible	Rinse with plenty of water	NO FOAM	Neutralize with weak base
Phosphoric Acid (H_3PO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak base
Sulfuric Acid (H_2SO_4) (diluted or concentrated)	Corrosive, not combustible	Rinse with plenty of water	Powder, CO_2, NO WATER	Neutralize with weak base
BASES				
Ammonium Hydroxide (NH_4OH)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid

(diluted)				
Potassium Hydroxide (KOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
Sodium Hydroxide (NaOH) (diluted)	Corrosive, not combustible	Rinse with plenty of water	Any extinguishing agent	Neutralize with weak acid
SOLVENTS	**Hazards**	**First Aid (Skin)**	**Fire-Fighting**	**Spillage**
Acetone	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
Acetonitrile	Flammable	Rinse with plenty of water	CO_2, Powder	Ventilate, Collect in container
Carbon Disulfide	Highly flammable	Rinse with plenty of water	CO_2, Powder	Evacuate, report to supervisor
Chloroform	Drowsiness, not combustible	Rinse with plenty of water	Any extinguishing agent	Evacuate, Collect in container
Diethyl Ether	Extremely flammable, drowsiness	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Collect in container
Ethyl Acetate	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container
Ethylene Glycol	Combustible	Rinse with water	CO_2, Powder	Collect in container
Hexane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
Hydrogen Peroxide	Corrosive, not combustible	Rinse with plenty of water	Water	Ventilate, wash with plenty of water
Isooctane	Drowsiness, Highly flammable	Rinse with water	CO_2, Powder	Evacuate, Collect in container

Methanol	Highly flammable	Rinse with water	CO_2, Powder, Water	Evacuate, Collect in container
Methylene Chloride	Drowsiness, combustible	Rinse with water	Any extinguishing agent	Ventilate, Collect in container
MTBE	Highly flammable	Rinse with water	CO_2, Powder	Ventilate, Collect in container
THF	Highly flammable	Rinse with water	CO_2, Powder, Water	Ventilate, Collect in container
Toluene	Highly flammable	Rinse with water	CO_2, Powder	Collect in container

Appendix D

Laboratory Management and Staff CVs/Qualifications

ANATEK LABS, INC.

MIKE PEARSON
MIKE@ANATEKLABS.COM

EXPERIENCE

08/00– Present **Laboratory Manager**, Alturas Analytics, Inc, Moscow, ID
Manages and initiates experiments in the laboratory including:
Develops and directs employees in the development of HPLC/MS/MS methods,
Maintains analytical equipment, supervise scientific employees, perform HPLC/MS/MS quantitation of drugs and other compounds from various matrices, develops HPLC/MS/MS methods

03/92- Present **Laboratory Director**, Anatek Labs, Inc., Moscow, ID
Directs all aspects of the laboratory including:
Supervise scientific and administrative personnel, develop business plan and marketing strategy, prepare and analyze budgets, bid contracts

09/87-03/92 **Instrumentation Specialist**, Precision Analytics, Pullman, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Ion Chromatography and Flow Injection Analysis
- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Method development and analysis of small molecule organic and inorganic compounds using the above techniques
- Extractions and wet chemistry including solid and liquid phase extraction techniques

EDUCATION

BS in Electrical Engineering, University of Idaho, Moscow, ID, 1987

ANATEK LABS, INC.

JOHN W. CODDINGTON
JOHN@ANATEKLABS.COM

EXPERIENCE

1999 – Present **Laboratory Manager**, Anatek Labs, Inc, Moscow, ID
Responsible for all aspects of day-to-day operation of a full service analytical laboratory. Typical duties include training junior level staff, preparing bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines, and customer relations.

1997 – 1999 **Research Associate**, Washington State University, Pullman, WA.

1995 – 1997 **Teaching Assistant**, Washington State University, Pullman, WA

1993 – 1995 **Research Assistant**, Washington State University, Pullman, WA

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Ion Chromatography and Flow Injection Analysis
- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Method development and analysis of small molecule organic and inorganic compounds using the above techniques
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- NMR and IR for characterization of organic and inorganic compounds
- Inorganic and Organic synthetic methods

EDUCATION

Ph.D. in Chemistry, Washington State University, Pullman, WA, 1997
BS in Chemistry, Oregon State University, Corvallis, OR, 1993

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society – Member since 1993
Edward Wagner Memorial Scholarship, Washington State University, 1996

PUBLICATIONS AND REFERENCES

Primary author on 8 publications in refereed ACS journals from 1996-2001 – available upon request

References available upon request

ANATEK LABS, INC.

ERIN LINSKEY
ERIN@ANATEKLABS.COM

EXPERIENCE

7/02 – Present **Inorganic Supervisor, Chemist III**, Anatek Labs, Inc, Moscow, ID
Typical duties include training junior level staff, editing and improving analytical procedures and coordinating Inorganic department, troubleshooting methods and analytical instruments. Responsible for performing preparation and analysis of trace and ultra trace metal levels in samples.

9/98 – 7/02 **Analyst/Lab Technician**, Anatek Labs, Inc, Moscow, ID

9/97 – 5/98 **Lab Technician**, Stukenholtz Laboratory, Twin Falls, ID

SKILLS AND TECHNIQUES

- ICP-MS, Atomic Absorption/Atomic Emission spectroscopy AA and AE
- CVAFS – Cold vapor atomic fluorescence spectroscopy
- Ion Chromatography IC
- Flow Injection Analysis FIA
- Wet Chemistry and Microbiology

EDUCATION

BS in Biology, Minor History, University of Idaho, Moscow, ID, 2000

AWARDS AND PROFESSIONAL AFFILIATIONS

National Dean's List, member, 2000 - present
American Red Cross, Certified First Responder, 1999 – present
Presidential Award for Academic Achievement, 1993

ANATEK LABS INC.
GENE M. SOLOMON
GENES@ANATEKLABS.COM

EXPERIENCE

8/04 – Present **QA/QC Officer**, Anatek Labs, Inc., Moscow, ID
Responsible for maintaining company QA Plan, SOPs, and training records. Responsible for ordering and organizing PE samples, performing internal audits and acting as liaison to the Quality departments of the various certifying agencies (IDOH, WADOH, WADOE, etc.)

8/04 – Present **QA/QC Officer**, Alturas Analytics, Inc., Moscow, ID
Responsible for maintaining company SOPs, and training records. Responsible for performing internal audits of all GLP studies. Company Safety Officer.

8/94 – Present **GMP Software Consultant & Trainer**, self-employed, worldwide

1/95 – Present **Technical Writer/Editor**, self-employed, various locations

1/92 – 8/94 **Customer Service Manager**, Blue Mountain Software, State College, PA

EDUCATION

B.A. in Economics with High Honors, University of Montana, Missoula, 1988

LABORATORY QA/QC EXPERIENCE

QA Officer, Anatek Labs, Inc./Alturas Analytics, Inc. Aug 2004 – present

- Maintain master schedule per GLP guidelines
- Maintain audit checklist per GLP guidelines
- Ensure that laboratory and appropriate studies are GLP compliant
- Inspect study binders as needed for GLP studies
- Report study deficiencies to the President and Study Director
- Perform QA audits as per SOP and NELAC guidelines
- Suggests and implements changes to SOP's
- Maintains all Administrative SOP's
- Ensure that SOP's are followed
- Maintains QA Plan per NELAC and State regulations
- Perform annual audits to ensure compliance with NELAC

PROFESSIONAL MEMBERSHIP

Member Pacific Regional Chapter of the Society of Quality Assurance, Aug 2004 – present
Associate Member of the Society of Quality Assurance, Aug 2004 – present

ANATEK LABS, INC.
TODD TARUSCIO
TODDT@ANATEKLABS.COM

EXPERIENCE

2006– Present	**Technical Director**, Anatek Labs, Inc, Moscow, ID Manage and coordinate activities of laboratory departments, assuring objectives of the QA Plan are met. Provide technical support to laboratory staff, and investigate new methods and technologies. Responsible for non-routine instrument maintenance. Write reports and work with customers as necessary.
1999 – 2006	Organic Group Leader/Manager, Analytical Sciences Laboratory, Dept. of Food Science and Toxicology, University of Idaho, Moscow, ID General & direct supervision of scientists & technicians performing organic analysis, including pesticides, herbicides, and other compounds in biological and environmental samples. Also responsible for QA/QC oversight and Good Laboratory Practice compliance.
1994-1999	Laboratory Manager, Anatek Labs, Inc., Moscow, ID Managed full service environmental laboratory, including inorganic and organic analyses of water and soil samples.
1989-1994	Teaching Assistant, Dept. of Zoology, Washington State University, Pullman Organized, supervised, and lectured in physiology courses, including human, mammalian, and cell physiology.

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, FID, NPD detection
- Gas Chromatography/Mass spectrometry (GC/MS), and tandem mass spectrometry (GC/MS/MS)
- HPLC with UV and Fluorescence detection and post column reaction techniques
- Liquid Chromatography with tandem mass spectrometry (LC/MS/MS)
- Ion Chromatography
- Residue analysis, method development and validation, technical report writing, personnel management
- Extractions and wet chemistry including solid and liquid phase extraction techniques

EDUCATION

Ph.D in Zoophysiology, Washington State University, Pullman, 1994

B.S. in Biochemistry, Washington State University, Pullman, 1989

ANATEK LABS INC.
KATHLEEN A. SATTLER
KATHY@ANATEKLABS.COM

EXPERIENCE

10/01 – Present **Laboratory Manager**, Anatek Labs, Inc., Spokane, WA
Responsible for all aspects of day-to-day operation of a full service analytical laboratory. Typical duties include training junior level staff, preparing bids and reports, troubleshooting methods and analytical instruments, and developing new methods per customer guidelines, and customer relations.

07/96 – 10/01 **Microbiology Supervisor**, Anatek Labs, Inc., Spokane, WA

10/96 – 02/97 **Laboratory Assistant**, Sacred Heart Medical Center, Spokane, WA

07/95 – 07/96 **Microbiologist I**, Bremerton-Kitsap County Health District, Bremerton, WA

SKILLS AND TECHNIQUES

- Bacteria cultures, isolation, identification
- Membrane filtration
- Multiple tube fermentation
- Heterotrophic plate count
- Bacteriological examination of water
- Proficient with aseptic technique
- Nutrient agar preparation
- Centrifugation and separation of blood for testing
- Spectrophotometry
- Dilutions, titrations
- Urine analysis
- Quality control and Quality analysis

EDUCATION

B.S. in Microbiology, Minor in Chemistry, University of Idaho, 1994

Professional Affiliations

American Water Works Association Member
AWWA Inland Empire Subsection Member

ANATEK LABS INC.
MELISSA J. LEWIS
MELISSA@ANATEKLABS.COM

EXPERIENCE

01/03 – Present	**QA/QC Officer**, Anatek Labs, Inc., Spokane, WA Responsible for the QA/QC plan, writing and reviewing SOP's, keeping the current SOP's in the system. Also responsible for the QC of data packages. Report the PT's to the correct agencies and order the PT studies. Keep track of pipet calibrations and thermometer checks.
01/02 – Present	**Laboratory Technician III**, Anatek Labs, Inc., Spokane, WA Responsible for HCID and TPH-D and TPH-Dx in all matrices on the GC/FID. Responsible for troubleshooting and maintenance of instruments. Responsible for Sulfide in water, Carbon Dioxide, Total Residual Chlorine and other miscellaneous testing. Write reports for customers and customer service.
05/00 – 09/01	**Scientific Aide**, University of Idaho, Moscow, ID
11/98 – 05/00	**Laboratory Assistant**, University of Idaho, Moscow, ID

SKILLS AND TECHNIQUES

- HPLC, GC-MS, ECD, NPD, IC, FID
- COD's
- Coliform MPN methods
- Nutrient agar preparation
- Heterotrophic plate count
- Spectrophotometry
- Dilutions, titrations
- Quality control and Quality analysis
- Wet chemistry: pH, Alkalinity, TDS, TSS, Conductivity, BOD, Turbidity, TRC, Sulfide
- Organic analysis: PCB's, HCID, TPH-D, TPH-Dx
- Liquid phase extractions and solid phase extractions
- Familiar with FDA GLP (Good Laboratory Practice) Regulations
- Veterinary toxicology – Aflitoxins, Ionophores, Strychnine, ACHE
- Instrument Maintenance

EDUCATION

B.S. in General Studies in Natural Sciences, Lewis Clark State College, 1996

ANATEK LABS INC.
WENDY OZMINKOWSKI
WENDYO@ANATEKLABS.COM

EXPERIENCE

2004 – Present	**Chemist III,** Anatek Labs, Inc., Spokane, WA Responsible for TOX's, G/BTEX, VOC's, VPH's, OxyFuels, Ion analysis and BTU's. Responsible for troubleshooting and repair of instruments and methods.
2002 – 2004	**Organic Chemistry Supervisor**, SVL Analytical, Inc., Kellogg, ID
1998 – 2002	**Organic Chemist I**, SVL Analytical, Inc., Kellogg, ID
1998	**Laboratory Technician,** Quality Coatings, Post Falls, ID
1993 – 1995	**Laboratory Technician**, North Idaho College, Coeur d'Alene, ID

SKILLS AND TECHNIQUES

- Gas Chromatography (GC) with ECD, ELCD, FID, PID detection
- Gas Chromatography/Mass spectrometry (GC/MS)
- Ion Chromatography (IC)
- Extractions and wet chemistry including solid and liquid phase extraction techniques
- Dohrmann Phoenix 8000 NDIR
- TOX 10

EDUCATION

B.S. in Chemistry, University of Idaho, 1996

AWARDS AND PROFESSIONAL AFFILIATIONS

American Chemical Society, 2000-2004

ANATEK LABS INC.

KARICE T. SCOTT
KARICES@ANATEKLABS.COM

EXPERIENCE

10/03 – Present **Sample Custodian**, Anatek Labs, Inc., Spokane, WA
Responsibilities include sample receipt/processing, customer service and general office.

09/95-05/03 **Social Activities Director**, The Spokane Club, Spokane, WA

SKILLS AND TECHNIQUES

- Microsoft Office applications
- Sample handling
- Database maintenance
- Customer relations
- Shipping and receiving

EDUCATION

Business Skills Certificate, Spokane Falls Community College, 1992

ANATEK LABS INC.
ANDREW P. MENDEZ
ANDREWM@ANATEKLABS.COM

EXPERIENCE

2/11 – Present **Radiation Safety Officer**, Anatek Labs, Inc., Spokane, WA
Responsibilities: Preparation/implementation of radiochemistry division
Overseeing safe use/transport of radioactive material
Radionuclide analysis of drinking water

10/09 - Present **Chemist I**, Anatek Labs, Inc., Spokane, WA
Responsibilities: Analysis of PCB's in all matrices on the GC/ECD.
Variety of Wet Chem. analyses
Troubleshooting and maintenance of instruments.
General lab maintenance

8/08-5/09 **Lab Assistant,** Carroll College, Helena, MT
Responsibilities: Setup, monitoring, and cleanup of routine experiments
Reagent preparation

SKILLS AND TECHNIQUES

- ICP-MS, GC-ECD, IPC
- Spectrophotometry
- Preparation/implementation of wide range of SOPs
- Dilutions, titrations
- Liquid phase extractions and solid phase extractions
- Wet chemistry: pH (in soil, drinking and wastewater and other matrices), Alkalinity, TDS, Hardness, Conductivity, Turbidity, Color
- Quality control and Quality analysis
- Instrument Maintenance
- Gas Proportional Counter

EDUCATION

B.A. in Chemistry and Spanish, Carroll College, 2009

ANATEK LABS INC.
KATIE ANDERSON
KATIEA@ANATEKLABS.COM

EXPERIENCE

6/09 - Present **Chemist I**, Anatek Labs, Inc., Spokane, WA
Responsible for Resistivity, Hardness, Cyanide
Responsible for Coliform MPN method, and Coliform Presence/Absence Method
Responsible for Metals on ICP-MS

6/08-9/08 **Summer Intern**, Washington State Patrol Crime Lab, Marysville, WA

SKILLS AND TECHNIQUES

- pH Probe
- Turbidimeter
- Cyanide Probe
- Coliform MPN Method
- Coliform Presence/Absence Method
- Wet chemistry: Alkalinity, TSS, TDS, Acidity, Hardness, Cyanide, pH, Turbidity, Color, Resistivity, Conductivity
- Quality control and Quality analysis
- Dilutions and titrations
- Heterotrophic plate count
- ICP-MS
- IC
- Preparation of Media
- ABI 300
- PCR Amplification
- Diamond Head FD-IR

EDUCATION

B.S. in Biochemistry – Forensic Sciences, Eastern Washington University, 2009

Appendix E

Current State Certifications – Moscow, ID

Idaho Department of Health (EPA ID00013)
Washington Department of Ecology (C1320)
Florida Department of Health (NELAP #E87893)
(Primary Accrediting Authority for NELAP)
Oregon Department of Environmental Quality (ORELAP # ID200001)
Nevada Department of Conservation and Natural Resources (ID00013)
Montana Department of Public Health and Human Services (CERT0028)
New Mexico Environment Department, Drinking Water Bureau (ID00013)
Colorado Department of Public Health and Environment (ID00013)
Arizona Department of Health Services (AZ0701)
Indiana State Department of Health (C-ID-01)
Kentucky Department for Environmental Protection (90142)
EPA Region 8 / Wyoming (EPA ID00013)

Current State Certifications – Spokane, WA

Washington Department of Ecology (C1287)
Idaho Department of Health (EPA WA00169)
Montana Department of Public Health and Human Services (CERT0095)

Current State Certificates and Scopes available upon request

Appendix F

Backup, Fault Tolerance, Disaster Recovery and Data Archive of Mission-critical Information Storage and Services

Bo Cheng
Information Systems Manager

Updated 6/1/2007

Introductions

Mission-critical information storage and services are those that a business cannot afford to lose. Loss of such data or interruption of such services will seriously impact the daily operations of the business and incurs monetary loss.

Fault Tolerance

Fault tolerance in data storage involves redundant storage disks to tolerate certain faults in the hardware. For example, in RAID 5 implementation, in case of failure of one disk, the remaining disks in the array still maintain the data. But the array is in a critical state and its performance is greatly reduced, until the failed disk is replaced and the array is rebuilt.

Fault tolerance only tolerates hardware faults. It does not cover human or application software faults. For example, accidental or intentional deletion by operators or file damage caused by misbehaving applications is not covered by fault tolerance. So fault tolerance is by no means the replacement of backup.

Backup

Backup is the process of copying important data files to backup devices, usually tapes or disks, to create an extra copy. In case of loss of or damage to these files, they can be restored. Backup is usually a recurring job scheduled at off-peak hours.

Since tapes are data stream devices, files cannot be read off tapes directly by application. Files have to be restored to disks before they can be accessed. Because tape drives, compared with disks, are slow, file restore can be time consuming. But tapes offer the largest capacity and low cost per GB capacity.

The latest trend in the technology is the use of D2D (disk-to-disk) backup. The D2D become practical and economically feasible as a result of ever increasing capacity of disks and the decreasing of cost per GB for disks. D2D backup is a near-line backup that offers fast restore. The disadvantage is D2D backup is usually on-site thus total loss of the server room will destroy both the active data and the backup. Anatek Labs currently uses combination of D2D and traditional tape backup, in which the data files are backed up by D2D to backup disks and subsequently the backup disks are copied onto tapes. We believe this approach has the benefits of both D2D and tape backup technology.

In general, backup cannot copy certain system files and open database files e.g. SQL databases and Exchange Information Store. The latter problem can be worked around by using the database's own backup utility to create file backup on the disk first then copying it to tapes.

Disaster Recovery

Disaster is an incident of loss of the server operating system due to hardware or software failure, not just data files.

Generally backup works well only on loss of regular data files. In case of loss of the server system, i.e., the operating system crashes, the server cannot be effectively rebuilt from tape backup, because the server must be up and running before the data can be restored. Since backup fails to copy certain system files, many services must be installed and configured manually in case of server crash, before data files can be restored. Rebuilding a server in such a way is time consuming and the rebuilt system may not be exactly the same as the original. If the rebuild is done in a hurry due to time constraints, some minor functionality may be missing or misconfigured and user complaints will result.

A disaster recovery plan involves capturing the server's entire disk or partition into an image, disregarding its internal file structure, while the server is offline. In case of total failure of a server, the system can be quickly rebuilt from the image, provided failed hardware, if any, has been replaced.

As imaging of a server requires taking it down, it is usually not a recurring job. It is done once after major configuration changes are made to the server and the server is running stably.

Data Archive

Infrequently used older data should be archived onto tapes or optical disks. Data archive serves dual purposes. It frees online disk storage, and, if it is still necessary to put a copy online, the archive provides a backup.

Again, tapes have the largest capacity but are slow to retrieve. Modern optical disks, e.g. writable CD and DVD offer large capacity and fast retrieval at an attractive price, plus, such storage is considered permanent.

Identification of mission-critical information storage and services

Analytical data and results acquired by the instruments:

They reside on a Snap server. Snap is a NAS (Network Attached Storage) server that has its own proprietary operating system and file system. It provides network shares for many common operating systems including Windows and Macintosh. Current and recent data files are in \Data share. Older files are archived in \Data_Archive share, with subdirectories named after the month/year when archiving was performed.

SQL Server running on Windows server:

SQL server databases for LIMS and other miscellaneous databases: LIMS databases provide data entry, storage and reporting. databases and their logs reside on redundant disk drive arrays. Further, database files and log files reside on separate disk spindles for maximum recoverability in case of disk failure.

Exchange Server running on Windows server:

Provides e-mail, tasking, scheduling and other collaborating functions to the company.

Exchange Information Store, including employees' mailboxes and public folders:
All public/private databases and their logs reside on redundant disk drive arrays. Further, database files and log files reside on separate disk spindles for maximum recoverability in case of disk failure.

Windows Domain Controller Server:

Provides domain user logon. It is also the platform on which SQL, Exchange, Web and other services.

Windows File Server:

Provide general file service for user shares.

IIS on Windows Server:

Provides a web service for Internet, Intranet and Extranet.

QuickBooks company files on Windows File Server:

Stores all accounting information of the company, including banking, purchasing, receivable, payable and payroll. They are stored on the RAID disk of Windows file server.

Data security/integrity implementations

Fault Tolerance

The Snap server network storage has four physical disks configured as a RAID 5 array. This configuration protects against single disk failure. The disks are not hot swappable.

All Windows Servers have been configured with RAID 5 or RAID 10 for storage of critical data files. All disks are hot swappable. The domain controller has redundant power supply.

Backup

The backup software currently in use is ArcServe 2000 and Windows 2000/XP NTbackup utility. Backup hardware is the combination of hard disks on a few workstations for D2D backup, and a 160GB DLT tape drive on a dedicated tape backup server. ArcServe 2000 and the tape drive are on a Windows 2000 computer that serves as dedicated tape server. Ntbackup is running on this and another Windows 2000 machine does D2D part of backup. Both machines are located in the server room.

ArcServer does not backup the SQL and Exchange databases on the Windows server when they are open and in use. To backup the open database files, SQL built-in backup utility and Exchange plug-in for Ntbackup are used to backup those databases to disk files first, which is picked up normal tape backup. At least three sets of tape media are in the media pool for rotation.

Disaster recovery

We have Symantec Ghost 7.5 as imaging tool. The entire hard disks of the Windows servers and majority of workstations have been taken as a snapshot. The images of those disks were either burned onto DVD disks or storage on removable drives.

As imaging the servers needs to take them off line, the imaging is not a regularly scheduled task. However, when major changes are made to servers, re-imaging should be done once the servers have been tested to be running satisfactorily.

Workstation imaging is updated when there is major configuration change in hardware or software.

Data archiving

The older data file on analytical data storage server (older than 6 or 12 months, as dictated by data volume) are moved to different locations on the Snap server at intervals of 6 or 12 months, or when deemed necessary. These locations are read-only for regular users. Due to their static nature these files are not backed up on a regular basis. Instead, when the files are moved into such locations, they are zipped and burned onto DVD/CD disks as permanent archive. The permanent archive has two copies, one kept on-site and another off-site. The DVD/CD disks, if properly stored, should have a lift time of at least 50 years. A few randomly selected DVD/CD disks are checked for readability annually to ensure the availability of older data files.

A copy of the old data files kept in the read-only area stays on line, as long as the storage server has enough space for them. When the space approaches depletion, the oldest files will be purged.

The locations for the older data are secured so only system administrators can change them. All regular users have read only permission.

Summary

We have hardware redundancy to protect against disk failure for the most important data. Backup scheme is a combination of D2D and tape technology, which offers both off-site backup media storage and fast restore. The tape backup is up to one week old. The servers and majority of workstations are imaged for quick disaster recovery. Data archiving is done on a regular basis and two permanent copies of archived data are kept.

Appendix G

Control Chart Information

Control Charting

Control charting is a useful way to determine accuracy and precision data for specific repeated recovery calculations (surrogates, LFBs, CCVs, etc.). It is most useful to calculate acceptance criteria from the most recent data, and allows comparison to written method requirements if they exist.

At minimum, control charts must be made for control standards. For methods that require the addition of surrogate compounds, control charts are also required for the surrogate recoveries.

Definitions: Let X_1, X_2, X_3, X_4,.....X_n ($n \geq 20$) represent the first n time ordered determinations for an analyte, and then define the following:

$$X = \text{average} = \frac{1}{n}\,(X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots + X_n)$$

$$S = \text{Standard Deviation of the Group} = \left[\frac{\Sigma(X_n - X)^2}{n-1}\right]^{\frac{1}{2}}$$

Based on the average and standard deviation information of this n number of trials a control chart can be plotted using the formulas outlined in Table 1. An example of a control chart is shown in Figure 1 with X = 99 % and S = 4 %. Such plot can then be used to determine if one or a set of trial is out of control.

Table 1: Control Chart Formula.

Parameter	**Symbol**	**Formula**
Centerline	CL	X
Upper Control Limit	UCL	X + 3S
Lower Control Limit	LCL	X – 3S
Upper Warning Limit	UWL	X + 2S
Lower Warning Limit	LWL	X – 2S

Criteria for an Out-of-Control Situation

A process is considered out of statistical control whenever one of the following conditions is demonstrated from control charting.

a. Any one point is outside of the control limits.

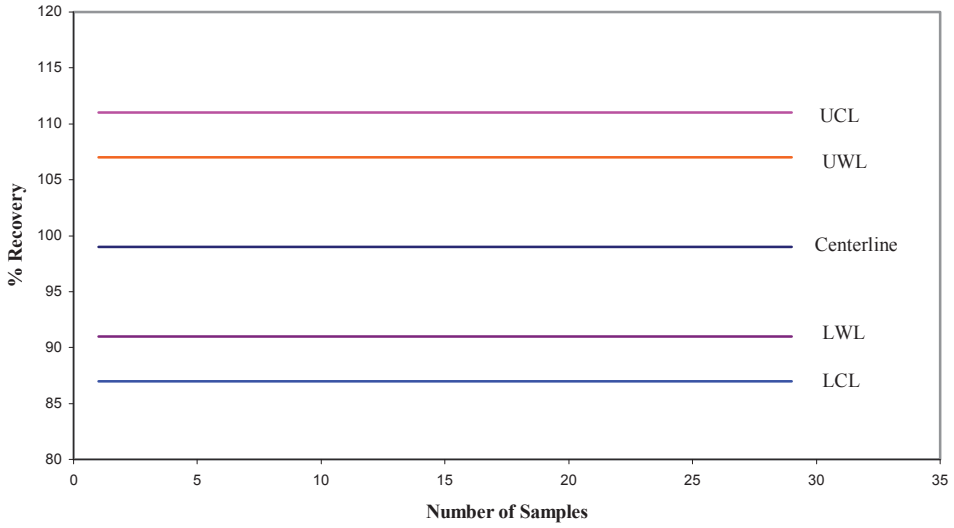
b. Any three consecutive points are outside the warning limits.

c. Any ten consecutive points are on the same side of the centerline.

d. Any six consecutive points are such that each deviation is greater than its predecessor.

e. Any obvious cyclic pattern is seen in the points.

Figure 1: A sample control chart.



Corrective Action

When a process is out of control as determined by control chart monitoring, an immediate solution must be found before processing more samples. An example might be the slow deterioration of the PID lamp, which might cause recoveries to slowly decrease. This problem may easily be remedied by more frequent cleaning or perhaps more frequent calibration.

Appendix H

Method Detection Limit

USEPA DEFINITION AND METHOD FOR MDL

From: 40 CFR (7–1–95 Edition) Part 136, Appendix B

APPENDIX B TO PART 136 — DEFINITION AND PROCEDURE FOR THE DETERMINATION OF THE METHOD DETECTION LIMIT — REVISION 1.11

Definition

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Scope and Application

This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete, specific, and well defined analytical method. It is essential that all sample processing steps of the analytical method be included in the determination of the method detection limit. The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample. The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device- or instrument-independent.

Procedure

1. Make an estimate of the detection limit using one of the following:
(a) The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5.

(b) The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

(c) That region of the standard curve where there is a significant change in sensitivity, i.e., a break in the slope of the standard curve. (d) Instrumental limitations. It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the initial estimate of the detection limit.

2. Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferent concentrations are not detected at the method detection limit of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferent). The

interferent concentration is presupposed to be normally distributed in representative samples of a given matrix.

3. (a) If the MDL is to be determined in reagent (blank) water, prepare a laboratory standard (analyte in reagent water) at a concentration which is at least equal to or in the same concentration range as the estimated method detection limit. (Recommend between 1 and 5 times the estimated method detection limit.) Proceed to Step 4.

(b) If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated detection limit, proceed to Step 4. If the measured level of analyte is less than the estimated detection limit, add a known amount of analyte to bring the level of analyte between one and five times the estimated detection limit. If the measured level of analyte is greater than five times the estimated detection limit, there are two options.

> (1) Obtain another sample with a lower level of analyte in the same matrix if possible.
>
> (2) The sample may be used as is for determining the method detection limit if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes as the analyte concentration increases from the MDL, hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

4. (a) Take a minimum of seven aliquots of the sample to be used to calculate the method detection limit and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

(b) It may be economically and technically desirable to evaluate the estimated method detection limit before proceeding with 4a. This will: (1) Prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an inflated MDL will be calculated from data obtained at many times the real MDL even though the level of analyte is less than five times the calculated method detection limit. To insure that the estimate of the method detection limit is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower method detection limit. Take two aliquots of the sample to be used to calculate the method detection limit and process each through the entire method, including blank measurements as described above in 4a. Evaluate these data: (1) If these measurements indicate the sample is in desirable range for determination of the MDL, take five additional aliquots and proceed. Use all seven measurements for calculation of the MDL. (2) If these measurements indicate the sample is not in correct range, reestimate the MDL, obtain new sample as in

3 and repeat either 4a or 4b.

5. Calculate the variance (S2) and standard deviation (S) of the replicate measurements, as follows:

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \left(\frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right)\right]$$

$$s = (s^2)^{1/2}$$

where: Xi; i = 1 to n, are the analytical results in the final method reporting units obtained from the n sample aliquots and
S refers to the sum of the X values from i = 1 to n.

6. (a) Compute the MDL as follows:

MDL = t(n-1, 1-alpha = 0.99) (S)

where: MDL = the method detection limit
t(n-1, 1-alpha = .99) = the students' t value appropriate for a 99% confidence level and alpha standard deviation estimate with n-1 degrees of freedom. See Table.
S = standard deviation of the replicate analyses.

(b) The 95% confidence interval estimates for the MDL derived in 6a are computed according to the following equations derived from percentiles of the chi square over degrees of freedom distribution (X^2/df).

LCL = 0.64 MDL
UCL = 2.20 MDL

where: LCL and UCL are the lower and upper 95% confidence limits respectively based on seven aliquots.

7. Optional iterative procedure to verify the reasonableness of the estimate of the MDL and subsequent MDL determinations.

(a) If this is the initial attempt to compute MDL based on the estimate of MDL formulated in Step 1, take the MDL as calculated in Step 6, spike the matrix at this calculated MDL and proceed through the procedure starting with Step 4.

(b) If this is the second or later iteration of the MDL calculation, use S^2 from the current MDL calculation and S^2 from the previous MDL calculation to compute the F-ratio. The F-ratio is calculated by substituting the larger S^2 into the numerator S^2_A and the other into

the denominator S^2_B. The computed F-ratio is then compared with the F-ratio found in the table which is 3.05 as follows: if $S^2_A / S^2_B < 3.05$, then compute the pooled standard deviation by the following equation:

$S_{pooled} = [(6S^2_A = 6S^2_B) / 12]^{1/2}$

if $S^2_A / S^2_B > 3.05$, respike at the most recent calculated MDL and process the samples through the procedure starting with Step 4. If the most recent calculated MDL does not permit qualitative identification when samples are spiked at that level, report the MDL as a concentration between the current and previous MDL which permits qualitative identification.

(c) Use the Spooled as calculated in 7b to compute the final MDL according to the following equation:

$MDL = 2.681 (S_{pooled})$

where 2.681 is equal to t(12, 1-alpha = .99).

(d) The 95% confidence limits for MDL derived in 7c are computed according to the following equations derived from percentiles of the chi squared over degrees of freedom distribution.

LCL = 0.72 MDL
UCL = 1.65 MDL

where LCL and UCL are the lower and upper 95% confidence limits respectively based on 14 aliquots.

TABLES OF STUDENTS' t VALUES AT THE 99 PERCENT CONFIDENCE LEVEL

Number of replicates	Degrees of freedom (n-1)	t(n-1, .99)
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
61	60	2.390
00	00	2.326

Reporting

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units. If the analytical method permits options which affect the method detection limit, these conditions must be specified with the MDL value. The sample matrix used to determine the MDL must also be identified with MDL value. Re-port the mean analyte level with the MDL and indicate if the MDL procedure was iterated. If a laboratory standard or a sample that contained a known amount analyte was used for this determination, also report the mean recovery. If the level of analyte in the sample was below the determined MDL or exceeds 10 times the MDL of the analyte in reagent water, do not report a value for the MDL. [49 FR 43430, Oct. 26, 1984; 50 FR 694, 696, Jan. 4, 1985, as amended at 51 FR 23703, June 30, 1986]

Interpretation of Data Index
Pesticide National Synthesis Project Home Page
Contact: Robert J. Gilliom, rgilliom@usgs.gov
Maintained: Tamara Shelton, tshelton@usgs.gov
URL: ***http://ca.water.usgs.gov/pnsp/rep/interpret/.html***
Last Modified: Thu Feb 17 2000

Appendix I

CALIBRATION METHODS AND EQUATIONS

This chapter provides an overview of calibration models and equations commonly used by methods performed at Anatek Labs, Inc. Calibration information is provided here as a reference, so that definitions and equations do not have to be provided in each individual analytical SOP. Review of this information shall be considered adequate on-going training in calibration models and equations.

This chapter consists of the following sections:

- Definitions
- General Criteria for All Calibration Models
- External Standard Calibration
- Internal Standard Calibration
- Response/Calibration Factor Model
- Linear Calibration Using A Least Square Regression
- Weighted Least Squares Regression

DEFINITIONS

Calibration can be defined in several ways:

- **Reference standards with known values for selected points covering the chosen concentration range are measured with the instrument. A functional relationship is then established between the values of the standards and the corresponding measurements.**

- **Calibration: set of operations that establish, under specific conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards.**

Instrument calibration is intended to eliminate or reduce bias in an instrument's readings over a range for all continuous values.

Precision is a measure of the degree of agreement among replicate analyses of a sample, usually expressed as a standard deviation.

Bias is consistent deviation of measured values from the true value, caused by systematic errors in a procedure.

Accuracy is the combination of bias and precision of an analytical procedure, which reflects the closeness of a measured value to a true value

An acceptable calibration assures that an instrument will produce results which meet or exceed some defined criteria with a specified degree of confidence.

GENERAL CRITERIA FOR ALL CALIBRATION MODELS

- **Mid-points cannot be dropped to meet criteria**
- **Points can be reanalyzed, original run must be discarded**
- **Analyzing additional standards and discarding some to achieve a better correlation coefficient value is prohibited**
- **Narrowing of curve on either end is allowed**

Initial Calibration

Perform initial calibration with a minimum of three concentrations of standards for linear curve, a minimum of five concentrations for nonlinear curves, or as specified by the method of choice.

At the beginning of each day that samples are to be analyzed, a calibration curve covering the sample concentration range and all target analytes should be generated according to the approved SOP. Depending on concentration ranges, the curve should be composed of three or more points. The reporting limit should be included in the calibration range.

Daily Verification Standard

Where the determinative time is extensive and the instrument is very stable, the calibration curve should be initially developed. Thereafter, each day analyses are performed, this curve should be verified by analysis of at least one standard for each of the target analytes at the expected concentration range. This verification should be done at both the beginning and end of the analyses.

Calibration Plot

A working curve is a plot of the instrument response as a function of analyte concentration. The concentration of an unknown sample is determined by correlating its response to the mathematical relationship of concentration to the instrument response established by the curve.

Response Factor/Calibration Factor

Both calibration factors and response factors are measures of the slope of the calibration relationship. Each calibration or response factor represents the slope of the line between the response for a given standard and the origin. Under ideal conditions, the factors will not vary with the concentration of the standard. In practice, some variation is to be expected.

If response factors or calibration factors are used, the calculated % RSD for each analyte of interest must be less than or equal the method-specified value. Refer to the applicable method for the calibration procedure and acceptance criteria on the response factors or calibration factors for each analyte.

Correlation Coefficient

The correlation coefficient is a measure of the degree with which the independent variable and its partner move either together or in opposition. A positive result indicates direct correlation and a negative result indicates an inverse correlation.

If linear regression is used, use the minimum correlation coefficient specified in the method. If the minimum correlation coefficient is not specified then a minimum value of 0.995 is recommended. The appropriate linear or nonlinear correlation coefficient for standard concentration to instrument response should be > 0.995.

It is not necessarily true that a relationship measured by r is meaningful. There must be a rational relationship of the two variables under investigation.

The sample on which the data is based must be large enough to ensure that the influence of chance causes of variation is minimized.

Coefficient of Determination

In a correlation analysis, r2 (occasionally called the "correlation index") may be calculated most simply by squaring the correlation coefficient, r. It may be described as the amount of variability in one of the variables accounted for by correlating that variable with the second variable. As in regression analysis, r2 may be considered to be a measure of the strength of the straight-line relationship. In order for the linear regression model to be used for quantitative purposes, r, COD, or r2 must be greater than or equal to 0.99

EXTERNAL STANDARD CALIBRATION

For an external standard quantitation, known data from a calibration standard and unknown data from the sample are combined to generate a quantitative report.

It is called external standard because the standard or known material is separate or external to the unknown material. External standard calibration is one of the most common approaches to calibrations. It involves a simple comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards.

Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards. The ratio of the detector response to the amount (mass) of analyte in the calibration standard is defined as the calibration factor (CF).

$$CF = (Ax)/(Cx)$$

Where: Ax = Area of the compound
Cx = Concentration of the compound

Advantages:

- The advantages of external standard calibration are that it is simple to perform this type of calibration and it can be applied to a wide variety of methods.

Disadvantages:

- The primary disadvantage is that it is greatly affected by the stability of the chromatographic detector system and the presence of chromatographic interferences in a sample or sample extract.

INTERNAL STANDARD CALIBRATION

Internal standard calibration involves the comparison of the instrument responses from the target compounds in the sample to the responses of reference standards added to the sample or sample extract before injection.

The response of the target compound is normalized to the response of the reference standard. This reference standard is called an *internal standard* because it is contained within the aliquot of the sample or sample extract that is actually injected into the instrumentation. A constant amount of the internal standard is added to all samples or extracts. That same amount of the internal standard is also included in each of the calibration standards.

The ratio of the peak area (or height) of the target compound in the sample or sample extract to the peak area (or height) of the internal standard in the sample or sample extract is compared to a similar ratio derived for each calibration standard.

This ratio is termed the response factor (RF) or relative response factor (RRF), indicating that the target compound response is calculated relative to that of the internal standard.

$$\mathbf{RF = ((Ax)(Cis))/((Ais)(Cx))}$$

Where: **Ax = Area of the compound**
Cx = Concentration of the compound
Ais = Area of the internal standard
Cis = Concentration of the internal standard

Selection of Internal Standards

- Internal standards that are similar in analytical behavior to the compounds of interest, and not expected to be found in the samples
- The analyst needs to demonstrate that the measurement of the internal standard is not affected by target analytes, surrogates, or by matrix interferences
- This is not as useful for GC and HPLC methods with non-MS detectors, unless the internal standards could be separated from target compounds chromatographically.

Advantages:

- Accounts for routine variation in the response of the chromatographic system
- Accounts for the variations in the exact volume of sample or sample extract introduced into the chromatographic system
- The retention times of the target compound and the internal standard may be used to calculate the relative retention time (RRT) of the target compound and can then be used to compensate for small retention time shifts

Disadvantages:

- The principal disadvantage to internal standard calibration is that the internal standards must be compounds that are not found in the samples to be analyzed and they must produce an unambiguous response on the chromatographic detector system.

RESPONSE/CALIBRATION FACTOR MODEL

Calibration Factor: A measure of the chromatographic response of a target analyte relative to the mass injected.

Response Factor: A measure of the relative mass spectral response of an analyte compared to its internal standard.

Each calibration or response factor represents the slope of the line between the response for a given standard and the origin. The average calibration factor or response factor of the standards for each analyte is then used to calculate the concentration of the sample.

When the variation, measured as the relative standard deviation (RSD) of the factors, is less than or equal to 20%, then the slopes of the lines for each standard are sufficiently close to one another that the use of the linear model is generally appropriate over the range of standards that are analyzed. A relative standard deviation (RSD) of 25% or less is considered linear.

Response/Calibration Factor Equations

External Standard Equation

$$CF = (Ax)/(Cx)$$

or

Internal Standard Equation

$$RF = ((Ax)(Cis))/((Ais)(Cx))$$

Where: Ax = Area of the compound
Cx = Concentration of the compound
Ais = Area of the internal standard
Cis = Concentration of the internal standard

Response/Calibration Factor Statistical Equations

Average RF or CF: $RFAVE = (S\ RFi / n)$

Standard Deviation (s): $s = \sqrt{\{ [S (RFi - RFAVE)2] / (n-1) \}}$

Relative Standard Deviation (RSD): $RSD = s / RFAVE * 100$

Where: n = number of pairs of data
RFi = Response Factor for each level
RFAVE = Average of all the response factors
S = the sum of all the individual values

In the equations above RF can be replaced with CF

Response/Calibration Factor Equations for Concentration

External Standard Equation

$$Cx = Ax/CFAVE$$

or

Internal Standard Equation

$$Cx = ((Ax)*(Cis)) / ((Ais)*(RFAVE))$$

Advantages

- Assumes linearity through the origin, no negative calculated concentrations.
- Simple calculation

Disadvantages

- Linearity of the curve is required.
- May not reflect actual detector response curve.

LINEAR CALIBRATION USING A LEAST SQUARE REGRESSION

According to NIST Linear least squares regression is by far the most widely used modeling method. It is what most people mean when they say they have used "regression", "linear regression" or "least squares" to fit a model to their data.

Least square regression is a method of determining the curve that best describes the relationship between expected and observed sets of data by minimizing the sums of the squares of deviation between observed and expected values. The regression calculations attempt to minimize this sum of the squares, hence the name “least squares regression.”

A linear calibration model based on a least squares regression may be employed based on past experience or a prior knowledge of the instrument response and at the discretion of the analyst. This approach may be used for analytes that do meet the RSD Limits. The linear calibration model is most easily achieved by performing a linear least squares regression of the instrument response versus the mass of the analyte.

Correlation Coefficient Definition: A measure of the interdependence of two random variables that ranges in value from −1 to +1, indicating perfect negative correlation at −1, absence of correlation at zero, and perfect positive correlation at +1. Also called coefficient of correlation.

Linear Equation

$$y = mx + b$$

Where: y = Response Ax for External Standard
Or
Ax/Ais for Internal Standard

x = Concentration Cx for External Standard
or
Cx/Cis for Internal Standard
m = Slope
b = Intercept

Linear Regression Statistical Equations

Slope (m)

$$m = \frac{[(Swxiyi * Sw) - (Swxi * Swyi)]}{[(Sw * Swxi2) - (Swxi * Swxi)]}$$

Intercept (b)

$$b = yAVE – (m * (xAVE))$$

Correlation Coefficient (r)

$$r = \frac{[(Sw * Swxiyi) - (Swxi * Swyi)]}{\sqrt{\{[(Sw * Swxi2) - (Swx * Swxi)] * [(Sw * Swyi2) – (Swyi * Swyi)]\}}}$$

Coefficient of Determination (r2)

$$r2 = r * r$$

Where:
- n = number of x, y pairs
- xi = individual values for the independent variable
- yi = individual values for the dependent variable
- w = weighting factor, for equal or no weighting w = 1
- xAVE = average of the x values
- yAVE = average of the y values
- S = the sum of all the individual values

Equations for Concentration

External Standard Equation

$$Cx = \{Ax-b\} /m$$

or

Internal Standard Equation

$$Cx = [\{(Ax)/(Ais)\}-b] /m *Cis$$

Advantages

- This technique is the simplest and most commonly applied form of Linear Curve
- Computation of coefficients and standard deviations is easy

Disadvantages

- If least squares regression (linear and non-linear) is used for curve construction it is usually noticed that the lower levels of the calibration may fail the re-fit criteria (<20% D) even when the r/COD/r2 criteria have been met.

- Analysts that use least squares regression and rely only on the r/COD/r2 criteria for curve acceptance may not be aware of this potential problem at the lower calibration levels.

WEIGHTED LEAST SQUARE REGRESSION

Each term in the weighted least squares criterion includes an additional weight that determines how much each observation in the data set influences the final parameter estimates and it can be used with functions that are either linear or nonlinear in the parameters.

One of the common assumptions underlying most process modeling methods, including linear and nonlinear least squares regression, is that each data point provides equally precise information about the deterministic part of the total process variation. In other words, it is assumed that the standard deviation of the error term is constant over all values of the predictor or explanatory variables. This assumption clearly does not hold, even approximately, in every modeling application.

In a weighted fit, less weight is given to the less precise measurements and more weight to more precise measurements when estimating the unknown parameters in the model. Using weights that are inversely proportional to the variance at each level of the explanatory variables yields the most precise parameter estimates possible.

Method 8000C describes variance as the difference between the observed instrument response for the ith calibration standard and the predicted or calculated response for the ith calibration standard.

Weighting the sum of the squares of the differences may significantly improve the ability of the least square regression to fit the linear model to the data.

$$\sum w_i (y_i - y'_i)^2$$

where:

w_i = Weighting factor for the ith calibration standard (w=1 for unweighted least square regression)

y_i = Observed instrument response for the ith calibration standard

y'_I = Predicted (or calculated) response for the ith standard

$\sum$ = The sum of all individual values

The mathematics used in unweighted least squares regression has a tendency to favor numbers of larger value over numbers of smaller value. Thus the regression curves that are generated will tend to fit points that are at the upper calibration levels better than those points at the lower calibration levels.

Examples of weighting factors which can place more emphasis on numbers of smaller value are:

$$w_i = 1/y_i \quad \text{or} \quad w_i = 1/y_i^2$$

where,

wi = weighting factor for the ith calibration standard (wi=1 for unweighted least squares regression).

y_i = observed instrument response (area or height) for the ith calibration standard.

Different Types Of Weights

No Weights:	Default higher weighting of higher amounts or signal values
1/Amount:	Nearly cancels out the weighting of higher amounts
1/Amount^2 :	Causes over-proportional weighting of smaller amounts
1/Response:	Nearly cancels out the weighting of higher signal values
1/Response^2:	Causes over-proportional weighting of smaller signal values
1/RSD:	Weights signal values with small relative standard deviations more than those with large relative standard deviations
1/RSD ² :	Weights signal values with small relative standard deviations clearly more than those with large relative standard deviation.

Advantages

- Weighted least squares is an efficient method that makes good use of small data sets. It also shares the ability to provide different types of easily interpretable statistical intervals for estimation, prediction, calibration and optimization.

- The main advantage that weighted least squares enjoys over other methods is the ability to handle regression situations in which the data points are of varying quality.

Disadvantages

- The biggest disadvantage of weighted least squares is probably the fact that the theory behind this method is based on the assumption that the weights are known exactly. The exact weights are almost never known in real applications, so estimated weights must be used instead. The effect of using estimated weights is difficult to assess, but experience indicates that small variations in the weights due to estimation do not often affect a regression analysis or its interpretation.

- When the weights are estimated from small numbers of replicated observations, the results of an analysis can be very badly and unpredictably affected. This is especially likely to be the case when the weights for extreme values of the predictor or explanatory variables are estimated using only a few observations. It is important to remain aware of this potential problem, and to only use weighted least squares when the weights can be estimated precisely relative to one another.

- Weighted least squares regression is also sensitive to the effects of outliers. If potential outliers are not investigated and dealt with appropriately, they will likely have a negative impact on the parameter estimation and other aspects of a weighted least squares analysis.

- If a weighted least squares regression actually increases the influence of an outlier, the results of the analysis may be far inferior to an unweighted least squares analysis.

APPENDIX J

Authorized Signatures

The individuals listed below are authorized to sign/approve documents in the classes listed. See also SOP ALI-30.

Approval Signatures - Moscow

Quotes/Contracts/RFP Submissions

- John Coddington, Lab Manager
- Todd Taruscio, Technical Director
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director
- Gene Solomon, QA Officer

Analytical Reports

- John Coddington, Lab Manager
- Todd Taruscio, Technical Director
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director

SOPs

- John Coddington, Lab Manager
- Gene Solomon, QA Officer
- Justin Doty, Customer Service Manager (for office procedures)
- Erin Linskey/Todd Taruscio, Technical Director (in Lab Manager's absence)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Corrective Action Reports

- John Coddington, Lab Manager
- Todd Taruscio, Technical Director
- Erin Linskey, Technical Director
- Mike Pearson, Lab Director
- Gene Solomon, QA Officer

Demonstrations of Capability (IDC/DOC)

- John Coddington, Lab Manager
- Gene Solomon, QA Officer
- Erin Linskey/Todd Taruscio, Technical Director (in Lab Manager's absence)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Approval Signatures - Spokane

Quotes/Contracts/RFP Submissions

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

Analytical Reports

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

SOPs

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director
- Karice Scott, Office Manager (for office procedures)
- Mike Pearson, Lab Director (in Lab Manager's absence)

Corrective Action Reports

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director

Demonstrations of Capability (IDC/DOC)

- Kathy Sattler, Lab Manager
- Melissa Lewis, QA Officer
- Mike Pearson, Lab Director (in Lab Manager's absence)

SeaCrestGroup
AN ENVIRONMENTAL SERVICES COMPANY

OPERATIONS

And

QUALITY ASSURANCE MANUAL

SCOQAM

January 2015

Concurrences and Approvals:

(1) Name: Shannon Phelps Phone: 303.661.9324

Title: Laboratory Manager, Director, Owner

Signature:_____Date:_____

(2) Name: Jennifer James Phone: 303.661.9324

Title: Human Recources/Controller

Signature:_____Date:_____

(3) Name: Emily Gustafson Phone: 303.661.9324

Title: QAQC Supervisor

Signature:_____Date:_____

(4) Name: Raelynn Kadunc Phone: 303.661.9324

Title: Analytical Laboratory Supervisor

Signature: _____Date: _____

(5) Name: Andrea Stucky Phone: 303.661.9324

Title: QAQC Officer

Signature:_____Date:_____

Table of Contents

1. **INTRODUCTION**
   - **1.1.** Statement of Intent
   - **1.2.** Statement of Policy
   - **1.3.** Accreditation
   - **1.4.** Hierarchy

2. **ORGANIZATION, FACILITIES, and EQUIPMENT**
   - **2.1.** Organization
   - **2.2.** Educational, Experience, and Training Requirements
   - **2.3.** Roles and Responsibilities
     - **2.3.1.** Laboratory Manager
     - **2.3.2.** QAQC Supervisor
     - **2.3.3.** Health and Safety Officer
     - **2.3.4.** Lead Laboratory Technician
     - **2.3.5.** QAQC Officer
     - **2.3.6.** Laboratory Staff
   - **2.4.** Facilities
   - **2.5.** Equipment
     - **2.5.1.** Inventory
     - **2.5.2.** Maintenance, Service, and Certification

3. **SAMPLE SCHEDULING, HANDLING, STORAGE, and DISPOSAL**
   - **3.1.** Sample Collection
     - **3.1.1.** Procedures
     - **3.1.2.** Containers and Holding Times
   - **3.2.** Sample Scheduling
   - **3.3.** Sample Receipt
     - **3.3.1.** Sample Acceptance Policy
     - **3.3.2.** Sample Receiving Procedure

3.4. Sample Logging and Preservation

3.4.1. Assignment of Laboratory Numbers

3.4.2. Preservation of Samples

3.5. Custody

3.5.1. Documentation of Custody

3.5.2. Assuming Custody of Samples

3.5.3. Relinquishing or Transferring Custody

3.6. Disposal of Laboratory Samples

3.6.1. Regulations

3.6.2. Disposal Process Initiation

3.7. Special Handling and Disposal for Potentially Hazardous Samples

3.7.1. Receipt

3.7.2. Special Containers and Notification

3.7.3. Storage

3.7.4. Handling Procedure for Analysis

3.7.5. Personal Protective Equipment (PPE)

3.7.6. Disposal

4. GENERAL LABORATORY PRACTICES and PROCEDURES

4.1. Good Lab Practices

4.1.1. Policy

4.1.2. Corrections to Records

4.1.3. Adherence to SOPs

4.2. Document Control and File Management

4.2.1. Chain-of-Custody Logging

4.2.2. Chain-of-Custody Receipt Form

4.2.3. Instrument Calibration and Maintenance Log Books

4.2.4. SeaCrest Operations and Quality Assurance Manual (SCOQAM)

4.2.5. Standard Operating Procedures (SOPs)

4.2.6. Confidentiality of Client Data

4.2.7. Training Files

4.2.8. QA/QC Records

4.2.9. Document/Form Revisions

4.2.10. Record Management/Disposition

4.3. Annual Management Review

4.4. Laboratory Apparatus and Instruments

4.4.1. Incubators and Waterbaths

4.4.2. Refrigerators, Freezers, and Drying Ovens

4.4.3. Autoclave

4.4.4. Balances

4.4.5. Thermometers

4.4.6. Advanced Analytical Equipment

4.4.7. Other Major Instrumentation

4.4.8. Records of NIST Traceability and Conformity

4.5. Laboratory Supplies

4.5.1. Glassware and Non-Disposable Plastics

4.5.2. Chemicals, Reagents, Solvents, Standards, and Gases

4.5.3. Laboratory Pure Water

4.6. Laboratory Hazardous and Non-Hazardous Waste Handling and Disposal Procedures

4.6.1. Policy

4.6.2. Determination of Hazardous Waste

4.6.3. Waste Minimization

4.6.4. Waste Packaging, Labeling, and Storage

4.6.5. Waste Disposal

4.6.6. Waste Records

4.6.7. Contingency Measures

4.6.8. Disposal of Outdated or Waste Chemicals/Containers

5. PERFORMANCE QUALITY CONTROL and DATA HANDLING

5.1. Terminology

5.2. Essential Quality Control Requirements

5.2.1. Demonstration of Capability

5.2.2. Instrument Calibration

5.2.3. Acceptance Criteria

5.3. Data Handling

5.4. Data Reporting

5.4.1. Statistical Methods Used

5.4.2. Verifying and Validating Statistical Methods

5.4.3. Report Narrative

5.5. Data Management and Data Security

5.6. Annual Performance Summary

5.7. QC Study Plan

5.8. Corrective Actions

5.8.1. Technical Corrective Action

5.8.2. Formal Corrective Action

5.9. Preventive Actions

6. LABORATORY SAFETY

6.1. Policy

6.2. General Health and Safety Policies

6.3. Health and Safety Plan

7. METHODOLOGY

8. ELEMENTAL ANALYSIS

8.1. Introduction

8.2. Methodology

8.2.1. Method Selection

8.2.2. Method Development and Modification

8.2.3. Safety

8.2.4. Reagent Water

8.2.5. Reagents and Standards

8.2.6. Expired Standards and Reference Materials

8.3. Instrumentation, Data Generation, and Data Storage

8.3.1. Instrumentation

8.3.2. Data Generation

8.3.3. Data Storage

8.4. Quality Assurance and Training

8.4.1. Quality Assurance Quality Control

8.4.2. Training

9. APPENDIX: HEALTH AND SAFETY PLAN

1. INTRODUCTION

1.1 Statement of Intent

The purpose of the SeaCrest Group Operations and Quality Assurance Manual (SCOQAM) is to document and define the quality assurance policies, procedures, and practices of the SeaCrest Group (SCG). A defined system of quality assurance practices and operational policies is essential for ensuring that data generated by SCG processes are well defined and defensible. Each individual staff member shares the responsibility for maintaining knowledge of this manual and for following established quality control procedures.

1.2 Statement of Policy

It is the basic policy of SCG to conduct all activities, be them in the laboratory or in the field, with four guiding principles: (1) Safety, (2) Integrity, (3) Quality, and (4) Service.

1.2.1 Safety

The primary focus of all SeaCrest operations must be safety. No laboratory testing or field assignment in which safety cannot be achieved is undertaken by SCG. It is the responsibility of every staff member to familiarize themselves with SCG Health and Safety documents and training. It is the responsibility of management to ensure these materials are available and up-to-date. Furthermore, it is the responsibility of management to ensure adequate safety training to staff. In lab/field operations that present a potential hazardous environment, employees are given access to material and equipment to mitigate the potential hazard.

1.2.2 Data Integrity and Laboratory Ethics

It is the responsibility of each staff member and management to conduct all business with integrity and in an ethical manner. The ability to defend the integrity of the data is through complete documentation of actions and activities which includes such items as: maintaining chain of custody and security of the samples; clear documentation of the activities performed in the preparation and analysis of the samples and in the final data reduction, review, and reporting; and, by maintaining complete and clear files of these records.

1.2.3 Quality

It is SCG policy that all data generated conform with EPA, state, local, and all other applicable parties regulatory documents and methods. Furthermore, all data generated must meet or exceed internal QA parameters. Management is responsible for ensuring correct and most recent methods are being employed and that all laboratory SOPs and Quality Assurance protocols, including this document, are annually reviewed and revised as needed.

1.2.4 Service

SeaCrest Group is a service oriented company and, as such, all staff must maintain an awareness of customer needs and objectives. This is accomplished through open and clear communication between customers and staff and the timely reporting of lab results. All staff must maintain a degree of attention toward providing customers with results within the timeframe established by the laboratory manager.

1.3 Accreditation

Currently neither the EPA nor any state agency SCG reports to require accreditation or any certifications to conduct the testing performed here. It is SCG policy to show and maintain competency by documenting and maintaining a Quality Assurance System (QAS), submitting laboratory methods and processes to external audits, and annually participating in the EPA's DMRQA (Discharge Monitoring Report Quality Assurance) program. It is the responsibility of management to continually evaluate both government and private accreditation standards for feasibility and practicality and obtain such accreditation management deems necessary to improve our quality assurance system.

1.4 Hierarchy

This manual describes policies of the SeaCrest Group Quality Assurance System. Specific operational and technical details are contained in laboratory SOPs. Laboratory SOPs are derived directly from EPA approved methods and standards and, in such, take precedent over this manual. In the event deviation from the standard is required and/or a new method is to be employed, a SOP is to be written and reviewed by the QAQCS prior to it being implemented. In the event of time sensitive results, where a new laboratory SOP cannot be consigned within the time frame required, management can employ an approved external method subject to review by the QAQCS and the SCOQAM.

2. ORGANIZATION, FACILITIES, and EQUIPMENT

2.1 Organization

Below is a list of all SeaCrest Group staff and their primary area of responsibility:

Name	Primary Duties
Shannon Phelps	Laboratory Manager Owner
Jennifer James	Human Resources/Controller
Emily Gustafson	QAQC Supervisor
Raelynn Kadunc	Analytical Lab Supervisor
Andrea Stucky	Lead Aquatic Laboratory Technician QA/QC Officer
Alexander Arnold	Aquatic Laboratory Technician Health & Safety Officer
Kyra Brisson	Aquatic Laboratory Technician
Amanda Shephard	Aquatic Laboratory Technician

2.2 Educational, Experience, and Training Requirements

At a minimum SCG requires all staff to hold a bachelors degree in an area associated with operations. It is management's responsibility to impose additional hiring requirements based on position demands. Prior experience is not required to be eligible for hiring, but priority will be given to candidates with prior job-related experience and skill sets. All past education and experience a candidate cites will be verified by management. SeaCrest Group is a drug free workplace and management reserves the right to refuse and/or terminate employees found to be in violation this policy.

SeaCrest Group has developed an initial training program each new staff member will complete within 6 months of hire. At the end of the training program, management will review the staff member's progress and make one of three recommendations to the Laboratory Manager: 1) Successful completion of program. Cleared to advanced training; 2) Additional training required. Re-evaluate in 6 months; 3) Unsuccessful completion of program. Employment terminated.

All training will be documented and retained by management. The following is required within 6 months of hire:

Title of Training	Required By	Person Responsible
Familiarization and review of all laboratory SOPs and the SCOQAM	Essential SOPs within 1 month. All others within 6 months. Annual review	QAQC Supervisor
Data Integrity ***	Within 3 months. Annual review	QAQC Supervisor
Laboratory Safety	Initial day of hire. Monthly safety meetings. Bi-annual review of Health & Safety	Health and Safety Officer
Handling, Minimizing, and Disposing Waste	Within 6 months of hire	Health and Safety Officer
Proper HazMat storage and usage	Within 3 months of hire. Annual review	Health and Safety Officer

*** Data Integrity topics will be documented in writing and include:

1. Organizational mission and its relationship to full disclosure and honesty in data recording and reporting
2. Procedures to ensure data integrity
3. In-depth data monitoring

After successful completion of the initial training program, staff will be required to take part in monthly training programs to be decided on by management.

2.3 Roles and Responsibilities

2.3.1 Laboratory Manager (LM):

- Has overall management responsibility including budgeting, policy development, and marketing
- Co-runs and maintains day-to-day operations of the laboratory
- Responsible for approval, implementation, and operation of the QAS. QAQC Supervisor will oversee day-to-day management of the QAS.
- Assures qualified staff are assigned to the laboratory
- Acts as primary contact to clients, vendors, and regulators

2.3.2 QAQC Supervisor (QAQCS):

- With the approval of the LM, hires and maintains a qualified staff
- Co-runs and maintains day-to-day operations of the laboratory
- Ensures all staff is following established laboratory protocols and SOPs

- Oversees the production and reporting of laboratory generated data
- Initiates and leads annual staff reviews
- Has delegated responsibility and authority for the implementation, management, and maintenance of the QAS.
- Performs internal audits on methods, protocols, procedures, and staff performance
- Initiates technical corrective actions
- Maintains QA documentation to include:
  - All audits
  - Staff training records
  - Corrective action reports
- Reviews and approves all laboratory SOPs and QA protocols and submits them to the LM for final approval.
- Advises LM of QA/QC issues
- Advises LM of laboratory issues

2.3.3 Health and Safety Officer

- Ensures laboratory practices do not conflict with SCG Health and Safety Manual
- Reviews and makes appropriate changes to Health and Safety Manual to be submitted to the LM for final approval.
- Maintains laboratory MSDS
- Leads monthly health and safety training

2.3.4 Lead Laboratory Technician (LLT)

- Ensures day-to-day operations are in accordance with laboratory protocols and SOPs
- Perform inventory checks, as needed, and notify LM of laboratory needs to ensure adequate supplies are maintained
- Works with the QAQCS in implementing and maintaining the QAS
- Ensures staff is receiving adequate training and experience
- Oversees the production of raw data
- Assigns and oversees technical corrective actions
- Implements and maintains procedures for preventative actions

2.3.5 QAQC Officer

- Ensures day-to-day operations are in accordance with laboratory protocols and SOPs
- Works with the QAQCS in implementing and maintaining the QAS
- Maintains copies of all QA/QC's performed in the year
- Advises QAQCS of quality control issues
- Ensures staff is receiving adequate training and experience
- Implements requirements of the QAS

2.3.6 Laboratory Staff

- Responsible for maintaining working knowledge of all SCG SOPs, procedures, and protocols including the Health and Safety Manual
- Responsible for conducting laboratory and/or field testing in accordance with all SCG SOPs, procedures, and protocols
- Responsible for notifying QAQCS or LM of any issues/ problems with SOPs, work environment, or general concerns

2.4 Facilities

The current facility includes adequate room for management offices, a wide variety of biological testing, water analyses, species culturing, and other needs that may arise from our customers. Space and supporting equipment is available for all operational needs.

2.5 Equipment

2.5.1 Inventory

SeaCrest Group has and maintains an active inventory of all equipment necessary to remain at an operational level 365 days and year. Additions to this inventory occur whenever operational needs increase or new services are offered.

2.5.2 Maintenance, Service, and Certification

Staff is responsible for daily calibration and checks on all equipment. General maintenance guidelines are available in coinciding laboratory equipment SOPs. Issues/problems that cannot be resolved by staff are brought to the attention of the Laboratory Manager for further corrective action including but not limited to: specialized service from licensed professional, returning to seller, retiring the instrument, and/or purchasing replacements.

3. SAMPLE SCHEDULING, HANDLING, STORAGE, and DISPOSAL

3.1 Sample Collection

3.1.1 Procedure

Currently SeaCrest Group does not offer sample collection services to our clients. It is SCG policy to provide our clients with written EPA approved sampling methods and procedures. Field sampling follows established EPA methods and SCG SOPs.

3.1.2 Containers and Holding Times

Test Sampling Kits are shipped to clients approximately 1 week prior to the scheduled start date of the test. These kits include: sampling instructions, chain-of-custody documentation, and medium density polyethylene (MDPE) sampling containers. All samples are preserved upon receipt at the lab utilizing at least one technique, most commonly by maintaining a temperature of 0-6°C. Other testing performed by SCG may require different sampling containers and/or preservation techniques. Methods for these are found in laboratory SOPs derived from: Standard Methods for the Examining Water and Wastewater; EPA Methods for Chemical Analysis of Water and Waste; and/or EPA-821-R-02-12.

The EPA mandates a holding time for samples of 36 hours with a maximum allotment of 72 hours with prior approval for all Whole Effluent Testing (WET) performed by SCG. Additional testing performed by SCG and its subcontractors allows for greater holding times with preservation of the sample. All preservation methods and holding times are located in laboratory SOPs.

3.2 Sample Scheduling

All testing performed by SCG is scheduled and approved by the Laboratory Manager (LM). It is the LM's responsibility to ensure scheduling is done in such a way to guarantee: 1) adequate resources available for each test; 2) scheduling load does not interfere with the QAS; 3) ample time is allotted between scheduling and receiving to prepare for the test. Management retains the right to reschedule, refuse, and/or cancel a test(s) if the above criteria cannot be met.

3.3 Sample Receipt

3.3.1 Sample Acceptance Policy

Samples entering the laboratory in support or compliance of NPDES regulations require appropriate methods to be employed from sampling to receipt at lab. SCG retains to right to refuse any sample delivered to the lab if samples are: 1) out of required holding time; 2) not properly preserved; 3) tamper evident seals broken or disturbed; 4) damaged or leaking sampling containers; 5) chain-of-custody is absent, incorrect/incomplete, and/or not signed.

In the event SCG receives a sample requesting analysis that requires: 1) certification/accreditation; 2) technical expertise outside of SCG personnel abilities; 3) methodology/procedures not contained in SCG SOPs; 4) hazardous samples; management will contact the client to resolve any differences in methodology, quality control, and/or scope of work. If the requested analysis is outside the laboratory's capabilities and/or management decides not to implement new SOPs to include the new analysis, the sample will be refused and the client contacted by management.

Sample acceptance or refusal will be document and records maintained by management.

3.3.2 Sample Receiving Procedure

Upon acceptance of a sample, SCG staff will assume custody of said sample. A laboratory tracking number will be assigned and the sample checked-in as per SCG sample receiving SOPs.

3.4 Sample Logging and Preservation

3.4.1 Assignment of Laboratory Numbers

Each sample and container received by SCG is assigned a unique and traceable number. SCG laboratory numbers are assigned consecutively from sample to sample. Consecutive numbers start on January 1st and end on December 31st based on the following pattern: XYY-ABCD where X represents the current location of SCG, YY represent the calendar year, and ABCD represents consecutive unique sample numbers (Note: analysis requiring multiple samples/sampling days receive an additional number denoting position in the sampling sequence i.e. 308-1234 #1, 308-1234 #2). Additionally, each laboratory number will have a letter qualifier, identifying the department of the requested analysis. WET tests will be indentified as ".B". Analytical tests will be identified with a ".A". Organic analyses will be identified with a ".O".

3.4.2 Preservation and Storage of Samples

For samples requiring additional analysis from an outside lab, preservation techniques and methods will be used as required by the analytical method needed. It is the responsibility of management to ensure correct preservation and storage methods are used in these instances.

Following the completion of the sample acceptance and receipt procedures, samples will be immediately placed in storage coolers with a temperature regulated between 0-6°C. Storage coolers are checked daily for temperature deviation using NIST certified digital thermometers. Monthly thermometer checks are done using a second NIST certified thermometer to ensure equipment is operating correctly. Any temperature deviation outside the acceptable range will require management to: 1) initiate corrective action; 2) cancel all analysis of the affected samples; 3) contact all affected clients and inform them of the equipment malfunction and SCG corrective action.

Samples remain between 0-6°C at all times they are not being used in testing.

3.5 Custody

3.5.1 Documentation of Custody

Documentation of sample custody is achieved through: tamper evident seals, chain-of-custody forms (COC), and any other log book. SCG provides each client with a COC to be used and remain with the sample. Internal documentation of custody is maintained by management.

3.5.2 Assuming Custody of Samples

For all analysis performed by SCG, custody must be assumed by a staff member prior to the start of analysis. Assuming custody requires that both the client/sampler and a SCG staff member sign and date a COC indicating transfer and receipt of custody. It is the responsibility of management to maintain records of all custody transfers.

3.5.3 Relinquishing or Transferring Custody

In cases where additional analysis is required by an outside party, custody will be transferred. The relinquishing or transferring of custody shall only be done by using correct COC forms and with the approval of management.

3.6 Disposal of Laboratory Samples

3.6.1 Regulations

The vast majority of samples that undergo analysis at SCG are classified as “Non-Hazardous Waste” and can de disposed of directly to the City of Louisville Waste Water Treatment Plant or to an area landfill (see subchapter 3.7 for hazardous waste handling and disposal procedures). Currently there are no known laws that regulate the disposal of non-hazardous liquid waste.

3.6.2 Disposal Process Initiation

Following the completion of a test (which includes the final data report) all associated samples are eligible for disposal unless a client request SCG retains the sample for potential further analysis. All disposal activity is logged and retained by management.

3.7 Special Handling and Disposal for Potentially Hazardous Samples

3.7.1 Receipt

On occasion SCG will be asked to perform analysis on material classified as “hazardous” or on material with unknown associated hazards. The laboratory manager is the only SCG personnel authorized to schedule any analysis associated with potentially hazardous material.

SCG personnel will refuse acceptance of hazardous or potentially hazardous samples if: 1) Hazard identification documentation (MSDS) does not accompany the sample; 2) the

sample was received improperly packaged, shipped, and/or stored; 3) the sample arrives at the laboratory open, container broken, or leaking; 4) if appropriate custody documentation does not accompany the sample; 5) safe disposal documentation does not accompany the sample; 6) the sample is not labeled and/or is improperly labeled. Upon acceptance by SCG, the Health and Safety officer and the Laboratory manager are to be notified.

3.7.2 Special Containers and Notification

Upon receipt at the laboratory, hazardous materials will remain in the "safe" transport container until it undergoes analysis (see 3.7.3, 3.7.4, 3.7.5). The sample will be checked-in and assigned a laboratory number. The laboratory number will follow standard assignment protocols discussed in 3.4.1 with the exception that the letters "HM" will follow the year (308-HM-1234). Appropriate hazard labels will be affixed to the sample and laboratory personnel informed of the sample.

3.7.3 Storage

All samples considered hazardous or potentially hazardous will be stored in their original shipping container and placed either in the fume hood or in a HazMat refrigerator (in cases when temperature preservation is required). If there is any question as to the integrity of the storage container, the entire original container will be placed in a secondary airtight containment vessel. The laboratory manager and the Health and Safety Officer are to be informed of any potential storage or container problems.

3.7.3.1 Contingency Measures

Management has developed and maintains a Hazardous Waste Contingency Plan which outlines SCG emergency response procedures. The Health and Safety Officer annually reviews this plan and makes suggestions to management concerning all issues associated with this plan.

3.7.4 Handling Procedure for Analysis

All analyses of hazardous or potentially hazardous material will take place under a fume hood or in a designated "clean" room. The determination as to the environment safe analysis can occur is a responsibility of management and will be decided by the hazard threat of the sample. All SCG personnel associated with analysis are required to wear full protective equipment/clothing (PPE 3.7.5) during analysis. Samples undergoing analysis are never to be moved from their storage location to the testing location opened. Upon completion of analysis, samples are to be repacked in an airtight containment vessel, sealed, relabeled, and returned to the appropriate storage location.

3.7.5 Personal Protective Equipment (PPE)

SCG requires all employees to be familiar with PPE available to them and its uses. It is the responsibility of the Health and Safety Officer to ensure this. When dealing with hazardous or potentially hazardous material appropriate PPE is to be worn from the collection of sample to returning it to the appropriate storage location. SCG requires certain types of PPE to be available in the laboratory at all times. These include: latex and non-latex examination gloves, heat resistant gloves, splash goggles, face shields, dust/fine particle masks, flame retardant laboratory coats, and splash aprons. More

specialized PPE may be required for certain types of samples and it is the responsibility of management to ensure appropriate PPE is available to staff in such events.

3.7.6 Disposal

Samples which have been deemed to be hazardous by SCG or other bodies require special disposal procedures. SCG contracts with a private, licensed, company to dispose of all laboratory material of a hazardous nature. SCG abides by “Cradle to Grave” procedures and maintains permanent documentation of all hazardous materials purchased, obtained, received, and disposed of.

4. GENERAL LABORATORY PRACTICES and PROCEDURES

4.1 Good Lab Practices

4.1.1 Policy

It is SCG policy to apply the Quality Assurance System to all aspects of operations. Management recognizes the necessity that each staff member adheres to Good Laboratory Practices (GLP) and, in such, maintains oversight of all laboratory operations.

4.1.2 Corrections to Records

Transparency and accountability in data collection/reporting is an essential value in the QAS and GLP. Management understands occasional errors made during the collection and reporting of data are inevitable and, in such, it is SCG policy that all errors requiring correction will be documented and the client made aware of the error and SCG corrective action.

4.1.2.1 Corrections to Hard Copy Data Sheets

All corrections being made on a hard copy data sheet will be done by a single line cross out, correctors initials, and cause of error (EE for entry error, IE for instrument error, CE for calculation error, ME for method error, OE for other errors [OE requires further documentation detailing the error]). Multiple line cross outs ("scribbling out"), correction ink, or erasable mark corrections are never permitted to correct errors. All error corrections, with the exception of transcription errors, require notification of the laboratory manager and documentation detailing reason and corrective action.

4.1.2.2 Corrections to Final Reports

In the event management determines a significant error was made to a final report, a new corrected report will be sent to the client. A significant error is defined as: 1) incorrect data; 2) misleading data; 3) essential data absent; 4) data gathered not in accordance with the QAS. Management will submit a narrative with the re-sent report explaining the error and SCG corrective action. Both reports and the management narrative will be retained by SCG.

4.1.3 Adherence to SOPs

It is SCG policy that all laboratory SOPs be followed. Staff members are required to read and sign documentation stating they have read and will abide by laboratory SOPs. Management will maintain these documents in individual training records. Staff signing said documentation will be held accountable to them. Management reserves the right to impose disciplinary action, including termination, on any staff member found to be operating outside laboratory SOPs. In the instance deviation from an established SOP is required, staff is to document the reasons for such deviation and submit a "Request for Deviation from Method" to the Laboratory Manager and the QAQC Supervisor for approval. Documentation describing the deviation will be maintained by the QAQCS. It is the responsibility of the QAQCS to determine if the SOP deviated from requires revision.

4.2 Document Control and File Management

It is SCG policy to maintain current and archived records with all laboratory processes and activities in an accessible format and location.

4.2.1 Chain-of-Custody Logging

COCs associated with samples received at SCG are maintained by the LM in individual project/client files. COCs associated with samples sent from SCG are maintained by laboratory staff under the review of the LM. Clients receive a copy of the accepted COC with the final report. Archiving of COCs is under the discretion of the LM.

4.2.2 Chain-of-Custody Receipt Form

Upon receipt at SCG, the condition of the sample, custody documents, and tamper seals are documented on a sample receipt form. The form is attached to the original COC and given to the LM to be maintained along with the COC.

4.2.3 Instrument Calibration and Maintenance Log Books

Every instrument in use by SCG is required to have calibration and maintenance log books. These logs are to contain at a minimum: instrument name and serial number, unique SCG designation, NIST certification date and expiration date, associated SOP, calibration data log sheet, QAQC data log sheet, maintenance data log sheet, preventative maintenance data log sheet, and major repair/service numbers. Log books are maintained by staff and periodically reviewed by the QAQCS. When an instrument is removed from service the associated logs will be archived for a minimum of five years.

4.2.4 SeaCrest Operations and Quality Assurance Manual

SCOQAM is a central component to the QAS and, in such, is reviewed and update annually (January-January). In the event of a SCG method(s), procedure(s), and/or scope of work change, the SCOQAM will be updated as needed to reflect these changes regardless of current time of year. Past versions of the SCOQAM are maintained digitally and in hard copy form by the LM and the QAQCS. It is SCG policy to mandate the QAQCS review and revise the SCOQAM but all personnel can make suggestions to revise at any time during the year. Recommendations can be made directly to the QAQCS or LM.

It is the responsibility of all staff to annually review the SCOQAM and become familiar with all exclusions, inclusions, and revisions.

4.2.5 Standard Operating Procedure (SOPs)

Currently active SOPs are written in a format unique to SCG. In an effort to standardize laboratory operations and reduce redundancy in laboratory SOPs, all new laboratory SOPs will be written in accordance with EPA/600/B-07/001, “Guidance for Preparing Standard Operating Procedures (SOPs).” SOPs written in prior to January 2009 will be phased out and replaced with common format SOPs as they are written.

Writing and review of laboratory SOPs is the responsibility of the QAQCS. Under the direction of the QAQCS, the writing of new SOPs can be delegated to any qualified staff member. Methods and procedures contained in laboratory SOPs are derived directly

from regulatory guidance documents and do not contradict said documents. A list of all referenced methods and procedures can be found in chapter 7, "Methodology."

4.2.6 Confidentiality of Client Data

It is SCG policy never to release information that could be construed as personal and private to any third party without previous consent. All material SCG has made available to public audits will not contain any information as to the identity of our clients. SCG maintains dual data log books, one containing all pertinent client information and the other containing no direct client information outside the assigned laboratory number, when data is recorded along with client information. It is the responsibility of all staff to remain discrete when discussing SCG operations and capabilities with third parties.

4.2.7 Training Files

SCG management will maintain training files on each staff member. Documented training within these files will be used by management when assessing job performance, promotions, and/or filling vacancies within SCG. It is the responsibility of management to ensure new employees receives adequate general and specialized training during the first year of employment. It is the responsibility of all staff not in the training phase of employment to maintain an operational level of training and to take advantage of training offered.

4.2.8 QA/QC Records

All records of QA/QC's performed by staff members are maintained by the QAQCS or are retained in the QA/QC data log associated with the procedure or instrument. The QAQCS will maintain an up-to-date master QA/QC database as well as documentation indicating all corrective actions employed due to variances outside acceptable QA/QC range. It will be the responsibility of the QAQCS to maintain: 1) Certification for weights, thermometers, and any other instrumentation that so requires; 2) internal and external audits including deficiencies, corrective action plans, and corrective action results; 3) copies of all methodology SOPs and QA/QC's derived from; 4) official laboratory forms, documents, and data sheets.

4.2.9 Document/Form Revisions

A review of all laboratory forms will be made annually by either the LM or an appointee of the LM. If a change is deemed necessary by the LM, the QAQCS will be notified of the requested change. The QAQCS will review the request to ensure it does not contradict laboratory SOPs. Once the revised form is approved and updated, all earlier version of the form are to be discarded. All reviews, revisions, and updates are documented and maintained by the LM.

4.2.10 Record Management

All data produced, laboratory methods and procedures, laboratory guidelines, final reports, QA documentation, laboratory forms and documents, and documented internal communication is the property of Watergoat Enterprises, dba SeaCrest Group, and is maintained under the direction of the Laboratory Manager. Upon sale or disbandment of SCG, it is to the responsibility of the Owner to retain control of said documents that would breech SCG Client Confidentiality Policy.

4.3 Annual Management review

During the last quarter of the fiscal year the LM and QAQCS will conduct an annual review of the QAS to determine adequacy of the current system and/or for any improvements needed. The review will be documented and maintained by the QAQCS and will cover at minimum the following:

- Staff surveys on overall impression of the QAS and operations
- Combination and summary of internal and external audits conducted throughout the year
- Staff proficiency
- Corrective action plans and progress
- Changes in volume of work over the past year and anticipated volume of work in the upcoming year
- Near term goals and objectives
- Development of an action plan to implement new procedures/methods and correct outstanding deficiencies including a time line for completion.

4.4 Laboratory Apparatus and Instruments

It is SCG policy to maintain an adequate inventory of functional instrumentation and essential laboratory equipment/apparatus to exceed present demands anticipating growth. Instruments and/or laboratory equipment deemed to be non-functional are placed out of service pending repair or replacement. It is the responsibility of management to continually evaluate the effectiveness of all in-service instruments and equipment and to procure new instrumentation and/or equipment if determined to be necessary. All laboratory instrumentation and equipment is subjected to, at minimum, monthly QA/QC checks. The QAQCS will maintain instrumentation QA/QC's as well as all associated certifications.

4.4.1 Incubators and Waterbaths

SCG currently operates 3 incubators designated "testing incubators," 1 incubator designated "culture incubator," and 1 incubator designated "test water incubator." Temperature checks are performed and documented daily for all SCG incubators using NIST certified thermometers. Light readings are taken on applicable incubators whenever bulbs are replaced, new illumination added, or at minimum monthly. Laboratory SOPs detail lighting requirements for each individual incubator.

SCG currently owns 3 and operates 2 water baths. Operational water baths are used in the culturing process of test species. Temperatures checks are performed and documented daily using NIST certified thermometers.

Temperature variations in any control incubator or water bath require the unit to be placed out-of-services pending repair. Prior to placing any out-of-service unit back in service, hourly temperature checks are performed over a 2 day span. All temperature variations will be documented and the LM notified.

4.4.2 Refrigerators, Freezers, and Drying Ovens

SCG currently operates 3 refrigerators: “test water refrigerator” –used for preserving samples undergoing testing between 0-6°C, “HazMat refrigerator” –used for preserving material of a potentially hazardous nature, and “Clean refrigerator” – used for preserving and storing all material associated with culturing and test animal feeds. Temperature checks are performed and documented daily using a NIST certified thermometer. If a temperature variation is discovered, the laboratory manager will be notified and clients with associated samples will be notified of an environmental control failure and ongoing test canceled.

4.4.3 Autoclave

SCG operates 1 autoclave used for sterilizing non-disposable laboratory glassware. Temperature checks are performed and documented with each use. A monthly sterilization check will be performed using autoclave indicator tape or indicator pellets. The LM will be notified of any issues concerning the autoclave.

4.4.4 Balances

SCG currently owns 3 balances and operates 2. It is SCG policy to maintain at least 1 top-loading and 1 analytical balance in service at all times. Calibration is performed and documented daily and validated using a NIST traceable weight. Monthly calibration checks are performed and documented using a range of NIST traceable weights. Laboratory SOPs are maintained on individual balances and contain the range of traceability. NIST weight sets are certified annually and records of such are maintained by the QAQCS. Staff is to report any variance outside the range of acceptable limits to the LM and the QAQCS. Any balance that either does not calibrate within the acceptable range or has an unacceptable variance shall be place out-of-service pending repair or replacement. All major cleaning and maintenance is performed by an outside party at the discretion of the LM or QAQCS.

4.4.5 Thermometers

It is SCG policy to only use thermometers that: 1) are NIST certified or 2) are verified monthly using a NIST certified thermometer. Thermometers used in the laboratory are both digital and mercury-in-glass styles. It is the responsibility of the LM to ensure disposal of out-of-service mercury-in-glass thermometers is done in accordance with local regulations and environmental protocols. The QAQCS will maintain NIST traceability and/or NIST validation documentation on all thermometers in the laboratory.

4.4.6 Advanced Analytical Equipment

SeaCrest operates 4 instruments used in elemental quantification of analytes and inorganic compounds. This instrumentation is subject to periodic validation by manufacturer representatives at minimum of annually or whenever instrument performance has declined as evident by QC response.

4.4.7 Other Major Laboratory Instrumentation

SCG owns and operates a wide variety of instruments necessary to the testing performed. A complete list of in-service meters is maintained by the QAQCS. All meters in use are maintained in accordance with manufacture recommendations and guideline and have established SOPs describing service procedures. All instruments have corresponding data logs to document service, calibration, and applicable QA/QCs. The QAQCS verifies correct operational functionality at a minimum of monthly.

4.4.8 Records of NIST Traceability and Conformity

Records of NIST traceability for all applicable instruments and equipment are maintained by the QAQCS. It is the responsibility of the Quality Control Officer to ensure all new instruments and/or equipment that require annual NIST verification are submitted to the QAQCS. It is the responsibility of the QAQCS to ensure all NIST traceability records are current and complete.

4.5 Laboratory Supplies

Each staff member has the responsibility of continually monitoring the inventory status of essential laboratory supplies and notifying the LM when new orders are needed. The LM will facilitate ordering supplies and maintaining an “emergency” surplus of essential laboratory supplies. Monthly inventory audits will be conducted under the direction of the LLT and discrepancies documented and corrected.

4.5.1 Glassware and Non-Disposable Plastics

All laboratory glassware and non-disposable plastics (NDPs) require through cleaning a sufficient “dry time” following each use. Cleaning procedures are located in laboratory SOPs. Glassware and NDPs are replaced as needed. Under the direction of the LM, staff will evaluate glassware and NDPs semiannually to determine if replacements are needed and to confirm/correct inventory.

4.5.2 Chemicals, Reagents, Solvents, Standards, and Gases

4.5.2.1 Procurement and Receipt

The LM is responsible for ordering all chemicals found in the laboratory. Chemicals are purchased in small quantities to minimize excessive shelf life and chemical degradation. Upon receipt all chemicals will have “Date Received”, “Date Opened”, and “Expiration Date” written on the original chemical container in permanent ink. The chemical is logged into the “Chemical Inventory” log book and laboratory MSDS books are updated to include the new addition to the inventory. If a manufacturer expiration date is not found on the original container staff is to contact the QAQCS. It is the responsibility of the QAQCS to assign an expiration date based on stability and/or other information available.

4.5.2.2 Storage and Usage

Chemicals classified as non-hazardous or low hazard are stored in their original container in designated locations. Staff will document receipt, usage, and

disposal/depletion of all chemicals in chemical inventory log books located in the laboratory. Monthly inventory verification audits will be conducted under the direction of the LM.

Chemicals classified as hazardous or potentially hazardous will be stored, handled and used as described in subchapter 3.7. The LM is the only authorized party to order, procure, or receive chemicals of a hazardous nature.

4.5.2.3 Quality of Chemicals, Reagents, and Standards

It is SCG policy to not deviate from established methods when performing chemistry analysis. All chemicals, reagents, and/or standards used in analysis are to meet or exceed the quality required by the method. Weekly QA/QC's are performed on all chemicals, reagents, and standards to ensure their purity and suitability for analysis being performed by SCG. The QAQCS is responsible for verifying correct chemicals, reagents, and standards are being used in all analysis performed by SCG. Alternative chemicals, reagents, and/or standards may only be used with the approval of the QAQCS and the LM and following an acceptable comparison test.

4.5.3 Laboratory Pure Water

SCG uses a deionization system to ensure all water used in testing, culturing, and cleaning is free of contaminants and pure. The City of Louisville's municipal drinking water is the source water. Daily checks are performed on the system to verify the correct operations. Annual analytical checks are performed by a third party to verify laboratory water is pure and without contaminants.

4.6 Hazardous and Non-Hazardous Waste Handling and Disposal

4.6.1 Policy

It is the policy of SCG to retain, store, label, and dispose of all waste deemed hazardous in a way that ensures compliance with all Federal, State, and local laws. This policy is also designed to minimize staff exposure to hazardous waste and to protect the environment.

4.6.2 Determination of Hazardous Waste

Primary classification of hazardous waste resides with documentation (MSDS), manufacture guidelines, and/or substance composition. If the above are not available it is the responsibility of the Health and Safety Officer to make said determination.

4.6.3 Waste Minimization

It is SCG policy to limit the amount of waste sent to landfills. It is the responsibility of each staff member to actively participate in the established recycling program and to monitor waste streams. Under the direction of the LM, employees are encouraged to

implement new procedures to further minimize waste. Management encourages employees to utilize non-disposable plastics and glassware in testing whenever possible.

4.6.4 Waste Packaging, Labeling, and Storage

All waste deemed hazardous is to be labeled and stored as described in subchapter 3.7. Waste deemed non-hazardous is to be stored in appropriate containers until disposal.

4.6.5 Waste Disposal

All waste deemed hazardous is to be disposed of as described in subchapter 3.7.6. Waste deemed non-hazardous is disposed of in compliance with all Federal, State, and local laws and regulations. Individual staff members have the authority to initiate waste disposal under the direction of the LM. Proper disposal procedures are located in applicable laboratory SOPs.

4.6.6 Waste Records

All records related to the generation and disposal of hazardous waste will be maintained permanently retained. It is the responsibility of the LM to maintain the records. Records related to disposal of non-hazardous waste will be maintained for at least one year. The LM is the only authorized party to remove non-hazardous waste records from SCG archives.

4.6.7 Contingency Measures

SCG has developed a response and contingency plan to address a potential accidental release of hazardous waste. It is the responsibility of the Health and Safety Officer to maintain this plan and ensure each employee receives adequate training on said procedures.

4.6.8 Disposal of Outdates or Waste Chemicals/Containers

It is the responsibility of the LM and the Health and Safety Officer to develop procedures to dispose of outdated waste and their associated containers. Annual chemical inventory audits will be conducted under the direction of the LM to minimize the potential for prolonged storage of expired chemicals.

5. PERFORMANCE QUALITY CONTROL and DATA HANDLING

5.1 Terminology

- **Acceptance Criteria:** specified limits placed on characteristics of a quality control item as defined in required methods. These limits are either statistically defined by historical method performance or by specific method requirements.
- **Accuracy:** the degree of agreement between an observed value and an accepted reference value
- **Audit:** a systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity
- **Bias:** consistent deviation of measured values from the true value, caused by systematic errors in a procedure.
- **Blank:** a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value.
- **Calibration:** to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements
- **Chain of Custody:** record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses
- **Corrective Action:** the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.
  - **Formal Corrective Action:** a higher level corrective action that includes a four step process of describing the issue, performing a root cause analysis leading to a proposed action, acceptance and closure.
  - **Technical Corrective Action:** routine actions taken in the laboratory, or elsewhere, to correct expected occasional deviations from method acceptance criteria, instrument malfunctions, or other causes. Trends or frequent re-occurrences of technical corrective actions will initiate a formal corrective action.
- **Data Quality Objectives (DQO's):** Process used to develop performance and acceptance criteria (DQO's) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.
- **Deficiency:** an unauthorized deviation from acceptable procedures or practices, or a defect in an item.
- **Demonstration of Capability:** a procedure to establish the ability of the analyst to generate acceptable accuracy.
- **Holding Time:** the period of time (usually in hours or days) from sample collection until sample preparation or analysis. The initial time is the time a grab sample is collected or the time the last aliquot of a composite is collected. The final time is the time sample preparation or analysis begins
- **Laboratory Control Sample Duplicate (LCS Dupe):** a replicate

laboratory control sample prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

- **Method Blank:** a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
- **Preservation:** refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.
- **Preventive Action:** is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints
- **Quality System:** A defined system of quality assurance practices and operational policies.
- **Sample**: a particular aliquot of a certain matrix (soil/sediment, water, air, etc.) collected at a specific location, date, and time (grab or composite). This aliquot could be distributed over several different size or type containers depending on the analytical and/or preservation requirements.
- **Spike:** a known mass of target analyte added to a blank sample or subsample; used to determine recovery efficiency or for other quality control purposes.
- **Traceability:** the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons

5.2 Essential Quality Control Requirements

5.2.1 Demonstration of Capability (DOC)

Staff authorized to perform analysis independently at SCG will have a DOC on file. DOC's will contain applicable training records, appropriate SOP(s) signoff sheet, and successful completion proficiency testing. DOC's will be reassessed annually or any time a new method, procedure, and/or protocol is implemented.

5.2.2 Instrument Calibration

Instruments are calibrated daily and are only considered "in-service" if successful calibration requirements are met. Additional, weekly and monthly calibration checks are performed on all instrumentation in-service at SCG. If any calibration check does not meet the required accuracy, the instrument is placed out-of-service until management clears it following corrective action.

5.2.3 Acceptance Criteria

All methods employed by SCG have acceptance criteria against which all quality control results are evaluated. When no method acceptance criteria is available, either from the manufacturer or a regulatory body, internal criteria is developed. The QAQCS will develop method specific procedures for creating internal acceptance criteria. Internal acceptance criteria require a minimum of 20 replicates prior to developing acceptance

limits. All internal acceptance criteria are re-evaluated at a minimum annually. Specific acceptance criteria and limits are found in applicable laboratory SOPs.

5.3 Data Handling

5.3.1 Deviation from Holding Times or Standard Method

It is SCG policy to perform all requested analysis and/or testing within the allowable holding time and utilizing the proper method(s). Whenever a client request testing be performed outside maximum holding times or utilizing foreign methods, the LM will attach a remark explaining the variance to the final report.

5.3.2 Units

All SCG data is collected and reported utilizing the International System (SI) of units (metric). Utilizing other units of measurement can only be done if the client so request it and the LM approves the deviation. The LM will attach a remark explaining the deviation to the final report.

5.3.3 Significant Figures

The number of digits collected and report from analysis is dependent on the degree of accuracy an applicable method requires. It is SCG policy to meet or exceed the degree of accuracy required by methods and maintains an adequate inventory of instrumentation to ensure this. If a method(s) does not specify the degree of accuracy required it is the responsibility of the QAQCS to define the level to be obtained. It is general SCG policy to collect and report to at least the tenth place for all data collected.

5.3.4 Rounding

It is SCG policy to avoid manual rounding of numbers whenever possible. In the instances where manual rounding is required the following formula is used: If the digit 6, 7, 8, or 9 is dropped, increase preceding digit

by one unit; if the digit 0, l, 2, 3, or 4 is dropped, do not alter preceding

digit. If the digit 5 is dropped, round off preceding digit to the nearest even number: thus 2.25 becomes 2.2 and 2.35 becomes 2.4. Use only the digit beyond the last significant figure for rounding. Rounding should be performed only after arriving at the final result in the calculation. Individual laboratory SOPs describe procedures for rounding exceptionally large or small numbers.

5.3.5 Determination of Outliers

Data may not be discarded without proper justification or explanation. Justifiable reasons to remove outliers include:

- Known and documented laboratory error
- Statistically different data (statistical outlier test, standard deviation from the mean).

All data discarded will be included in the final report with an explanation as to why it was no included and the method(s) used to determine it an outlier.

5.3.6 Uncertainty

Uncertainty differs from error in that it takes the form of a range of values as opposed to error which is the difference from a true value and is represented by a single value. It is SCG policy to employ methods that have a predefined level of uncertainty built into them and provide an explanation of such uncertainty so as to minimize the level of misinterpretation of the data. It is the responsibility of the QAQCS to review and verify method uncertainty at minimum monthly. This is most often accomplished using Laboratory Control Sample (LCS) to accurately estimate method uncertainty. If consecutive LCS testing yields results outside the expected range, the method is placed out-of-service and the QAQCS notified. The QAQCS will initiate corrective action and/or replace the method.

5.4 Data Reporting

It is the responsibility of the LM to ensure only accurate and defensible data is contained within final reports. All final reports are written under the direction of the LM and approved by the LM prior to being submitted to clients.

5.4.1 Statistical Methods Used

It is SCG policy to only use statistical methods approved by the EPA for test performed by SCG. It is the responsibility of the LM to ensure proper statistical methods are being employed when data is being quantified and qualified. Statistical programs used at SCG are EPA recommended or EPA written. The LM will consult applicable methods when determining the proper method to use.

5.4.2 Verifying and Validating Methods

The verification and validation of statistical methods is done by EPA approved statistical software. It is the responsibility of the LM to interpret anomalies potentially generated by individual methods and correct them and/or utilize different methodology. All statistical data generated is verified by the LM and QAQCS prior to the final report being submitted to the client.

5.4.3 Report Narrative

Additional explanatory remarks about the data can be added by the LM (or designee) in the Case Narrative section of the data report. It is the responsibility of the LM to ensure all variances from method, test abnormalities, outliers, and/or other pertinent information is included in the narrative. It is SCG policy to not interpret or offer opinions of the data outside what is so necessary by methods. If clients request interpretations or opinions of the data, said remarks will not be included in the report narrative but in a separate section of the report. The basis on which the interpretation or opinion was made is to be clearly defined in this section.

5.5 Data Management and Data Security

Currently, all data generated at SCG is maintained in two (2) formats: original hard copy and digital true copy. All digital media is maintained and backed-up by a subcontractor of SCG. SCG is presently evaluating different means of data storage.

All data generated in connection with testing is considered privileged and confidential and is maintained is such a way. Chapter 4 details SCG policy and means of protecting client confidentiality.

5.6 Annual Performance Summary

During the last quarter of each fiscal year the QAQCS will develop and present a comprehensive study of SeaCrest Group's QAS and overall performance of the laboratory to management. The study will include at a minimum of: QC data, approved deviation from methods, all tests defined as invalid and reasons for classification, training progress, evaluation of the QAS, summary of previous year corrective actions and outcomes, corrective action(s) presently needed, and purposed changes to the QAS for upcoming year.

5.7 QC Study Plan

A QC study plan is developed when planning new DQO's, method development studies, evaluating a new or modified method, or addressing a non-routine QC issue/problem for corrective action. The development of a QC study plan consists of staff convening to discuss the reason(s) a study necessary, define the objective(s), and develop the study procedure(s). The final draft of a QC study plan will be submitted to the QAQCS for approval. Upon approval, periodic summary reports will be submitted to the QAQCS for comments.

5.8 Corrective Actions

A corrective action is any action or procedure initiated to rectify a non-conformity. The two types of corrective actions are as follow:

5.8.1 Technical Corrective Actions (TCA)

Routine action taken in the laboratory, or elsewhere, to correct expected occasional deviations from method acceptance criteria, instrument malfunctions, or other causes. Examples include re-running an LCS because the recovery was outside of acceptance criteria, or recalibrating an instrument and re-analyzing samples because of a calibration and/or DUPE failure. All TCAs will be documented along with reasons for a TCA. No further action is required if it is apparent the error or deviation from the norm was random. The QAQCS will be notified of all TCAs.

5.8.2 Formal Corrective Actions (FCA)

FCAs are a higher level of corrective actions than TCAs . FCAs can be initiated by anyone in response to a trend in TCAs, a customer complaint, data inquiries, sample receipt issues, SOP deficiencies, or any other issue which may require a corrective action. The QAQCS will be notified immediately when staff initiates a FCA. All FCAs are documented and maintained by the QAQCS and consist of four parts:

- **Origination.** Includes a description of the issue and any details of specific samples or batches involved in the issue.

- **Investigation/Action** Consists of a root cause analysis to try and determine why the issue occurred. It is necessary to determine the cause of the failure in order to implement an appropriate corrective action to prevent the failure in the future.
- **Follow-up/Review** Once the cause of the failure has been determined, and a proposed remedy/corrective action has been developed, the QAQCS will review the corrective action and follow-up with any questions or clarifications.
- **Closure** After a suitable period of time to verify effectiveness of the corrective action, the QAQCS will sign-off on the FCA as closed.

5.9 Preventive Actions

Preventive Actions consist of pro-active processes to prevent problems or complaints and are used as opportunities for improvement. Preventive action procedures include:

- Compilation of TCAs on a quarterly basis for trend analysis. Technical corrective actions are grouped into the following categories for trend analysis: Blank issues, Calibration issues, LCS failures and marginal exceedances, customer complaints/inquiries and custody/sample receipt issues
- Opportunities for improvement suggested during TCAs
- Annual review of the SCOQAM

6. LABORATORY SAFETY

6.1 Policy

It is the policy of SeaCrest Group that all activities performed by or under the direction of SCG personal be conducted in a manner that promotes a safe work environment. It is the responsibility of all staff to follow established health and safety policies and to notify management whenever safety concerns arise. The Health and Safety Officer has the responsibility to periodically perform operations safety audits and to maintain updated safety policies and procedures. The Health and Safety Officer reports directly to the Laboratory Manager.

6.2 General Health and Safety Policies

- All SCG personal are required to wear appropriate safety glasses and lab coats at all times when in the laboratory. It is the responsibility of management to ensure each employee is supplied with the appropriate PPE.
- Shorts, “tank-top” type shirts, and open toes shoes are not permissible in the laboratory.
- Staff is required to remove “excessive” jewelry and to sanitize their hands frequently throughout the work day.
- When working with flammable and/or corrosive material staff is required to wear appropriate clothing in addition to proper PPE (ex. Synthetic clothing is not acceptable when working with an open flame or flammable material).
- All containers, receptacles, and storage apparatus are to be properly labeled and stored in the appropriate location.
- Eating, drinking, and smoking is permitted only in designated “non-laboratory” areas on site.
- Laboratory apparatus is never to be used for a food/drink receptacle.
- Chemical inventories are maintained and updated on a monthly basis
- All hazardous or potentially hazardous stocks/standards are to be prepared under a fume hood and stored in the appropriate location.
- All staff is to receive safety training on a monthly basis to address noted safety violations or on other applicable material.
- All safety concerns, violations, and/or incidents require a Formal Corrective Action to be commenced immediately.

6.3 Health and Safety Plan

Refer to Appendix A for the SeaCrest Group Health and Safety Plan

7. METHODOLOGY

Methods used by SCG are guided by DQOs required by individual procedures, testing requirements, and/or the QAQCS. Individual test methods are contained within applicable laboratory SOPs and are reviewed at least annually by the QAQCS and the LM. All deviation from established methodology requires: 1) supporting evidence/data supporting the deviation, 2) approval from the LM and QAQCS, 3) generation of a new laboratory SOP outlining the new method. Under no circumstances are any SCG personnel to deviate from an established method or procedure without first consulting the client.

All testing methods and procedures used in NPDES compliance monitoring are to conform to EPA methods, the applicable state authority methods, and any other regulatory agency required under individual permits. This document requires the LM to be familiar with all NPDES permits held by SCG clients.

8. Elemental Analysis

8.1 Introduction

This chapter outlines the analytical operations, capabilities, and quality control procedures employed by the analytical unit of SCG. Analytical quality control procedures are designed to measure, assess, and validate the analytical processes employed by SCG, but at no time are they to conflict with procedures and/or protocols as outlines in chapter 5. Individual laboratory SOPs contain method related QAQC procedures and requirements as so required from their source method.

SCG employs an analyst(s) to perform all analytical work deemed to be within the capability of SCG. SCG management reserves the right to sub out client driven analytical testing for the following reasons: 1) Instrumentation driven (maintenance, operating below the level required by QC protocols), 2) analysis required outside the scope of abilities of SCG personnel, 3) load or required turn around required outside the range of performance of SCG personnel. It is the responsibility of the LM to ensure all analytical work done outside SCG conforms to applicable methodology and regulations.

8.2 Methodology

Various EPA programs, including RCRA, CERCLA, NPDES, and Drinking Water require or recommend the use of specific analytical methods associated with these programs. Currently SCG analytical capabilities only support the NPDES program and said program's methodology. Methodology supporting other EPA programs is contained in SCG libraries but not in an operational capacity. The LM and QAQCS are the only two SCG personnel authorized to introduce new methodology into operational phases. SeaCrest SOP 4.0.* details the requirements a new method(s) must undergo prior to the method being approved for use.

8.2.1 Method Selection

As required by federal law, all SCG analytical methods have been approved by the USEPA for NPDES compliance monitoring. All SCG analytical methods are located in title 40, Protection of the Environment, part 136, Guideline Establishing Test Procedures for the Analysis of Pollutants, of the federal register. It is the responsibility of the QAQCS to ensure all methods conform to said law.

8.2.2 Method Development or Modification

Any new instrumentation installation, development of methods, or major modifications will be performed or guided by head analyst in consultation with the QAQCS. Analysts should consult with the LM and QAQCS if there are questions about whether a method modification will trigger a demonstration of capability (DOC). At a minimum, verification consists of 1) optimizing instruments and methods to perform analyses within the specific method criteria and/or QC guidelines of this manual or individual laboratory SOPs 2) performing a DOC and method detection limit (MDL), if necessary, and 3) documenting that the verification was performed and storage of the documentation by the QAQCS. The DOC is reviewed and approved by the LM and the QAQCS. The progression of method development and modifications shall be well documented. The analyst should test matrices and interferences which are relevant to the test method. As a final step, the analyst shall develop a standard operating procedure consistent with the format used by SCG when implementing a new method, or shall revise the existing SOP

when a method modification has been performed. When the method SOP has been approved, the LM will provide the SOP effective date on the SOP title page.

8.2.3 Safety

Safety precautions associated with the safe handling of chemicals, reagents, solutions and samples will be observed and are a primary responsibility of the analyst. The analyst will take the necessary precautions to prevent exposure or harm both to self and co-workers.

8.2.4 Reagent Water

Water used to prepare calibration standards, spike solutions, standard reference solutions or any sample dilutions or mixtures must meet or exceed the requirements for Type I grade water as specified by the American Society for Testing and Materials (ASTM); Standard Practice D 1193 unless otherwise noted in the method or SOP. This grade water is equivalent to Type I water as specified in Standard Methods 1080. Resistivity is measured to verify the quality of water, with a requirement of 18 megohm-cm at 25EC or better. See also section 2.2 of "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," (EPA 600/4-79-019, March l979).

8.2.5 Reagents and Standards

Reagents must be ACS reagent grade quality or better unless otherwise noted in the method or SOP. Reagents and standards will be dated upon receipt and when opened or prepared, and properly discarded when outdated, or when evidence of deterioration is detected (see Chapter 4). Working solutions and mixtures made from stock reagents and standards will be used only for the appropriate working life of the solution. In general, this is from one week to no more than six months for materials that tend to degrade. In the absence of specific guidelines for working reagents and standards, the primary analyst may choose to prepare these materials fresh each time the analysis is performed or use the sample holding times as a guide for the useful working life. The shelf life may be much longer for other materials that do not degrade easily (e.g., simple salts, solutions for metals analyses).

8.2.6 Expired Standards and Reference Materials

Standards and reference materials are dated upon receipt and are properly disposed of after the expiration date. For materials that do not degrade easily (e.g., simple salts, solutions for metals analyses) the shelf life may be much longer than dates arbitrarily assigned by the vendor. It is acceptable to use a material past the expiration date if it is documented that the material has not degraded. The preference however, is to avoid this practice and instead purchase smaller quantities to be consumed before the expiration date. The following guidance for expired standard verification should only be performed on materials that are generally considered to be stable. Materials that require special environmental conditions for storage (e.g., materials that photodegrade) or are only stable for weeks or months are not well suited for this verification procedure. If there is any question of the suitability of a material for verification, the head analyst and/or QAQCS must be consulted. Internal standards do not need to be recertified.

8.3 Instrumentation, Data Generation, and Data Storage

8.3.1 Instrumentation

SCG currently operates three instruments in support of analytical capabilities.

1) iCE 3500 flame atomic absorption spectrometer
2) iCE 3500 stabilized temperature platform graphite furnace atomic absorption spectrometer
3) Evolution 160 UV/Visible spectrophotometer

All instrumentation is maintained by SCG personnel and manufacturer representatives (Thermo Fisher Scientific). It is the responsibility of SCG analyst to periodically assess instrument performance by calculating drift in QC testing and running instrument specific tests found within applicable software and manuals. The LM and QAQCS are responsible for ensuring all maintenance required outside the abilities of SCG personnel is conducted in a timely fashion by qualified parties. SCG requires instrument validation by manufacturer representatives at least annually or whenever major maintenance has been performed.

8.3.2 Data Generation

It is a requirement of management that all data generated by analysis, QC testing, instrument validation, and training be maintained and stored for a minimum of five years. Under no circumstance is data to be removed, altered, or transferred from applicable software or storage libraries. It is the responsibility of the QAQCS to control access said areas.

8.3.3 Data Storage

Storage of generated data will be redundant to minimize the potential for lost or destroyed data. Data will be stored in secure formats on a minimum of two separate drives. It is a requirement of management that generated data be automatically backed-up and verified daily. Generated data pertaining to regulated analysis will be stored indefinitely while data pertaining to method development, training, and/or instrument validation will be stored for a minimum of five years. Prior to removing data from SCG archives and/or libraries management is required to conduct an impact study to ensure data is not still required.

8.4 Quality Assurance and Training

8.4.1 Quality Assurance Quality Control

Below is an excerpt from SCG SOP 4.0.* outline general analytical QC requirements:

Initial Quality Control Requirements

Prior to data being produced for any purpose outside internal testing, the following criteria must be completed. These criteria are to be readdressed with addition of 1) new methodology, 2) new analytes to be tested for within exiting methodology, 3) new personnel. Furthermore, at any point the QAQCS can require one or more of these criteria readdressed. **The production of any data, outside the requirements of this section, is not to be produced at any time during initial quality control testing.**

1. Initial Demonstration of Capability (IDC): Prior to being authorized to perform class 4 analysis personnel are to demonstrate proficiency with the analytical method. This

proficiency includes familiarization with the SOP, instrumentation operation and maintenance, health and safety concerns, waste management, sample preservation and holding times, sample preparation, and sample analysis. Personnel are to demonstrate their ability to operate the instrumentation and produce replicable results by analyzing at least four laboratory fortified blanks (LFB) at different concentrations following calibration and standardization. The LFBs should be prepared at a concentration between 10X the method detection limit (MDL - section 4) and the midpoint of the calibration curve. The IDC can only be run after analyzing and verifying all required calibration standards. This testing is to be done at a minimum of 3 times (on different days) with an acceptance criteria of ± 15% recovery and ≤20% relative standard deviation (RSD) from the batch.

2. Quality control sample (QCS): Prior to beginning the use of all class 4 methods, on a quarterly basis, as required by data quality needs, or when a client requests, verify the calibration standards and the instrument performance by analyzing a QCS. QCS solutions are obtained from outside vendors and contain a known quantity of the analyte of interest. Prepare and analyze the QCS the same way you would a sample. If the instrument determined concentrations are not within ± 10% of the stated values the method performance is considered unacceptable and the process must be rerun until acceptable determinations are achieved (if consecutive QCS testing is outside acceptable limits contact the laboratory manager as the solution may be bad). QCS are analyzed at least quarterly and whenever new calibration stock solutions are prepared.

3. Linear dynamic range (LDR): The LDR is that concentration over which the detector output is linearly related to the solute concentration. The linear dynamic range extends from the minimum detectable concentration (MDL) to that concentration where the response index is greater or less than the defined linearity limits. This will be evident as the signal response shifts from a linear plot to a consistent curve. The upper limit of the LDR must be established for the wavelength utilized for **each** analyte by determining the signal responses from a minimum of six different concentration standards across the range, two of which are close to the suspected upper limit of the LDR. The upper LDR limit should be an observed signal no more than 10% below the level extrapolated from the four lower standards. To determine the LDR, analyze succeedingly higher standard concentrations of the analyte until the observed analyte concentration is no more than 10% (% difference) below the stated concentration of the standard. All readings at or above the LDR must be diluted and reanalyzed or analyzed using an alternative method.

4. Method detection limit (MDL): MDLs must be established for all analytes using type 1 water fortified at a concentration of two to three times the estimated instrument detection limit. To determine MDL values, take seven replicate aliquots of the fortified water and process the entire analytical method (prep to analysis). To calculate MDL: **MDL = (t) x (S)** where t = pi (3.14) and S = the standard deviation of the replicate analyses. Prior to the MDL being established this process should occur on two more nonconsecutive days. Average the three MDL values to provide the method/analyte MDL. MDLs are re-determined at a minimum annually, when a new operator begins work, or whenever in the judgment of the analyst or management there is a change in analytical performance.

Assessing Laboratory Performance and Data Quality

With each batch of samples undergoing analysis multiple laboratory quality control (LQC) tests are performed. If any of the LQC testing falls outside acceptability criteria the entire batch is to be rerun with a new set of LQC tests.

1. Initial calibration: Calibrate initially with a minimum of a blank and three calibration standards of the analyte of interest. Select calibration standards that bracket the expected concentration of the sample(s) and that are within the method's LDR. The number of calibration points depends on the width of the dynamic range and the shape of the calibration curve. One calibration standard should be below the practical quantitation limit (PQL). Calibration standards should be prepared and analyzed no greater than one order of magnitude (1, 10, 100, 1000). The appropriate linear or nonlinear correlation coefficient for standard concentration to instrument response should be ≥0.995. Use initial calibration for quantitation and analyte concentration in samples. Repeat initial calibration daily or whenever calibration verification acceptance criteria are not satisfied. **Refer to individual method SOPs and manufacturer recommendations when calibrating specific instrumentation.**

2. Calibration verification: Calibration verification is a periodic confirmation that the instrument response has not changed significantly from the initial calibration. Verify calibration by analyzing a midpoint calibration standard and calibration blank at the beginning, the end, and after a set of ten samples of a sample run. Concentration determinations outside 90 to 100% of the expected concentration indicates a potential problem and the analyses should be temporally suspended while the analyst verifies instrument performance (software function). If the standard determinations are outside 80 to 120% of the expected concentration, immediately cease all sample analyses and initiate corrective action. Following corrective action repeat initial calibration and restart sample analysis from the last acceptable calibration verification standard.

3. Method/reagent blank (MB): A Method blank (also known as laboratory reagent blank) is a portion of reagent water treated exactly as a sample, including exposure to all equipment, glassware, procedures, and reagents. The MB is used to assess whether analytes or interferences are present within the analytical process or system. No analyte of interest should be present in the MB at a level ≥ MDL. Initiate immediate corrective action for any MB measurement above the MDL. Include a MB with each set of 20 or fewer samples.

4. Laboratory fortified blank (LFB): A laboratory fortified blank is a method blank that has been fortified with a known concentration of the analyte of interest. It is used to evaluate ongoing laboratory performance and analyte recovery in a clean matrix. Prepare fortified concentration(s) approximating the midpoint of the calibration curve or lower with stock solutions prepared from a source different from those used to develop working standards. Calculate accuracy as percent recovery using the following equation:

$$\%recovery = (LFB-MB)/s \times 100$$

Where: LFB = laboratory fortified blank

MB = Method blank

If the recovery of any analyte falls outside the required control limits of 85-115% immediately suspend analysis and initiate corrective action to identify the source of the problem. All samples in the batch need to be reanalyzed following an unacceptable LFB analysis.

5. Duplicates: Use duplicate samples of measurable concentration to measure precision of the analytical process. Randomly select a routine sample to be analyzed twice. Process duplicate samples independently of each other through the entire sample preparation and analytical process. Include a minimum of one duplicate sample for each matrix type per 20 samples. At present time there is no % recovery (% rec) criterion to be met in applicable source methods. SeaCrest requires a %rec of ±15% for analysis to be considered valid.

Additional QC measures <u>required</u> for GFAA analysis only. Some of the following measures can also be used with FLAA analysis depending on analysis and interferences.

6. Laboratory fortified matrix (LFM): Sample homogeneity and the chemical nature of the sample matrix can affect analyte recovery and the quality of the data. Taking separate aliquots from the sample for replicate and fortified analyses can be used to asses these effects. Use LFM analysis to evaluate the bias and precision of the method as influenced by a specific matrix. Note that all samples must demonstrate a background absorbance <1.0 before the test results obtained can be considered reliable. To prepare, the analyst adds a known amount of each analyte to a minimum of 10% of the routine samples. In each case the LFM aliquot must be a duplicate of the aliquot used for sample analysis added prior to sample preparation. The added analyte concentration must be the same as that used in the LFB. Prepare additional concentrations to approximately double the concentration of the unadjusted sample. It may be necessary to dilute the sample to bring the measurement within the established calibration curve. Limit total addition of volume to ≤ 5% of the total sample volume. Calculate the percent recovery for each analyte, corrected for concentrations measured in the unfortified sample, and compare these values to the designated LFM recovery range of 70-130%. Recovery calculations are not required if the concentration added is <25% of the unfortified concentration. Calculate percent recovery as follows:

$$\%\text{recovery} = (C_S - C)/s \times 100$$

Where: C_S = Fortified sample concentration

C = sample background correction

If the recovery of any analyte falls outside the designated recovery range, but still within the range of calibration, the performance for that analyte is considered valid (in control) and the problem judged to be either matrix or solution related – not system. If the analyte recovery in the LFM is <70% and the background absorbance is <1.0, complete the analyte addition test (subsection 7) on an undiluted portion of the unfortified sample. The test results should be evaluated as follows:

- If recovery of the analyte addition test (<85%) confirms a low recovery for the LFM, a suppressive matrix interference is indicated and the unfortified sample must be analyzed by the method of standard additions.

- If the recovery of the analyte addition test is between 85-115%, a low recovery of the analyte in the LFM (<70%) may be related to the nature of the sample, the result of precipitation loss during sample prep, or an incorrect addition prior to analysis. Report analyte data determined from the analysis of the unfortified sample aliquot.

If the laboratory performance is shown to be in control but analyte recovery in the LFM is either >130% or above the upper calibration limit and the background absorbance is <1.0, complete the analyte addition test on a portion of unfortified sample aliquot. Evaluate the test as follows:

- If the percent recovery of the analyte addition test is >115%, an enhancing matrix interference is indicated and the unfortified sample aliquot must be analyzed by method of standard additions (subsection 8).
- If the percent recovery is between 85-115%, high recovery in the LFM may have been caused by random sample contamination, an incorrect addition of the analyte prior to sample preparation, or sample heterogeneity. Report analyte data determined from the analysis of the unfortified sample aliquot.
- If the percent recovery is <85%, either a case of both random contamination and operative matrix interference in the LFM is indicated or a suppressive matrix interference. Data should be flagged with appropriate explanation given with the report.

If performance is shown to be in control but the magnitude of sample background absorbance is >1.0, a non-specific spectral interference should be suspected. A portion of unfortified aliquot should be diluted (1:3) with acidified reagent water and reanalyzed. If dilution reduces the background absorbance to an acceptable level (<1.0), complete the analyte addition test on a portion of the diluted unfortified aliquot. Evaluate the test as follows:

- If the recovery is between 85-115%, report analyte data determined on the dilution of the unfortified aliquot.
- If the recovery is outside the range of 85-115% complete the sample analysis by the method of standard additions.

If either the analysis of an LFM sample(s) or application of the analyte addition tests indicate an operative interference, all other samples in the batch with suspected similar matrices to the LFM must be analyzed in the same manner.

7. Analyte addition test (AAT): AAT testing is used to assess possible matrix interference effects and indicate the need to complete sample analysis by the method of standard additions. Results generated by AAT testing should not be considered as valid if the background absorbance is >1.0. To perform AAT analysis add an analyte standard to a portion of prepared sample, recovery should be within 85-115% of the known value. The analyte addition may be added directly to sample in the furnace and should produce a minimum level absorbance of 0.1. The concentration of the analyte addition plus that in a sample should not exceed the linear calibration range of the analyte. If the analyte is not recovered within the specified limits, a matrix effect should be suspected and the sample analyzed by method of standard addition.

8. Method of standard additions (MSA): To perform MSA analysis prepare new standards in the sample matrix by adding known amounts of standard to one or more aliquots of the processed sample solution. This technique will compensate for a sample constituent that enhances or depresses the analyte signal – producing a different slope from that of the calibration standards. Prepare standards as follows:

   - Two identical aliquots of the sample solution, each of volume V_X, are taken. Label the first "A" and add a small volume of V_S of a standard analyte solution of concentration C. Label the second "B" and add the same volume V_S of the solvent. The analytical signals of A and B are measured and corrected for nonanalyte signals. The sample concentration C_X is calculated:

$$C_X = \frac{S_B V_S C_S}{(S_A - S_B)\, V_X}$$

Where: S_A and S_B = the analytical signals corrected for the blank of solutions A and B. V_S and C_S should be chosen so that S_A is roughly twice S_B. It is best if V_S is made considerable less than V_X, and thus C_S is greater than C_X. For the results of this analysis to be valid the following limitations must be taken into consideration:

1. The analytical curve must be linear.
2. The chemical form of the analyte added must respond in the same manner as the analyte in the sample.
3. The interference effect must be constant over the working range of concern.
4. The signal must be corrected for any additive interference.

8.4.2 Training

Management requires analysts to perform DOC testing prior to being authorized to perform analytical analysis. Analysts are required to readdress all DOCs at a minimum of annually or whenever management so requires. All DOC are maintained by the QAQCS.

SEACREST GROUP

Health and Safety Plan

SCOQAM Appendix A

Revised: November 2008

TABLE OF CONTENTS

CORPORATE SAFETY STATEMENT **1**
HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT **2**
1.0 INTRODUCTION 3
2.0 SUBSTANCE ABUSE POLICY 5
2.1 General *5*
3.0 ORGANIZATIONAL STRUCTURE ASSIGNMENT OF RESPONSIBILITY 7
3.1 Corporate and Project Responsibility *7*
3.2 Health and Safety Officer (HSO) *7*
3.3 Project Manager *8*
3.4 Site Manager *8*
3.5 Medical Support *8*
3.6 Work Crew *9*
3.7 Specialized Advisors (as required) *9*
4.0 TRAINING 10
4.1 Introduction *10*
4.2 New Employee Training Checklist *10*
4.3 40-Hour/24-Hour HAZWOPER Training *11*
4.4 Hazardous Waste Operations Field Experience *12*
4.5 8-Hour Supervisor Training *12*
4.6 8-Hour Refresher Training *12*
4.7 Training Equivalencies *12*
4.8 Risk Awareness Training *13*
4.9 Hazard Communications Training *13*
4.10 Respiratory Protection Training *13*
4.11 Hearing Conservation Training *14*
4.12 First Aid and CPR Training *14*
4.13 Construction Safety Training *15*
4.14 Training Record Maintenance *15*
5.0 MEDICAL SURVEILLANCE PROGRAM 16
5.1 Introduction *16*
5.2 Selection of Participants *16*
5.3 Medical Monitoring Requirements *16*
5.4 Employee Tracking *17*
5.5 Emergency Medical Treatment at Work Sites *17*
5.6 Medical Records Management /Results Reporting *17*
5.7 Forms and Instructions *18*
6.0 SUBCONTRACTOR HEALTH AND SAFETY REQUIREMENTS 19
6.1 Responsibilities *19*
6.2 Hazardous Waste Operations *20*
6.3 Health and Safety Aspects of Subcontractor Agreements *20*
Evaluating Contractor Compliance *21*
7.0 HAZARD COMMUNICATION PROGRAM 22
7.1 Material Safety Data Sheets *22*
7.2 Employee Information Training *22*
7.3 Labeling of Hazardous Chemicals *23*
8.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) 24
8.1 Administration and Responsibilities *24*
8.2 Selection of PPE *24*
8.3 Levels of Protection *25*
8.4 Work Mission Duration *26*
8.5 PPE Inspection, Storage, and Maintenance *27*
8.6 PPE Training and Fitting *27*
8.7 PPE Program Evaluation *27*
9.0 RESPIRATORY PROTECTION PROGRAM 29
9.1 Administration and Responsibilities *29*

9.2 Types of Respirators ... 29
9.3 Hazard Evaluation for Respirator Selection ... 30
9.4 Medical Surveillance ... 30
9.5 Respirator Fit Testing ... 30
9.6 Training ... 31
9.7 Inspection, Maintenance, Cleaning, and Storage ... 31
9.8 Respirator Inspection Procedures ... 31
9.9 Qualitative Fit Test Procedures ... 32
9.10 Quantitative Fit Test Procedures ... 32
10.0 CONFINED SPACE ENTRY PROGRAM ... 33
10.1 Program Responsibilities ... 33
10.2 Confined Space Hazards ... 34
10.3 Training Requirements ... 34
10.4 Personnel Requirements and Responsibilities for Entry Operations ... 34
10.5 Equipment Requirements ... 36
10.6 Confined Space Entry Preparation ... 36
11.0 EXPOSURE MONITORING PROGRAM ... 38
11.1 Administration and Responsibilities ... 38
11.2 Survey Equipment ... 38
11.3 Personal Monitoring ... 40
11.4 Action Levels ... 40
11.5 Site Monitoring ... 41
12.0 TRENCHING AND EXCAVATION ... 43
12.1 Program Responsibilities ... 43
12.2 Training ... 43
12.3 General Safety Requirements ... 43
12.4 Inspection Programs ... 44
12.5 Protective Systems ... 44
13.0 EMERGENCY PLANNING AND REPORTING ... 46
13.1 Planning ... 46
13.2 Emergency Equipment ... 51
13.3 Medical Treatment and First Aid ... 51
13.4 Emergency Response Procedures ... 52
13.5 Personnel and Vehicular Accidents Reporting ... 52
13.6 Log and Summary of Occupational Injuries and Illnesses ... 53
14.0 HEARING CONSERVATION PROGRAM ... 54
14.1 Program Administration and Responsibilities ... 54
14.2 Monitoring Program ... 55
14.3 Hearing Protectors ... 55
14.4 Recordkeeping ... 55
15.0 DRILLING OPERATIONS ... 56
15.1 Responsibilities ... 56
15.2 Housekeeping ... 56
15.3 Safety during Maintenance Activities ... 57
15.4 Safe Use of Hand Tools ... 57
15.5 Off-Road Movement of Drill Rigs ... 58
15.6 Safety Guidelines for Working Around Overhead and Underground Utilities ... 58
15.7 Safety During Drilling Operations ... 60
16.0 SITE SPECIFIC HEALTH AND SAFETY PLANS ... 61
16.1 SSHSP Content ... 61
16.2 Subcontractor Use of SSHSP ... 62
17.0 BLOODBORNE PATHOGENS PROGRAM ... 63
17.1 Program Administration and Responsibilities ... 63
17.2 Sources of Exposure ... 63
17.3 Training ... 63
17.4 Vaccinations, Post-exposure Evaluation, and Follow-up ... 64
17.5 Medical Recordkeeping ... 64

18.0 LABORATORY CHEMICAL HYGIENE PROGRAM 66
18.1 Program Administration and Responsibilities 66
18.2 Training 66
18.3 Elements of a Chemical Hygiene Plan 66
19.0 SITE SAFETY BRIEFINGS 68
20.0 DECONTAMINATION 69
20.1 Program Responsibilities 69
20.2 Contamination Prevention 69
20.3 Personal Decontamination 70
20.4 Equipment Decontamination 71
20.5 Decontamination Equipment 71
20.6 Disposal of Contaminated Materials 71
21.0 HEALTH AND SAFETY AUDITS 73
22.0 HEAT STRESS MANAGEMENT PROGRAM 74
22.1 Program Administration and Responsibilities 74
22.2 Heat Stress Prevention 74
23.0 COLD STRESS MANAGEMENT 77
23.1 Program Administration and Responsibilities 77
23.2 Cold Stress Prevention 77
23.3 Cold Stress Monitoring 77
24.0 TRANSPORTATION OF HAZARDOUS MATERIALS AND SAMPLES 79
24.1 Program Responsibilities 79
24.2 Training Requirements 79
24.3 Reportable Quantities 80
24.4 General Packaging Requirements 81
24.5 Shipping Papers 81
24.6 Emergency Response Information 82
25.0 OPERATION OF OWNED, LEASED OR PERSONAL VEHICLES 83
APPENDIX I. STANDARDS OF CONDUCT AND SAFETY RULES 85
APPENDIX II. INFORMED CONSENT STATEMENT ON ALCOHOL AND DRUG ABUSE 96
APPENDIX III. AUTHORIZATION TO RELEASE MEDICAL RECORD INFORMATION 97
APPENDIX IV. ACCIDENT REPORT POLICY AND REPORT FORMS 98
APPENDIX V. VEHICULAR ACCIDENT REPORTING 104
APPENDIX VI. TAIL GATE SAFETY MEETING 110
APPENDIX VII. SAFETY AUDIT CHECKLIST 112

CORPORATE SAFETY STATEMENT

The Management of SeaCrest Group (SCG) considers the safety of its workers and the general public as one of the most important aspects of its business. Management demonstrates its commitment to safety by providing the necessary facilities, equipment, training, medical monitoring, and support personnel required to implement the Corporate Health and Safety Plan. Operations managers, site supervisors and site safety officers have the complete support of Management in establishing, implementing and enforcing this Safety Program and other site specific health and safety plans. It is the duty of all employees to work safely and adhere to the requirements of the Safety Program and all applicable site specific health and safety plans. Failure to comply with the above mentioned requirements may result in disciplinary action or termination of employment.

This document will describe SeaCrest Group's Corporate Health and Safety Plan and act as a guide for site specific health and safety plans.

APPROVED BY:

_____

Shannon Phelps, Laboratory Director

_____

Emily Gustafson, Health and Safety Officer

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

This Health and Safety Plan is designed to provide you with knowledge of the recognized and established safe practices and procedures that apply to many of the work situations you may encounter while employed here at SeaCrest Group.

To cover every situation would be impossible. If you are in doubt about the safety of any condition, practice or procedure, consult your supervisor for guidance.

I, _____, have read and understand the Health and Safety Plan of SeaCrest Group, and understand that the violation of any safety or SCG policy is cause for stern disciplinary action which could include termination of employment.

Date: _____ Signed: _____

Witness: _____

INTRODUCTION

This SeaCrest Health and Safety Plan will be read by each employee upon commencement of employment with this SCG. It should also be consulted by supervisors and employees who need information concerning health and safety policy.

This document establishes the policies, responsibilities, and procedures for the prevention of injury and illness and ensuring the health and safety of workers involved in all SCG activities.

General Statement of Policy

1. SeaCrest Group's policy is to conduct all operations in such a manner that the health and safety of all personnel is given the highest priority. No operations shall be pursued at the expense of the safety of individuals performing a task.

2. Employees shall be provided with the necessary training and safety instruction, including a copy of the SeaCrest Health and Safety Plan. Only those employees qualified by training or experience shall be permitted to operate equipment. Employees must have a minimum 40 hours of health and safety training, and have established medical monitoring before working on any project involving a level of protection of C or above as defined by the USEPA**.**

3. Employees shall adhere to the requirements of the Corporate Health and Safety Plans. Failure to comply will be grounds for disciplinary action or termination of employment.

4. All employees are required to actively participate in this SCG Health and Safety Program. This includes attending safety meetings and adhering to all policies, rules and standards. Active participation in this program will be a substantial part of your performance review.

5. Equipment will be maintained in safe working condition to prevent accident or injury due to equipment failure or malfunction.

Employee Awareness and Participation

1. SeaCrest employees are its most valuable asset and therefore employee health and safety is essential to the success of SCG.

2. There will be mandatory attendance at regular, but not less than annual, safety meetings of all employees including management. Attendance and content of meeting will be documented. The intentions of the meetings will be to discuss any health and safety issues, review any incident or near miss during that year and for the employee's to bring to the attention of management any condition they feel is unsafe.

3. The basic policy of "safety first" will be stressed at each site orientation tailgate meeting and annual general safety meeting.

4. Employees will be encouraged to make suggestions to improve the safety of the work place. These suggestions will be acted upon promptly as appropriate to eliminate unsafe conditions.

5. The operators/supervisors will be responsible for ensuring that all employees on their work site are working in accordance with the Standards of Conduct and Safety rules (Appendix I).
6. Safety posters and other informational material will be posted to remind and encourage employees to work safely. In addition, annual accident reports and near miss reports will be posted for employees to review and discussion at safety meetings.

SUBSTANCE ABUSE POLICY

General

It is SCG's belief that the misuse of drugs impairs employee health, employee performance and creates unsafe working conditions. SeaCrest Group has established the following rules and regulations regarding the use, sale, or possession of drugs and alcohol on the job. These rules and regulations are mandatory and express conditions of employment. An informed consent form for acknowledging SeaCrest's alcohol and drug use policy is provided in Appendix II.

Unauthorized Use:

Possessing, using, distributing, or being under the influence of prohibited drugs while on the job or using SCG property is cause for termination of employment. Unauthorized use or possession of alcohol, or being under the influence of alcohol while on the job or while using SCG property may be cause for termination of employment. SCG property includes, but is not limited to, SCG or contractor owned or leased vehicles, vessels, aircraft and other equipment. Prohibited drugs include, but are not limited to, marijuana, hashish, herein, cocaine, hallucinogens, "designer" or generic drugs, depressants, stimulants and any other substances schedule has controlled substances pursuant to the Federal Control Substances Act, unless prescribed for current treatment by a licensed physician. The use of prescribed drugs or over-the-counter drugs which may adversely affect performance or behavior or compromise safety must be reported by the employee to his or her supervisor upon reporting for duty. Abuse of over-the-counter or prescribed drugs is prohibited.

An employee reporting for work visibly impaired is unable to perform required duties and will not be allowed to work. The supervisor will consult privately with the employee about the observation to rule out any problems that may have been caused by prescription drugs. If, in the sole opinion of the supervisor, the employee is considered impaired, the employee will be sent home or to a medical facility. The impaired employee will not be allowed to drive.

It is the responsibility of SeaCrest Group's supervisors to counsel with an employee whenever they see changes in performance that suggest an employee problem. The supervisor may suggest that the employee voluntarily seek help. Abuse of prescription drugs will not be tolerated.

SCG will not discriminate against applicants for employment because of past use of either drugs or alcohol. It is current use of drugs or abuse of alcohol which prevents employees from performing their jobs that SCG will not tolerate. While SeaCrest does not require pre-employment drug testing, SCG does reserve the right to request that an employee submit to a drug test when deemed appropriate. Failure to comply with this request, or a positive result, can result in automatic dismissal.

Testing

1. Following an industrial accident or near miss incident, employees and contractors involved may be re-tested.
2. When there is reasonable cause to believe that an employee is possessing, using, distributing, or being under the influence of prohibited drugs or alcohol on the job. Reasonable cause to believe that an employee is using, selling, or in possession of prohibited drugs or alcohol at the work place or is present on SCG premises under the influence of prohibited drugs or alcohol may include, but is not limited to, excessive absenteeism, declining productivity, excessive tardiness, and/or other suspect behavior that is deemed by individuals trained in such detection to indicated the use, sale, or possession of prohibited drugs or alcohol.
3. When required by state or federal law or any other regulation that may supersede this policy. Violation of this SCG test as outlined in this policy, will be cause for disciplinary action, up to and including discharge.

SeaCrest, in its sole discretion, reserves the right to take any other disciplinary action, including, but not limited to, discharging, warning, suspending, or continuing the employment of the employee on the express condition that the employee submit to rehabilitation or drug counseling. SCG is under no obligation under these rules to impose any lesser discipline prior to discharging an employee for violation of these rules.

ORGANIZATIONAL STRUCTURE ASSIGNMENT OF RESPONSIBILITY

Organization is necessary to safely work in the hazardous waste industry. While each site will have specific differences, the basic organizational structure will be used throughout SeaCrest operations. There must always be lines of authority, responsibility, and communications. A liaison with the community must also be established. All personnel must be aware of these lines of authority, and perform their function in the organizational structure as safely and efficiently as possible.

Corporate and Project Responsibility

Ultimate safety of the workers within SeaCrest are the responsibility of the officers of SCG. For every project, the Project Managers will be responsible for implementing the health and safety policies adopted by the officers for SCG. Each employee will be responsible for conducting their individual operations according to the policies outlined in this document and as directed by their responsible manager. Employees at all management levels are responsible for notifying their immediate and/or corporate managers of any unsafe working conditions which they encounter. It is the job of each project and corporate manager to immediately correct any unsafe working conditions.

Health and Safety Officer (HSO)

The Corporate Health and Safety Officer (HSO) is responsible for implementing this program. The HSO advises the Site Manager (who may or may not be the Project Manager) on all aspects of health and safety. The Site Manager ensures that each hazardous waste site has a qualified safety officer. If a Site Health and Safety Officer has not been assigned to the job site, the Project Manager will assume the responsibilities of the Site Health and Safety Officer.

The HSO or designee is responsible for but not limited to the following:

- Implementation and enforcement of SeaCrest Group's Health and Safety Plan;
- Implementing the Site Specific Health and Safety plan;
- Provide site training and briefings;
- Posting emergency numbers and route to nearest medical facility;
- Updating and utilizing equipment or procedures based upon new information gathered during operations;
- Specifying and modifying the levels of protection based upon new information gathered during operations;
- Examining workers for symptoms of exposure, heat and cold stress;
- Determining the suitability of workers for work in the exclusion zone according to the physician's report and the worker's current physical symptoms;
- Providing for first aid at the site;

- Stop any operation that threatens the health and safety of any person or the surrounding population;
- The logging of all monitoring results, visitors to the site and any accidents or injuries; and
- Coordination with outside medical agencies or authorities should their presence at the site become important.

Project Manager

This level of leadership has total control over specific projects. He or she is primarily an administrator when not participating in the field activities. They report directly to upper management. The Project Manager may fill this position on some projects. The Project Manager is responsible for, but not limited to the following:

- Implementation and enforcement of the corporate health and safety injury, illness prevention program;
- Preparing and organizing all project work;
- Selecting crew personnel and briefing them on specific assignments;
- Defining the scope of work;
- Coordinating with the foreman, health and safety officer and all other parties involved to complete the work plan;
- Ensuring that health and safety training and equipment requirements have been met;
- Obtaining permission from the proper authority to enter and start work; and
- Coordination with the owner and/or engineer.

Site Manager

The Site Manager is responsible for field operations and the safety of workers under his or her control. The Project Manager may fill this position on some projects.

The Site Manager is responsible for, but not limited to the following activities:

- Verify the availability of first aid & clearly communicate to workers how to get medical attention;
- Supervision of field operations;
- Site control enforcement;
- Coordination of work activities;
- Enforcement of health and safety standards & procedures;
- Public relations and state and federal liaison; and
- Working directly with the site health and safety officer.

Medical Support

There are three levels of medical support for project related needs:

1. A consulting physician, who specializes in occupational and environmental medicine, who supports development of a medical program to monitor for health effects from potential exposures to hazardous chemicals.
2. Medical personnel at hospitals and clinics who may respond to medical emergencies that may occur at various project sites.
3. Ambulance personnel that will provide emergency treatment as necessary.

It is the responsibility of the Project Manager to know in advance the needs and the logistics associated with the mobilization of each of these resources.

Work Crew

This category consists of no less than two workers assigned to a project. It is the front line of the organization. The work crew performs the on-site tasks necessary to fulfill objectives. No worker should enter or exit a hazardous or potentially hazardous work area alone. The work crew must follow the buddy system to ensure the safety of each individual. They are the first to become aware of any unsafe conditions that may surface during the project. They are responsible to avoid these conditions and notify the safety officer immediately, so the situation can be analyzed and the appropriate precautions taken.

Specialized Advisors (as required)

This group will be comprised of outside consultants in specialized fields, such as medical, legal, toxicology or other consultants.

TRAINING

Introduction

Health and safety training is an integral part of SeaCrest's health and safety program. All employees working at a site exposed to hazardous substances, health hazards, or safety hazards will receive training in accordance with HAZWOPER requirements specified in 29CFR1910.120 prior to participating in or supervising any activity at a site where they may be exposed to hazardous wastes, health hazards or safety hazards.

The objectives of the training program for SeaCrest employees engaged in hazardous waste site activities are to:

- Educate workers about the potential health and safety hazards they may encounter at a work site;
- Provide knowledge and skills necessary to minimize risk to worker health and safety;
- Provide thorough training in the proper use and potential limitations of safety and PPE; and
- Ensure that workers can safely avoid or respond appropriately to emergencies.

The type of training conducted for SeaCrest employees will depend on the employee's position, duties, and experience. SeaCrest employees will not participate or supervise field activities until they have been trained to a level commensurate with their job function and responsibilities. The HAZWOPER regulations specify hourly training requirements for five different categories of site workers.

Special training for the SeaCrest toxicity testing laboratory technicians will include:

- Familiarization with hazardous laboratory chemicals and MSDSs;
- Protective measures such as venting and PPE;
- Basic emergency response procedures, including location of fire extinguishers, evacuation exits, designated medical clinic, and emergency phone numbers.

New Employee Training Checklist

In accordance with the requirements of 29CFR1910.120 new field employees will need to be thoroughly familiar with the following information:

- Names of personnel and alternates responsible for site safety and health;
- Safety, health and other hazards present at the site;
- Use of Personal Protective Equipment (PPE);

- Work practices by which the field employee can minimize risks from hazards;
- Safe use of engineering controls and equipment on the site;
- Medical surveillance techniques, and recognition of symptoms and signs that might indicate overexposure to hazards;
- Emergency Response Plan which provides information on safe and effective responses to emergencies, including equipment needed;
- Confined space entry procedures (if applicable);
- A spill containment program;
- Decontamination procedures;
- Proper use of field equipment;
- First Aid and CPR; and
- Employee's rights and responsibilities.

40-Hour/24-Hour HAZWOPER Training

SeaCrest employees engaged in hazardous substance removal or other activities that potentially expose them to hazardous substances and health hazards (e.g., equipment operators, general laborers, and supervisory personnel) are required to receive at least 40 hours of off-site instruction, as well as a minimum three days of actual field experience under the direct supervision of a trained, experienced supervisor.

Twenty-four hour training is required for employees that will have less potential for exposure to hazardous substances and safety and health hazards. Site workers requiring 24 hours of training and eight hours of supervised field experience include the following:

- Workers who are on-site occasionally to perform a specific limited task (e.g., ground water monitoring) and who are unlikely to be exposed to hazardous substances over their PELs;
- Workers regularly on-site who work in areas where exposure levels are monitored and determined to be below PELs, and where no health or atmospheric hazards are posed;
- Managers and supervisors responsible for employees with 24 hour training requirements are also required to receive the same amount of training plus eight additional hours of specialized training in manging haardous waste operations.
- Workers with 24 hours of training who subsequently become general site workers or whole job requires that a respirator be worn are required to obtain the additional 16 hours and two days of field experience to fulfill the training requirements commensurate with their new responsibilities.

Visitors to the site will not be required to have completed any specific training in health and safety. However, they will be informed about the hazards at the site as well as PPE, decontamination procedures, and the site emergency plan. Site visitors will not be allowed to enter any hazardous area without fulfilling the proper training requirements.

Hazardous Waste Operations Field Experience

SeaCrest employees that are equipment operators, general laborers, and supervisory personnel engaged in hazardous substance removal or other activities that potentially expose them to hazardous substances and health hazards are required to have 24 hours of supervised field experience.

Employees that are unlikely to be exposed to hazardous substances over their PELs and where no health or atmospheric hazards are posed, will receive 8 hours of supervised field experience.

8-Hour Supervisor Training

Managers and supervisors of workers at hazardous waste sites will be required to take eight hours of supervisor training in their responsibilities under the health and safety program, the PPE program, the medical surveillance program, and the emergency response plan.

8-Hour Refresher Training

All SeaCrest employees who perform cleanup operations at uncontrolled hazardous waste sites, including managers and supervisors must receive a minimum of eight hours of annual refresher training. The purpose of the refresher training is to maintain competency essential for ensuring a safe work environment.

Training Equivalencies

Employees who have documentation or certification that their past work experience resulted in training equivalent to the training required under the OSHA regulations will not be required to have additional 40-hour, 24-hour, or 8-hour refresher training. However, these employees will be given site specific training before they enter the site and have appropriate supervised field experience at the new site.

Equivalent training includes any academic training or training that employees might have already received from actual hazardous waste site experience.

Risk Awareness Training

The SeaCrest Health and Safety Officer will conduct training to inform employees of the potential risks to which they may be exposed. Employees required to handle or use poisons, caustics, and other harmful substances will be made aware of the potential hazards, personal hygiene and protective measures required. At work site where harmful plants or animals are present employees will be instructed in the potential hazards, how to avoid injury and first aid procedures in the event of injury. Employees required to handle or use flammable liquids, gases or toxic materials will be made aware of the risks and instructed in the safe handling of these materials. Employees required to enter confined or enclosed spaces will be instructed in the risks involved, the necessary precautions to be taken, and the PPE required. This includes open top spaces that are more than 4 feet in depth.

Hazard Communications Training

Each SeaCrest employee who may be exposed to hazardous chemicals when working will be provided information and training prior to initial assignment to work with a hazardous chemical and whenever the hazard changes. Training will include:

- Ensuring that employees are aware of hazardous chemicals to which they may be exposed,
- Instruction on how to read and use labels;
- Instruction on reading and using material safety data sheets (MSDS);
- Training on risks of exposure to the chemicals in their workplaces; and
- Training on appropriate protective measures.

Records of Hazard Communication training will be kept in the employees personnel file to confirm that training was in accordance with the requirements of 29CFR1910.1200.

Respiratory Protection Training

Training in respiratory protection will include the following:

- Respiratory Hazards (e.g., aerosols, oxygen deficiency);
- Respirator Use and Selection;
- Determining Respiratory Protection;
- Types of Respirators;
    - Air-Purifying Respirators

- Air-Supplying Respirators (SCBA)
- Fit-testing.

Respiratory protection training will be given prior to working at a hazardous waste site and annually.

Hearing Conservation Training

Training in hearing conservation will be given to all employees exposed to noise at or above an 8-hour time-weighted average of 85 decibels. A copy of the OSHA standard will also be made available to the employees. The training program will be conducted annually for each employee in the hearing conservation program.

Training will provide the following information:

- Effects of noise on hearing;
- Purpose and types of hearing protectors and the advantages, disadvantages, and noise attenuation of each type;
- Instructions on selection, fitting, use, and care of hearing protectors;
- Purpose of audiometric testing and an explanation of the test procedures.

First Aid and CPR Training

First aid and CPR training will be given to employees that will be working at field locations. The training will be of sufficient length to assure that the trainees understand the concepts of first aid and CPR. The outline of a typical training program is shown below.

- Definition of first aid;
- Legal issues related to applying first aid (Good Samaritan Laws);
- Basic anatomy;
- Patient assessment and first aid for the following:
  - Cardiac arrest
  - Respiratory arrest
  - Hemorrhage
  - Lacerations/abrasions
  - Musculoskeletal injuries
  - Shock
  - Eye injuries

  - Burns
  - Loss of consciousness
  - Hypothermia/Hyperthermia
  - Paralysis
  - Poisoning
  - Loss of mental functioning
  - Drug overdose.
- CPR
- Application of dressings and slings
- Treatment of strains, sprains and fractures
- Immobilization of injured persons
- Handling and transporting injured persons
- Treatment of bites, stings, or contact with poisonous plants or animals.

Construction Safety Training

All workers at a construction site will be instructed in the potential hazards of the construction equipment and hazardous materials at the work site. They will be trained in the recognition, avoidance, and prevention of unsafe conditions, and emergency response. Construction workers will also receive training on the Site-Specific Health and Safety Plan and informed of the location of the plan at the work site.

Training Record Maintenance

A record of training will be maintained in each employee's personnel file to confirm that every person assigned to a specific task has adequate training for that task and that the training is up-to-date.

MEDICAL SURVEILLANCE PROGRAM

Introduction

SeaCrest employees engaged in hazardous waste operations and emergency response activities may be exposed to a number of potential hazards, including: toxic chemicals; safety and biological hazards; and physical agents, such as heat stress and radiation. For employees engaged in such activities a medical program will be established to monitor employee health, both at the beginning of employment and during the course of the work.

The goal of the medical surveillance program and periodic monitoring is for the protection of the health of SeaCrest employees. The medical surveillance program will enable the detection of pre-existing medical conditions that may place the employee under increased risk and will monitor employees engaged in hazardous operations to help to minimize the likelihood of medical problems developing during the course of the work.

Selection of Participants

The SeaCrest medical surveillance program will include monitoring of the following groups of employees:

- Employees who are, or may be, exposed to Permissible Exposure Level (PELs) of hazardous substances or health hazards for 30 or more days per year;
- Employees who wear a respirator for 30 or more days per year;
- Members of HAZMAT teams; and
- Employees who are injured as a result of overexposure during a site emergency or who show symptoms of illness that may have resulted from exposure to hazardous substances.
-

Medical Monitoring Requirements

All SeaCrest employees who are required by HAZWOPER to participate in a medical surveillance program will undergo a baseline medical examination prior to a field assignment. After this initial examination these employees will have a follow-up medical examination at least once per year, unless the occupational health physician believes a longer interval is appropriate. The longer interval will not exceed two years.

The employee will complete an occupational and medical history questionnaire describing all prior occupational exposures to chemical and physical hazards. The questionnaire will also document past illnesses and chronic diseases and lifestyle habits, such as smoking alcohol use and hobbies.

The baseline screening will also include a comprehensive physical examination that will include pulmonary function, audiometry, electrocardiogram, chest X-ray, complete blood count, routine urinalysis, and blood chemistry.

If the employee is unable to work while wearing PPE because of pre-existing conditions, he/she will be disqualified from working at potentially hazardous sites.

Employee Tracking

Periodic medical examinations will be conducted as long as the SeaCrest employee continues to work at potentially hazardous sites. At the end of employment as a hazardous waste site worker, the employee will be given a termination medical examination to make sure that the health of the individual has not changed as a result of work conditions.

Emergency Medical Treatment at Work Sites

Provisions for emergency treatment and acute non-emergency treatment will be made at each work site. The range of actual and potential hazards specific to a site will be considered, including chemical, physical, and biological hazards. Emergency medical treatment will be integrated into the overall site emergency response program. Medical facilities near the hazardous waste site, capable of sophisticated response to chemical and other exposures, will be identified

Medical Records Management /Results Reporting

Medical records for each employee will be maintained for at least 30 years after employment is terminated. The records will include the name and social security number of the employee, the physician's written opinions, including recommended occupational limitations and results of examinations and tests, any employee medical complaints related to occupational hazardous substance exposure, and a copy of the material that the attending physician was provided before the examination. SeaCrest will provide access to employee's medical records upon the request of the employee.

The SeaCrest Health and Safety Officer will be responsible for the following record keeping activities annually:

- Ensure that each accident or illness was promptly investigated to determine the cause and make necessary changes in health and safety procedures;
- Evaluate specific medical testing to determine potential site exposures;
- Add or delete medical tests as suggested by current industrial hygiene and environmental data;
- Review potential exposures and the Site Specific Health and Safety Plan (HASP) at all sites to determine whether additional testing is required;
- Review emergency treatment procedures and update lists of emergency contacts; and
- Assure timely access to medical records upon request of the employee.

Forms and Instructions

A form to be completed by a new employee authorizing release of prior medical record information to SeaCrest is shown in Appendix III.

SUBCONTRACTOR HEALTH AND SAFETY REQUIREMENTS

Responsibilities

In order to ensure a safe working environment, an employee who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, subcontractors, or their representatives of the following:

- Hazardous substances to which they might be exposed while on the job site.
- Symptoms and effects of overexposure.
- Appropriate personal protective equipment and other precautions they may take to lessen the possibility of exposure.
- Emergency response procedures.
- Any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer, including those identified in the employer's information program.

The SeaCrest Health and Safety Plan will be made available to all contractors working at a hazardous waste site.

The subcontractor at the site is responsible for adhering to the Site-specific Safety Plan for the operations they will be conducting at the hazardous waste site. The Site-specific Plan should include the following:

- Site History
- Key Personnel
- Health Risk Analysis
- Personal Protective Equipment
- Medical surveillance program
- Air Monitoring Protocol
- Site Security and Control
- Decontamination Procedures
- Standard Operating Procedures
- Emergency Response Plan

The subcontractor also is required to show proof of insurance at the amounts specified in the table below:

COVERAGE	LIMITS
Workers' Compensation/Employers' Liability	Statutory limit/$1 million/occurrence
Commercial General Liability	$1 million/occurrence/$2 million aggregate
Automobile Liability	$1 million combined single limit
Pollution Liability for handling and transporting hazardous materials	$1 million/occurrence
Professional Liability (if professional services are rendered)	$1 million/claim

Hazardous Waste Operations

Contract workers involved in hazardous substance or other activities which may expose the workers to hazardous substances and health hazards must have received a minimum of 40 hours of hazardous waste field operations training or equivalent experience. Workers on site only occasionally for a specific limited task and workers who work in areas which have been monitored and fully characterized who are unlikely to be exposed over permissible exposure limits and published exposure limits must have received a minimum of 24 hours of training or equivalent experience. Contract supervisors must receive an additional 8 hours of specialized training at the time of job assignment on SeaCrest's health and safety program, PPE program, spill containment program, and health hazard monitoring procedures. All contract workers must provide SeaCrest with training certificates for required training. Any contract worker who does not have certification of the required training will be prohibited from engaging in hazardous waste operations.

Health and Safety Aspects of Subcontractor Agreements

The health and safety aspects of subcontractor agreements include:

- Provision of appropriate PPE by the subcontractor;
- Respiratory protection training for the contract workers;
- Provision of decontamination equipment;
- Training in safe use of drill rigs and other heavy equipment;
- Compliance with site-specific health and safety plan.

6.4 Evaluating Contractor Compliance

The SeaCrest Health and Safety Officer will communicate with the Site Health and Safety Supervisor daily to make sure that the subcontractor is complying with the Site-Specific Health and Safety Plan. He/she will also visit the site periodically to determine whether the subcontractor is in compliance with the Site-Specific Health and Safety Plan. The Health and Safety Officer will report any deviations from the Health and Safety Plan to the subcontractor. The subcontractor will be required to correct any deviations from the plan as soon as possible.

HAZARD COMMUNICATION PROGRAM

SeaCrest Group has adopted a hazard communication program to enhance employee health and safety awareness. A written hazard communication program meets the standards of the OSHA Hazard Communication Standard 29 CFR 1910.1200. The objective of this written program is to effectively disseminate pertinent data on the safe handling of hazardous chemicals in the workplace and on the job sites to all appropriate personnel and to outline their rights and responsibilities under the OSHA Hazard Communication Standard. This program will be available upon request to all employees and their designated representatives.

The corporate Health and Safety Officer will administer this program.

Material Safety Data Sheets

The purpose of the MSDS is to provide detailed information in each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures. Copies of material safety data sheets (MSDS) for hazardous substances affecting SeaCrest Group operations or employees will be obtained from the manufacturer or client with copies kept on file at the work site, and in the job file. Incoming data sheets will be reviewed for new and significant health and safety information which will be passed on to affected employees.

The MSDSs will be readily accessible to the employees at all times. They will be kept in a binder in the laboratory.

In order to ensure that the most current MSDS is in the SCG file the following procedures will be followed:

- Designation of a person responsible for obtaining and maintaining the MSDSs;
- Procedures to follow when the MSDS is not received at the time of first shipment of the chemical;
- List of every hazardous chemical in the laboratory or field site which will be updated whenever a new hazardous chemical is purchased;
- Knowledge by each employee of the location of the MSDSs

Employee Information Training

Prior to starting work with a hazardous substance, it will be the responsibility of the Site Health and Safety Officer to give a health and safety orientation to employees in order to:

- Provide an overview of hazard communication regulations, including employee rights.
- Inform employees on availability of written hazard communication program.
- Discuss in detail the hazardous chemicals that may be encountered at the site.

- Minimize the physical and health effects of hazardous substances through safe work practices and personal protective equipment.
- Outline emergency and first aid procedures to follow in the event of exposure to a hazardous substance
- Direct employees to read labels and review material safety data sheets to obtain information.

It is important that all employees understand the information provided. Additional questions should be directed toward their supervisor. Whenever new hazardous substances are introduced, supervisors will conduct training for the employees on the new hazard.

Labeling of Hazardous Chemicals

Containers of hazardous chemicals will be labeled, tagged, or marked with the identity of the material (e.g., 1,1,1,-trichloroechane) and the appropriate hazard warnings (e.g., flammable). The labels will be legible and prominently displayed.

To ensure that the labeling is properly implemented, the following procedures are followed:

- Designation of a person responsible for ensuring proper labeling of all chemicals in the laboratory and chemicals that are being shipped;
- Written description of labeling system used; and
- Procedures for reviewing and updating label information when necessary.

If chemicals are transferred to another container, the new container will be clearly labeled with the same information that appears on the original container containing the chemical.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Administration and Responsibilities

Use of Personal Protective Equipment (PPE) is required by the OSHA regulations (29CFR1910). No single combination of protective equipment equipment and clothing will protect against all hazards. Thus, PPE will be used in conjuction with engineering controls and safe work practices.

A written PPE program will be prepared for work at each hazardous waste site and made available to all employees that may be required to use PPE at the work site. The PPE program for the work site will include hazard identification, medical monitoring, environmental surveillance, selection, use, maintenance, and decontamination of PPE, and training on the use of PPE. The PPE program is reviewed annually by the SeaCrest's Safety and Health Officer.

Selection of PPE

The skin and respiratory tract are usually the first to be attacked by chemical contaminants. To harm the body, chemicals must first gain entrance. Personal protective equipment is used to minimize or eliminate chemical compounds from contracting first barrier of tissues.

The proper selection of equipment is important in preventing exposures. There are several factors to consider when selecting PPE.

- Chemicals present
- Concentration of the chemicals
- Physical state
- Length of exposure
- Dexterity
- Ability to decontaminate
- Climatic conditions
- Work load

The following is the basic personal protective equipment:

- Head protection (Regulated by 29 CFR 1910.135 and the ANSI Z89.1)
- Foot protection (29 CFR 1910.136 and ANSI Z41.1)
- Eye and face protection (29 CFR 1910.133 (a) and ANSI Z87.1)
- General Requirements for PPE (29CFR1910.132)

- Hearing Protection (29CFR1926.101)
- Respiratory protection (29 CFR 1910.134 and ANSI Z88.2)

Corrective Lenses

SeaCrest employees whose vision requires the use of corrective lenses, and who are required to wear eye protection, shall wear goggles of one of the following types:

- Goggles that can be worn over corrective glasses without disturbing the adjustment of the PPE.
- Goggles that incorporate corrective lenses mounted behind the protective lenses of the PPE.

Contact Lenses

The wearing of contact lenses in conjunction with any type of respirator will not be allowed. Individuals needing corrective lenses will have a special spectacle kit which allows corrective lenses to be worn inside the respirator.

Levels of Protection

Level A protection, which includes positive pressure, full face-piece SCBA, totally encapsulating chemical-protective suit; inner and/or outer chemical-resistant gloves; and disposable protective suit, gloves, and boots. Level A protection will be used under the following conditions:

- Presence of hazardous substances that require the highest level of protection for skin, eyes, and the respiratory system;
- The atmosphere contains less than 19.5 % oxygen;
- Site operations will involve a high potential for splash, immersion or exposure to materials that are harmful to the skin;
- Operations are being conducted in confined, poorly ventilated areas, and the absence of hazardous substances has not yet been determined;
- Direct reading instruments indicate high levels of unidentified vapors or gases in the air;
- Visible indicators such as leaking containers or smoking chemical fires.

Level B protection included positive pressure, full face-piece SCBA, inner and /or outer chemical-resistant gloves; face shield; hooded chemical resistant clothing; coveralls; and outer chemical-resistant boots. Level B protection will be used under the following conditions:

- Type of chemical and atmospheric concentration of substances that have been identified require a high level of respiratory protection but less skin protection than Level A;
- The atmosphere contains less than 19.5% oxygen; or
- The presence of incompletely identified vapors and gases is indicated, but they are not suspected of being harmful to the skin.

Level C protection, which includes full-face air purifying respirators, inner and outer chemical-resistant gloves, hard hat, escape mask, and disposable chemical-resistant outer boots, will be used when the concentration and type of airborne substances is known and the criteria for using air-purifying respirators is met. The main selection criterion for Level C is that atmospheric concentrations and other selection criteria permit the use of an air-purifying respirator. The following criteria warrants the use of Level C protection:

- The atmospheric contaminants, liquid splashes or other direct contact will not adversely affect or be absorbed by the skin;
- The types of air contaminants have been identified, concentrations do not exceed IDLH levels, and an air-purifying respirator is available that can remove the contaminants; and
- Oxygen concentrations are not less than 19.5% by volume.

Level D protection, which may include gloves, coveralls, safety glasses, face shield, and chemical resistant steel-toe boots or shoes, is sufficient under the following conditions:

- No contaminants are present;
- Work operations preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Work Mission Duration

In selecting the appropriate PPE to use, the anticipated duration of the work mission is considered. Several factors that will limit the mission length include:

- Air supply consumption;
- Work rate;
- Fitness;
- Body size;
- Breathing patterns;
- Suit/ensemble permeation, degradation, and penetration;
- Ambient temperature;
- Coolant supply during hot weather.

PPE Inspection, Storage, and Maintenance

All PPE will be inspected including clothing, gloves, fully encapsulating suits, SCBA, supplied air respirators, and air-purifying respirators. The PPE inspection program will include:

- Inspection and operational testing of equipment received from the factory or distributor;
- Inspection of equipment when it is issued;
- Inspection before and after use or training and prior to maintenance; and
- Periodic inspection of stored equipment.

PPE Training and Fitting

The PPE program will ensure that the SeaCrest employees are trained in the proper use and fitting of PPE. Training will be conducted prior to actual PPE use in a hazardous environment and will occur at least annually. The PPE training will address:

- OSHA requirements specified in 29CFR1910, subparts I and Z;
- OSHA requirements for respiratory protection in 29CFR1910.134;
- Proper use and maintenance of the PPE including capabilities and limitations;
- Hazards and consequences of not using PPE;
- Instruction in inspection, donning, doffing, decontaminating, checking, fitting and using PPE;
- Individualized respirator fit testing to ensure proper fit;
- Use of PPE under normal conditions for familiarity and use of PPE in a test atmosphere to evaluate its effectiveness;
- Emergency procedures and self-rescue in the event of PPE failure;
- The elements of HASP and the individual's responsibilities and duties in an emergency;
- The human factors influencing PPE performance.

The "fit" of the respirator will be tested at a minimum annually on each potential user to ensure a tight seal. For qualitative respirator fit testing protocol, Appendix D of 29CFR1910.1025 will be used. For specific quantitative testing protocols, literature supplied by the manufacturer will be consulted.

PPE Program Evaluation

The PPE program will be reviewed by the SeaCrest Safety and Health Officer at a minimum annually. The following factors will be evaluated:

- The number of personnel-hours that are spent at various levels of PPE;
- The degree to which the site complies with HAZWOPER standards on PPE use, inspection, maintenance, and recordkeeping;
- Accident, injury, and illness statistics, and recorded levels of exposure;
- Adequacy of operating procedures to guide the selection of PPE;
- Degree of coordination with comprehensive and site-specific health and safety programs;
- Recommendations for improvement and modification of the PPE program and results of modifications.

RESPIRATORY PROTECTION PROGRAM

Administration and Responsibilities

The purpose of SeaCrest's Respiratory Protection Program is to ensure that all employees working at a hazardous waste site are protected from respiratory hazards through proper use of respirators. Respirators are to be used only when engineering controls (e.g., confinement of the operation and ventilation) are not feasible or in emergencies.

SeaCrest will provide the proper respirators when such equipment is necessary to protect the health and safety of employees. SeaCrest will be responsible for establishing a Respiratory Protection Program in accordance with OSHA's 29CFR1910.134 and other occupational health standards.

The SeaCrest Health and Safety Officer will be responsible for the development, documentation and administration of the respirator program, and will serve as the Respirator Program Administrator. The Health and Safety Officer will:

- Prepare written standard operating procedures for respiratory protection;
- Evaluate respiratory hazards at work sites;
- Provide guidance on the selection and purchase of approved respirators;
- Provide instruction on proper use, maintenance, and storage of respirator equipment;
- Conduct a fit testing program for respirator users;
- Maintain fit testing and respirator training records; and
- Evaluate the overall effectiveness of the respirator program.

Types of Respirators

There are several types of equipment for respiratory protection. They include:

- Air-Purifying Respirators which include
  - Particulate-removing filters and gas and
  - Vapor-removing cartridges and canisters.
- Atmosphere-supplying Respirators
  - Supplied-Air (air-line) Respirator (positive or negative pressure)
  - Self-Contained Breathing Apparatus (SCBA) (positive or negative pressure)
    - Closed-circuit SCBA
    - Open-circuit SCBA.

Hazard Evaluation for Respirator Selection

Air purifying respirators will only be used if all of the following conditions are met:

- Identity and concentration of the contaminant are known;
- Ambient concentration of a contaminant is below the IDLH concentration;
- Oxygen content in the atmosphere is greater than 19.5%;
- Respirator assembly is approved for protection against the specific concentration of a contaminant;
- There is periodic monitoring of the work area; and
- Respirator assembly has been successfully fit-tested on the user.

SCBA is used under the following conditions:

- Type of chemical and atmospheric concentration of substances that have been identified require a high level of respiratory protection
- The atmosphere contains less than 19.5% oxygen;
- The presence of unidentified or incompletely identified vapors and gases is indicated; or
- Operations are being conducted in confined, poorly ventilated areas, and the absence of hazardous substances has not yet been determined.

Medical Surveillance

Medical surveillance of all employees wearing a respirator for 30 or more days a year will be conducted as specified in Section 5.0. medical examination will be conducted once every 12 months unless the attending physician believes a longer interval is appropriate. Medical examinations will be conducted every two years at a minimum.

Respirator Fit Testing

The use of respirators is prohibited when conditions prevent a good facepiece-to face seal. A fit test will be conducted to determine the ability of each individual respirator wearer to obtain a satisfactory fit with any air-purifying respirator. Both qualitative and quantitative fit tests will be performed. Qualitative fit tests are supplemental to quantitative fit tests. Employees must successfully pass the fit test before being issued an air-purifying respirator. The procedures for qualitative and quantitative fit testing are described later in this section.

Training

Training in use of the respirator will be conducted prior to its use on-site. Training will include OSHA requirements for respiratory protection; proper use and maintenance of the respirator, including its capabilities and limitations; hazards of not using proper respiratory protection; respirator fit test; and emergency procedures in the event of respirator failure.

Inspection, Maintenance, Cleaning, and Storage

Each respirator will be inspected before and after every use. Respirators that are stored for emergency use will be inspected monthly. Details on the inspection procedures can be found in Section 9.8.

Respirators will be cleaned and disinfected regularly weekly or monthly, unless for frequent cleaning is necessary. Shared respirators will be cleaned and disinfected after each use. In order to clean and disinfect the respirators filters or cartridges should be removed. Clogged filters or spent cartridges will be discarded. The face piece and associated parts will be cleaned with mild detergent and warm water and rinsed in clean, warm water. The face piece and parts will be immersed in a disinfectent solution for about 2 minutes. Disinfectant wipes (70% isopropyl alcohol) can also be used as a disinfectant. The face piece and parts will be rinsed in clean warm water and air dried overnight. When the respirator is dry it will be reassembled.

The respirator and cartridges will be placed in a sealed container and stored in a clean, dry place at room temperature. Gas and vapor cartridges will be kept in a sealed container so that they do not passively absorb gases and vapors from the storage area. Particulate filters will be protected from dust and dirt. Emergency use respirators will be sorted in a sturdy compartment that is easily accessible and clearly marked.

Respirator Inspection Procedures

Each respirator will be inspected routinely before and after use by the respirator user to ensure that it is in proper working condition. The respirator should also be inspected after cleaning to determine if it needs replacement of parts or repairs. Each respirator stored for emergencies will be inspected at least monthly.

Inspection of air-purifying respirators includes the following:

- The **face piece** will be checked for dirt; cracks, tears, or holes; distortion of face piece; cracked, scratched, or loose-fitting lenses;
- The **headstraps** will be checked for breaks or tears, loss of esalticity, broken buckles or attachments, and worn serration on head harness, which might allow face piece to slip;
- The **inhalation and exhalation valves** will be checked for dust particles, dirt, or detergent residue on valve and valve seat; cracks, tears, or distortion in the valve material; and missing or defective valve covers;
- The **filter** will be checked for approval designation; missing or worn gaskets; worn threads on filter and face piece; cracks or dents in filter housing; deterioration of gas mask canister harness; and service life indicator or end of service date. The filter wil also be checked to make sure that the proper filter will be used to protect against the specific hazards at the site;
- The **breathing tube** will be checked for cracks or holes; missing or loose hose clamps, and broken or missing end connectors.

Inspection of the atmosphere-supplying respirators includes the following:

- The **hood, helmet, blouse or full suit** will be checked for rips or torn seams; headgear suspension; cracks or breaks in faceshield; protective screens that fit correctly over faceshields, hoods, or blouses.
- The **air supply system** will be checked for breathing air quality; breaks or kinks in the air supply hoses and fittings; tightness or connections; settings of regulators and valves; correct operation of air purifying elements and alarm for carbon monoxide or high temperatures.

Qualitative Fit Test Procedures

The employee wearing a respirator is exposed to an odorant and then asked to breath deeply, move head from side to side, move head up and down, and talk. The wearer reports any noticeable odor then the fit is faulty and an adjustment to the respirator seal is required. The most common odiferous material that are used for the qualitative fit test are banana oil and irritant smoke. The wearer must pass the respirator fit test before an air-purifying respirator will be issued. The qualitative fit test is supplemental to the quantitative fit test.

Quantitative Fit Test Procedures

To quantitatively measure respirator fit a particle counting instrument is used. The instrument compares the dust concentration in the surrounding air with the dust concentration inside the respirator. The ratio of these concentrations is called the “fit factor.”

A modified filter cartridge (or a modified respirator face piece) equipped with a sampling port is used to collect air from inside the respirator. With the sampler attached, the wearer is asked to breathe deeply, move head from side to side, move head up and down, and talk. During these movements any leakage is measured by the particle counting device.

CONFINED SPACE ENTRY PROGRAM

Program Responsibilities

SeaCrest will ensure protection of its employees from the hazards associated with confined space entry in accordance with OSHA regulations (29CFR1910.146 – permit-required confined spaces) and other relevant standards. SeaCrest will develop a written Confined Space Entry Program when an employee will be required to enter a confined space. A confined space has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces may include, underground vaults, tanks, storage bins, pits, and diked areas, vessels, and silos. A permit-required confined space has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere (e.g., asphyxiating, flammable, toxic;
- Contains a material that has the potential for engulfing the person entering the confined space;
- Has an internal configuration that might cause the entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- Contains any other recognized serious safety or health hazards.

The SeaCrest Health and Safety Officer will be responsible for the Confined Space Program. The HSO will be responsible for developing a written confined space program for permit-required confined spaces. The HSO and/or site supervisor will be responsible for ensuring that all requirements of the program are properly implemented. The program will include the following:

- Identify and evaluate permit space hazards before allowing employee entry;
- Test conditions in the permit space before entry operations and monitor the space during entry:
- Perform in the following sequence appropriate testing for atmospheric hazards (e.g., oxygen, combustible gases or vapors, and toxic gases or vapors;
- Implement measures to prevent unauthorized entry;
- Establish and implement procedures and practices, such as specifying acceptable entry conditions, isolating the permit space, providing barriers and posting warning signs, flushing or ventilating the permit space to eliminate to control hazards to allow safe permit-space entry operations;
- Identify employee job duties;
- Provide, maintain, and require use of PPE and any other equipment necessary for safe entry (e.g., testing, monitoring, ventilating, communications, lighting, ladders);
- Ensure that at least one attendant is stationed outside the permit space for the duration of the entry operations;
- Implement appropriate procedures for summoning rescue and emergency services;
- Establish and implement a system for the preparation, issuance, use, and cancellation of entry permits;
- Review established entry operations and annually revise the confined space entry program;

Confined Space Hazards

Confined space hazards include the following:

- Asphyxiating, flammable and/or toxic atmospheres;
- Burn hazards;
- Heat stress hazards;
- Mechanical and physical hazards;
- Engulfment hazards;
- Electrocution;
- Noise hazards;
- Unexpected movement of machinery.

Training Requirements

Before the work assignment begins, SeaCrest will provide proper training for all workers who are required to work in confined spaces. Training will include proper confined space entry and work procedures, potential and actual hazards associated with the confined space to be entered, and emergency rescue procedures. Training will be required for all authorized entrants, attendants, and lead worker. Training in CPR and First Aid is required for rescue team members. Additional training will be required when:

- the job duties change;
- the permit confined space program changes;
- a new hazard is encountered;
- the employee's job performance shows deficiencies.

Upon completion of training, employees will receive a certificate of training with the employee's name, signature of trainer, and dates of training. The certification will be made available for inspection by employees and their authorized representatives.

Personnel Requirements and Responsibilities for Entry Operations

The responsibilities and duties for the Authorized Entrant, Attendant, Entry Supervisor are listed below:

Authorized Entrant's Duties and Responsibilities include the following:

- Know the confined space hazards, including information on the mode of exposure, signs or symptoms, and consequences of exposure;
- Use appropriate PPE equipment properly;
- Maintain communication with attendants to enable the attendant to monitor the entrant's status as well as to alert the entrant to evacuate;
- Exit from the confined space as soon as possible when ordered to by the attendant or other authorized person; when entrant recognizes signs or symptoms of exposure, or when an automatic alarm is activated; and
- Alert the attendant when a prohibited condition exists or when warning signs or symptoms of exposure exist.

Attendant's Duties and Responsibilities include the following:

- Remain outside the permitted confined space during entry operations, unless relieved by another authorized attendant;
- Perform non-entry rescues when specified by SeaCrest's rescue procedure;
- Know existing and potential hazards, including information on the mode of exposure, signs or symptoms, consequences of exposure and their physiological effects;
- Maintain communication with and keep an accurate account of those workers entering permitted confined space;
- Order evacuation of the permit space when a prohibited condition exists, when the entrant shows signs of hazard exposure, when an emergency exists outside the confined space, and when the attendant cannot effectively and safely perform the required duties;
- Summon rescue and other services during an emergency;
- Ensure that unauthorized persons stay away from permitted confined spaces;
- Inform authorized entrants and entry supervisor of entry by unauthorized persons; and
- Perform no other duties that may interfere with the attendant's primary responsibilities.

The **Entry Supervisor's duties and responsibilities** include the following:

- Know the confined space hazards including mode of exposure, sign or symptoms and consequences of exposure;
- Verify emergency plans and specified entry conditions, such as permits, tests, procedures, and equipment before allowing entry;
- Terminate entry and cancel permits when entry operations are completed or if a new condition exists;
- Take appropriate measures to remove unauthorized entrants; and
- Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.

Equipment Requirements

The equipment that must be provided for confined space entry in accordance with the OSHA regulations is listed below. All equipment will be properly maintained, calibrated, and if used for emergency use inspected every month.

- Testing and monitoring equipment;
- Ventilation equipment;
- Communication equipment when necessary to maintain contact between confined space workers, attendants and emergency personnel;
- Personal protective equipment (PPE);
- Lighting equipment;
- Barriers and shields to keep people and equipment from falling into or interfering with the confined space operations;
- Equipment for safe entrance and egress from the confined space (e.g., ladders);
- Rescue and emergency equipment to assist in emergency situations, unless it is supplied by a rescue service.

Confined Space Entry Preparation

Specific preparations must be made prior to entry of any worker into a permitted confined space to ensure the safety of the entrant. The following preparations will be made prior to entry:

- The HSO will evaluate the confined space to determine whether a permit is required and will prepare the permit if it is required;
- The permit-required confined space must be evaluated before any employee can enter to identify all potential hazards;
- The proper communications, testing and monitoring, PPE and other required equipment must be available at the confined space;
- A method must be in place to cancel the permit when conditions change;
- Access to the confined space must be controlled with signs, barricades or other means to prevent unauthorized entry;
- Pipes or lines connected to the confined space to be entered which carry hazardous chemicals or other materials will be properly disconnected, blinded or blocked off;
- The necessary safety, rescue, and retrieval equipment will be tested prior to entry;
- The confined space will be emptied, flushed or otherwise purged of flammable or hazardous substances to the extent feasible by placing the discharge end of an explosion-proof fan inside the confined space;
- The air will be tested with appropriate equipment to determine whether dangerous air contamination and/or oxygen deficiency exists.
- Sources of ignition will not be introduced into the confined space until the hazardous condition (flammable or explosive concentration) has been eliminated;

- An approved retrieval system will be set up to remove confined space worker in case of an emergency. The retrieval system will be attached to the worker using an approved harness;
- Confined space entries will be periodically reviewed, especially those in which problems were encountered.

EXPOSURE MONITORING PROGRAM

Administration and Responsibilities

The OSHA regulations (29CFR1910.120) require that monitoring be performed where there may be any question of employee exposure to hazardous concentrations of hazardous substances in order to ensure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits or published exposure levels for hazardous substances. The regulations state that air monitoring will shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards. OSHA requires monitoring upon initial entry and periodically thereafter. In addition employees that are likely to have the highest exposures to those hazardous substances and health hazards likely to be present should be monitored.

The SeaCrest Health and Safety Officer will be responsible for developing an exposure monitoring program. The Site Safety Officer will be responsible for ensuring that monitoring is conducted at the site to identify any IDLH condition, exposure over permissible exposure limits (PEL) or published exposure levels, exposure over a radioactive material's dose limits or other dangerous condition, such as the presence of flammable materials or oxygen-deficient environments.

Survey Equipment

Survey equipment includes direct monitoring equipment and laboratory analyzed equipment. The direct reading equipment will be used to detect hazardous or IDLH conditions at a hazardous waste site. The Health and Safety Officer at the work site or other individual trained in using the monitoring equipment will use one or more of the following types of direct reading equipment to monitor exposure:

- Colorimetric devices, such as detector tubes and passive dosimeters;
- Combustible Gas Indicator or LEL meters;
- Photo Ionization Detector (PID) or Flame Ionization Detector (FID);
- Oxygen Meter;
- Radiation Geiger Counter;
- Noise Dosimeters.

Samples can also be collected in sampling containers to be analyzed by an analytical chemistry laboratory. A variety of analytical methods can be used depending on the detail of the analysis required. Some of the laboratory analytical methods that will be used include:

- ICP or AA for trace metals;
- Graphite Furnace AA for arsenic and mercury;
- GC or HPLC for polyaromatic hydrocarbons (PAH);
- GC/MS for volatile and semivolatile organic compounds, including pesticides, dioxin and other organic substances.

Personal Monitoring

Personal monitoring is required by 29CFR1910.120(h) for those employees who are working closest to the source of contaminant generation. Personal monitoring samples will be collected near the breathing zone to obtain an estimate of the actual inhalation exposure of workers who are not wearing respiratory protection and the potential exposure of workers who are wearing respirators. Personal monitoring devices that can be used include the sample pump or organic gas/vapor collection tubes, which are worn by the employee until the conclusion of sampling and then sent to a laboratory for analysis. If the employees are working in teams, each employee can wear a pump containing different sampling media so that more data can be obtained about exposure of the workers to hazardous materials. Another method is to place sample devices containing a variety of sampling media on pieces of heavy equipment close to the breathing zone of heavy equipment operators. Although they are not personal samples they would be reasonably representative of personal exposures.

Action Levels

Action levels for specific chemicals or classes of chemicals will be determined by referring to standard reference sources for data ang guidelines on permissible levels of exposure, flammability, etc. Some of the key guidelines that will be used to determine action levels are described below.

The IDLH Level is the concentration of a chemical considered to be Immediately Dangerous to Life or Health. It is published by the National Institute for Occupational Safety and Health (NIOSH). This level refers to acute respiratory exposure that poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health, or acute eye exposure that would prevent escape from a hazardous atmosphere. OSHA requires that pressure demand SCBA be used if levels of certain chemicals are above IDLH level.

Threshold Limit Value (TLV) can be used as a guideline for determining appropriate level of protection of the site worker. These values are found in “Threshold Limit Values for Chemical substances and Physical Agents” published annually by ACGIH (American Conference of Governmental Industrial Hygienists). The three categories of TLV are:

- Short-term exposure limit (STEL) is a 15-minure weighted average exposure which should not be exceeded at any time during a work day;
- Time-weighted average (TWA) is the concentration for an eight-hour work day and 40-hour work week;
- Ceiling (C) refers to concentrations which should not be exceeded during any part of the working exposure.

Permissible Exposure Limit (PEL) are enforceable standards promulgated by OSHA. The PEL for a substance is the 8-hour time-weighted average or ceiling concentration above which workers may not be exposed. The PELs in many cases have been derived from TLVs. The PEL will be used as the action level for a particular chemical when it is more stringent than the current TLV.

Recommended Exposure Limit (REL), a NIOSH exposure limit, is the concentration recommended by NIOSH for promulgation by OSHA as a PEL, but is not enforceable as is the OSHA PEL.

For explosive and flammable chemicals the LEL and UEL are used. Lower Explosive Limit (LEL) of a substance is the minimum concentration of gas or vapor in air below which the substance will not burn when exposed to a source of ignition. Upper Explosive Limit (UEL) of a substance is the maximum concentration of gas or vapor above which the substance will not burn. Above this concentration the mixture is too "rich" to burn or explode. The flammable range of a flammable substance is the range of concentrations between the LEL and the UEL.

Odor Threshold is reported by the American Industrial Hygiene Association and other health organizations. Caution will be used in using odor thresholds, since the sense of smell varies among individuals. Instead, a chemical cartridge change-out schedule will be implemented for a particular chemical, with odor used as a secondary indicator.

Since there are no quantitative data on threshold levels for eye irritation, the literature on a particular chemical will be reviewed. If the chemical causes eye irritation a health professional will evaluate the data to determine the level of personal protection needed for onsite workers.

Site Monitoring

The initial site monitoring will be conducted during the initial site characterization to enable selection of proper PPE and appropriate monitoring equipment for evaluating site conditions. Level B protection will be worn during the initial sampling. After visually identifying sources of possible generation of airborne contaminants, air samples will be collected downwind from the source along the axis of the wind direction. Samples will also be collected along the cross-axis of the wind direction to determine the degree of dispersion. Air samples will also be collected upwind of the source to ensure that there is no background interference and that the detected substances originated from the identified source.

Site monitoring will also include monitoring at the perimeter or "fenceline" of the site where PPE would no longer be required. Data on wind speed and direction will also be collected to assist in interpreting the results. **Perimeter monitoring** will be used to evaluate the integrity of the site's clean areas.

Periodic monitoring will be conducted at a site containing hazardous materials to determine whether atmospheric chemical conditions have changed following the initial site evaluation. Periodic monitoring will be conducted when:

- Work begins on a different portion of the site;
- Different contaminants are being handled;
- A different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling;
- Workers are handling leaking drums or working in areas with obvious liquid contamination (e.g., spill or contaminated water in a ponded area).

TRENCHING AND EXCAVATION

Program Responsibilities

The SeaCrest Health and Safety Officer is responsible for ensuring that the trenching and excavation operations are conducted in a safe manner so that workers are protected from the collapse of a trench. The SeaCrest Health and Safety Officer will prepare a site-specific health and safety that must be followed during trenching and excavation operation on site. He/she will verify that appropriate training has been conducted prior to the initiation of any excavation activities at the work site.

The SeaCrest Health and Safety Officer will communicate daily with the on site safety supervisor to ensure that safe procedures in compliance with the OSHA regulations are followed. The Health and Safety Officer will also visit the site periodically to verify compliance with the site health and safety plan and OSHA regulations. If the Health and Safety Officer observes unsafe activities at the excavation site, he/she will discuss this with the site safety supervisor and require that corrective action be taken immediately.

Training

Prior to the initiation of work all site workers involved in trenching and excavation activities will be instructed as to the nature of the hazards involved, the safety requirements in excavation work, in the protective measures that will be taken to prevent accidents, and in how to respond in an emergency (e.g., collapse of trench).

General Safety Requirements

The general safety procedures that will be followed for excavation work include the following:

- Site workers will not be allowed underneath loads handled by lifting or digging equipment;
- The operator of a vehicle being loaded or unloaded will be the only person allowed near the vehicle;
- Excavated material and other objects must be kept at least two feet from the opening of the trench or held in place by retaining devices;
- Site workers will not be allowed to work on the sides of sloped or benched excavations above other employees unless the lower worker is protected from falling material;
- Site workers must be protected from soil, equipment, spoil piles, and other materials that could fall into an excavation;

- Trenches four feet or more in depth must have a safe means of exit, such as a ramp or ladder within 25 feet of every worker.

Inspection Programs

Daily inspections will be mad of excavations, adjacent areas and protective systems by a competent person (e.g., professional engineer) for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems. The site health and safety supervisor will inspect the excavation for hazardous atmospheres or other hazardous conditions. An inspection will be conducted by a competent person before the beginning of work and as needed throughout the shift. Inspections will also be made after every rainstorm or other hazard increasing occurrence.

When a competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees will be removed from the area until the necessary precautions have been taken to ensure their safety.

Protective Systems

Each employee in an excavation will be protected from cave-ins by adequate protective systems, except when excavations are made entirely in stable rock or when they are less than 5 feet in depth and examination of the ground by an engineer provides no indication of a potential cave-in. Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system. Protective systems will be constructed in accordance with 29 CFR 1926.652 and will include:

- Design of sloping and benching systems;
- Determination of maximum allowable slopes and allowable configurations for sloping and benching;
- Approval of sloping and benching systems by a registered professional engineer;
- Design of support systems, shield systems, and other protective systems.

Other requirements include the following:

- Support systems, shield systems or other protective systems designed by a manufacturer will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer;

- Materials and equipment will be free from damage or defects that might impair their proper function;
- Support systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system;
- Shield systems will not be subject to loads exceeding those which the system was designed to withstand;
- Removal of support systems will begin from the bottom of the excavation;
- Backfilling will progress together with the removal of support systems;
- Installation of support systems will be closely coordinated with the excavation of trenches;
- Excavation of material up to 2 feet below the bottom of the members will be permitted only if the system is designed to resist the forces calculated for the full depth of the trench;
- Soil Classification will be required when shoring or shielding is selected as the means of worker protection, since the type of protective system chosen is based in part on soil stability.

EMERGENCY PLANNING AND REPORTING

Planning

When an emergency occurs personnel SeaCrest personnel will be ready to immediately rescue or respond to the emergency. Response equipment will be stored at an easily accessible location and will be checked periodically to ensure that it is in good working order. In order to handle emergencies effectively, planning is essential.

The SeaCrest Contingency Plan establishes procedures for responding to site emergencies. The Plan includes the following:

- Personnel
  - Roles
  - Lines of authority
  - Training
  - Communication
- Site
  - Mapping
  - Security and control
  - Refuges
  - Evacuation routes
  - Decontamination stations
- Medical/first aid
- Equipment
- Emergency procedures
- Documentation
- Reporting

The plan is compatible with the pollution response, disaster, fire, and emergency plans of local, state and federal agencies. Periodic drills are held, and the plan is reviewed when conditions change.

13.1.1 Causes of Emergencies

The causes of emergencies include worker related accidents or illness and work related activities. Worker-related emergencies include:

- Minor accidents (slips, trips, falls)
- Chemical exposure
- Medical problems (heat stress, cold stress, aggravation of pre-existing conditions
- PPE failure (air source failure, tearing, or permeation of protective clothing)
- Physical injuries (injuries from flying objects, serious falls, vehicle accidents)
- Electrical (burns, shock, electrocution)

Work activity-related emergencies include:

- Fire
- Explosion
- Leaks or spills
- Release of toxic vapors
- Reaction of incompatible chemicals
- Collapse of containers
- Discovery of radioactive materials

Any time a significant chemical release occurs at a hazardous waste site, the National Response Center will be notified. The NRC will activate federal response under the National Contingency Plan. The telephone number for the National Response Center is **800-424-8802**.

13.1.2 Personnel Involved in Emergency Response

A team of SeaCrest personnel and outside organizations (e.g., fire department) will be involved in emergency response. They include:

- Project team leader
  - Directs emergency response operations
  - Serves as liaison with appropriate government officials.
- Health and Safety Officer (or Site Safety Supervisor on site)
  - Recommends that work be stopped if any operation threatens worker or public health or safety
  - Familiar with emergency procedures, evacuation routes, and the appropriate emergency telephone numbers and contacts
  - Provides for emergency medical care
- Command Post Supervisor
  - Notifies emergency support personnel in case rescue operations are required
  - Assists Site Safety Supervisor in a rescue, if necessary
- Rescue Team
  - Emergency rescue team on stand-by near the exclusion zone to rescue workers if health or safety is endangered
  - State emergency response personnel (e.g., fire department)
- Decontamination Station Officers
  - Perform emergency decontamination
- 24-hour Medical Team
  - Transportation and treatment of victims by ambulance, hospitals, clinics or physicians
- Communication Personnel

  - Local emergency service networks provide communication links for mutual aid
  - Civil Defense organizations and local radio and television stations provide information to the public during an emergency
- Environmental Scientists
  - Determine probable movement of released toxic gases
  - Estimate the concentration of toxic gases in the community and the duration of exposure
- Hazardous Chemical Experts
  - Provide advice on chemical related emergency to responders on scene
- Firefighters
  - Respond to fires that occur at a site; rescue victims
- Meteorologists
  - Provide meteorological information needed during emergency
- Public Safety Personnel
  - County sheriff, industrial security forces, National Guear, Police control of site access, crowds, traffic
- On-Scene Coordinator
  - Coordinates federal response activities.

13.1.4 Training in Emergency Response

Since immediate, informed response is essential in an emergency, all site personnel and others entering the site will receive training on key emergency response procedures, such as evacuation routes and emergency signals.

13.1.5 Emergency Recognition and Prevention

Before daily work assignments brief meetings will be held to discuss hazards that may be encountered and how to recognize or monitor them, and procedures to follow in the event of an emergency.

13.1.6 Communications

In an emergency communications are extremely important and include internal and external communication. Internal communication will provide information such as the location of the injured personnel, orders to evacuate the site, and notice of blocked evacuation routes. External communication will be used to obtain outside support sources needed to provide assistance in an emergency.

13.1.7 Site Mapping

Detailed information about the site will be provided at various locations by a site map. The map will be used for training and emergency response planning (e.g., to define zones, determine evacuation routes, and identify emergency first aid, decontamination and Command Post stations.

13.1.8 Evacuation or Safe Distances

Safe distances can only be determined at the time of an emergency since various factors influence what is a safe distance. Factors that influence safe distances include:

- Toxicology properties of the substance, physical state, quantity released, rate released, vapor pressure
- Wind speed and direction
- Air temperature and temperature change with altitude
- Local topography (e.g., barriers that may enhance or retard a plume).

13.1.9 Public Evacuation

If an accident may threaten the health or safety of the surrounding community, the public will need to be informed and possibly evacuatied from the area. Site management will plan for this in coordination with appropriate local, state, and federal organizations.

13.1.10 Places of Refuge (Safety Stations)

Onsite refuges will be established for localized emergencies that do not require site evacuation. These refuges will only be used for essential needs, such as rest breaks, temporary relief from heat stress, and emergency response strategy meetings. The refuge will not be used for eating or compressed air changes.

Other refuges can be set up off-site as the safe exit destination to provide for first aid, wash water for chemical exposure victims, and communications with the Command Post. Evacuation equipment can also be stored at the off-site refuge for security.

13.1.11 Site Security and Control

In an emergency, entry of personnel into hazardous areas will be carefully controlled to prevent additional injury and exposure. Only necessary rescue and response personnel should be allowed into the Exclusion

Zone. A check point will be established and identification must be presented to a Checkpoint Control Manager. He/she will record name of person, time of entry, anticipated exit time, areas to be entered, team or "buddy," task being performed, location of task, protective equipment worn, rescue and response equipment used.

13.1.12 Evacuation Routes and Procedures

Multiple evacuation routes will be established in case the main exit is cut off by fire or explosion. The following guidelines will be used in establishing safe evacuation routes.

- Evacuation routes at a hazardous waste site will be placed in the upwind direction of the Exclusion Zone;
- Evacuation routes will go through the Contamination Reduction Zone;
- Accessibility of potential evacuation routes will be evaluated;
- Evacuation routes will be established in different locations from each other;
- Evacuation routes will be market with flagging, traffic cones or other markers;
- Maps of evacuation routes will be placed at strategic locations.

Emergency Equipment

In an emergency, equipment will be needed to rescue and treat victims, to protect response personnel, and to mitigate hazardous conditions (e.g., chemical containment or control of fires. Periodic checks will be made of all emergency response equipment to ensure that it is good condition and available when an emergency occurs. Safe and unobstructed access of all fire fighting and emergency equipment will be provided at all times. Equipment for emergency response will include PPE, medical equipment and supplies, and hazard mitigation equipment (e.g., fire fighting equipment, spill containment equipment).

Medical Treatment and First Aid

Medical treatment may range from bandaging minor cuts to life-saving techniques. SeaCrest employees will be trained in emergency medical treatment techniques and phone numbers of ambulance services and local hospitals. The emergency medical program will include the following:

- Annual training in first aid and CPR;
- Establishment of liaison with local medical personnel, hospitals, and ambulance service;
- Emergency first aid stations that are well supplied and restocked after every emergency.

Emergency Response Procedures

The first step in emergency response is notification of response personnel of an emergency and appropriate government agencies. Provide information on what happened, where it happened, to whom it happened, when it happened, how it happened, extent of damage, and aid needed.

Based on available information about the incident the type of action required will be decided and the necessary steps implemented. Rescue/response actions may include:

- Locate all victims, assess their condition, and determine resources needed for stabilization and transport;
- Allow no one to enter hazardous area without a partner;
- Assess existing and potential hazards to on-site personnel and off-site community;
- Allocate onsite personnel and equipment to rescue and incident response operations;
- Contact the required off-site personnel or facilities;
- Bring the hazardous situation under control and use measures to prevent the spread of the emergency;
- Administer any necessary medical procedures before removing victims from the area;
- Decontaminate victims and uninjured personnel if they are in a hazardous area;
- Move personnel to a safe distance upwind of the incident;
- Monitor incident for any significant changes.

Complete and accurate information will be documented for all incidents. Documentation can be used to help avert recurrences, as evidence in future legal action, for assessment of liability by insurance companies and for review by government agencies

Before normal activities are resumed emergency equipment and supplies will need to be restocked. Damaged equipment will be repaired and the Contingency Plan will be reviewed to evaluate lessons learned from the incident.

Personnel and Vehicular Accidents Reporting

In the event of an employee accident or incident while working on the job site or at the SeaCrest laboratory, the employee will notify the supervisor immediately. The supervisor will determine whether medical attention is needed. If medical attention is needed the injured employee will be taken to a medical facility and examined by a physician.

The accident or incident will be investigated and a report will be prepared for each incident or accident. Details on the SeaCrest employee accident report policy and accident investigation are presented in Appendix IV (App V in 1998 document). Incident report forms for SeaCrest personnel are also included in Appendix IV.

The minimum reporting requirements in the event of a vehicular accident are shown in Appendix V (App VII in 1998 document). Report forms for vehicular accidents by SeaCrest personnel are also included in Appendix V.

Log and Summary of Occupational Injuries and Illnesses

All employee accidents, incidents or illnesses and vehicular accidents occurring while at the job site or in the SeaCrest laboratory will be reported. Records of each accident or incident will be recorded on the accident reports shown in Appendices IV and V. A log will be maintained of all occupational injuries, accidents and illnesses of SeaCrest employees and their contractors. Summaries of each of the accidents will also be provided in the log book.

HEARING CONSERVATION PROGRAM

Program Administration and Responsibilities

SeaCrest will protect employees against the effects of noise exposure when the sound levels exceed those shown in the Table below:

Permissible Noise Exposures (from 29CFR1910.95)

Duration/day (Hours)	**Sound Level (dBA) slow response**
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

A hearing conservation program, which includes monitoring, will be initiated if the noise exposure equals or exceeds an 8-hour time-weighted average sound level of 85 decibels measured on the A scale (slow response)or equivalently, a dose of 50% (defined as the action level). The noise level will be considered without the use of protective equipment. SeaCrest will notify the employee if he/she is exposed at or above the action level.

The SeaCrest Health and Safety Officer will be responsible for developing a hearing conservation program and monitoring for employees.

Monitoring Program

A monitoring program will be established for every employee whose noise exposure equals or exceeds an 8-hour time-weighted average of 85 decibels. The monitoring program will consist of audiometric testing of the employee within 6 months of the employee's first exposure at or above the action level to establish a valid baseline audiogram. The audiogram will be repeated at least annually after obtaining the baseline audiogram. If the audiogram shows that an employee has suffered a standard threshold shift, SeaCrest may have the employee retested within 30 days. An audiologist or physician will review the problem audiogram and determine whether there is a need for further evaluation. If the physician determines that the threshold shift is related to occupational noise exposure, SeaCrest will make sure that the employee is fitted with hearing protectors, trained in their use and care, and be required to use them.

Hearing Protectors

SeaCrest will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or more. The hearing protectors will attenuate employee exposure down to at least an 8-hour time-weighted average of 90 decibels. For employees who have experienced a threshold shift hearing protectors will attenuate employee exposure to an 8-hour time-weighted average of 85 decibels.

Types of hearing protectors include disposable plugs, reusable plugs, headband plugs, and muffs. The type of hearing protector used will be determined by noise exposure of the employee and the noise reduction rating of the hearing protector.

Recordkeeping

SeaCrest will maintain a record of all employee audiometric test records. The records will include the following information: name and job classification of the employee, date of the audiogram, the examiner's name, date of the last calibration of the audiometer. All records will be provided upon request to the employees and former employees.

The noise exposure measurement records will be retained for two years. Audiometric test records will be retained for the duration of the affected employee's employment at SeaCrest.

DRILLING OPERATIONS

Responsibilities

The SeaCrest Health and Safety Officer will be responsible for overall safety at the site of drilling operations. Every drilling subcontractor must have a designated Safety Supervisor at the drilling site. The responsibilities of the Contractor's Safety Supervisor include the following:

- Ensure that the proper personal protective safety equipment is being used by the site workers and take appropriate action when the proper personal safety equipment is not being used;
- Be assured that the operator of the drilling rig is thoroughly familiar with the rig, its controls and capabilities;
- Inspect the drill rig when it first arrives on the site and daily, thereafter, for any structural damage, loose bolts and nuts, fuel leaks, damaged pressure gauges and pressure relief valves, etc.
- Check and test all safety devices, such as emergency shutdown switches at least daily at the beginning of a drilling shift;
- Check that all gauges, warning lights, and control levers are functioning properly;
- Train all new drill rig workers on safe operating practices on and around the drill rig;
- Provide each drill rig worker with a copy of the drilling operations safety manual;
- Observe each worker to ensure that the tasks are being performed in a safe manner;
- Ensure that a first aid kit and fire extinguisher are on each drill rig and easily accessible;
- Maintain a list of phone numbers and addresses of emergency assistance units (e.g., ambulance, police, hospitals, etc.).
- Ensure that at least one individual onsite is trained in First Aid and CPR.

Housekeeping

The first requirement for safe field operation is that each worker understands and fulfills the responsibility of proper maintenance and housekeeping on and around the rig. The requirements for good housekeeping are listed below.

- Suitable storage locations should be provided for all tools, materials, and supplies so that they can be safely handled.
- Avoid storing or transporting tools, materials, or supplies within or on the derrick of the drill rig;
- Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks to prevent spreading, rolling or sliding;
- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding, and other access ways should be kept free of materials, debris, and obstructions and substances such as grease or oil that could cause surfaces to become slick or otherwise hazardous;

- Keep all controls, control linkages, warning and operation lights, and lenses free of oil, grease and other materials that could affect the safety of the operations;
- Store gasoline only in a non-sparking red container with flame arrester in the fill spouts and clearly labeled with the word "gasoline."
- Contaminated pipe, drill rods, augers, sampling equipment, etc. should be moved away from the work area to prevent possible exposure to non-protected personnel and to prevent cross-contamination of clean materials.

Safety during Maintenance Activities

Maintenance should be performed in a safe manner as listed below:

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools;
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except for repairs and adjustments that can only be made with the engine running.
- Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key;
- Block the wheels and/or lower the leveling jacks and set the hand brakes before working under a drill rig;
- When possible and appropriate, release all pressure on hydraulic systems, drilling fluid system, and the air pressure systems of the drill rig prior to performing maintenance;
- Use caution when opening drain plugs and radiator caps and other pressurized plugs and caps;
- Do not touch an engine or the exhaust system following its operation until they have had adequate time to cool;
- Do not weld or cut on or near a fuel tank;
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig;
- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants;
- Replace all caps, filler plugs, protective guards or panels, high pressure hose clamps, and chains or cables that have been removed for maintenance before returning the drill rig to service.

Safe Use of Hand Tools

Some specific and general suggestions for the safe use of hand tools are listed below.

- Use the tool for its intended purpose;
- A damaged tool should be repaired before using again or discarded;
- Wear safety glasses when using a hammer or chisel;
- Keep all tools cleaned and stored in an orderly manner when not in use;
- Brush the jaws of pipe wrenches with wire brushes frequently to prevent an accumulation of dirt and grease, which could cause the wrenches to slip;

- Do not use pipe wrenches in place of a rod-holding device;
- Replace hook and heel jaws when they become visible worn;
- Screwdrivers with blades that fit the screw slot should be used;
- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform should the wrench slip or joint suddenly let go;
- Do not use cheater bars on tight joints.

Off-Road Movement of Drill Rigs

Safety guidelines for off-road movement of drill rigs include the following:

- Before moving a drill rig, first walk the route of travel, and inspect for depressions, stumps, gullies, ruts, and similar obstacles;
- Check the brakes of the drill rig carrier before traveling on rough, uneven or hilly ground;
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mounting;
- Engage the front axle when traveling off-highway on hilly terrain;
- Evaluate the capability of the drill rig to travel side hill and use caution when traveling;
- Cross obstacles, such as small logs erosion channels or ditches squarely, not at an angle;
- After the drill rig has been move to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.
- Do not travel off-road with the derrick of the rig in the raised or partially raised position.

Safety Guidelines for Working Around Overhead and Underground Utilities

The use of a drill rig on a site within the vicinity of electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the crew. Procedures to follow for safe operations are listed below.

- Obtain all necessary underground permits prior to commencing drilling operations. If there are questions about the possibility of underground lines, pipeline, etc., do not begin drilling until the situation is resolved;
- Overhead and buried utilities must be located, and noted on all boring location plans and boring assignment sheets;
- When overhead electrical power lines exist at or near a drilling site or project, assume that all wires are alive and dangerous;
- Watch for sagging power lines before entering a site; if they are present call the utility company and ask them to raise the lines or turn of the power;
- Before raising the drill rig derrick on a site in the vicinity of power lines, walk completely around the drill rig and determine what the minimum distance from any point on the drill rig will be to the

nearest power line when the derrick is raised. Do not raise the derrick or operate the drill rig if the distance is less than 20 feet;

- To avoid contact with power lines, only move the drill rig with the derrick down;
- If there are any questions concerning the safety of drilling sites in the vicinity of overhead power lines, call the utility company;
- Always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water. Contact appropriate companies to determine presence of such lines;
- Contact the owners of utility lines or the nearest underground utility location service before drilling;
- Do not assume that underground utilities are located on or near the boundary or property line under the sign warning of the presence of utilities. Contact the utility to verify the location.

Safety During Drilling Operations

Every worker is responsible for safe operations during drilling. Safety measures that should be taken during drilling include the following:

- Never drive the drill rig from hole to hole with the derrick in the raised position;
- Before raising the derrick look up to check for overhead obstructions;
- All drill rig personnel and visitors should be cleared from the areas immediately to the rear and sides of the derrick before raising the mast;
- Before starting drilling operations, secure and/or lock the derrick, if required, according to the drill manufacturer's recommendations;
- The operator of the drill rig should only operate the rig from the position of the controls. The operator of the rig should shut down the drill engine before leaving the vicinity of the drill;
- All tools should be carefully passed by hand between personnel or a hoist line should be used;
- Alcoholic beverages, depressants or chemical stimulants should not be used prior to starting work on a drill rig;
- If it is necessary to drill in an enclosed area, exhaust fumes should be conducted out of the area;
- Clean mud and grease from boots before mounting a drill platform and use handholds and railing; watch for slippery ground when dismounting from the platform;
- All air and water lines and pumps should be drained when not in use in freezing weather;
- All unattended bore holes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole; all open boreholes should be covered and protected or backfilled adequately and according to local and state regulations on completion of the drilling project;
- Work performed at a height of 6 feet or more requires fall protection;
- When climbing the derrick or working on an elevated derrick platform, a body harness and lanyard should be used; the lanyard should be 2 feet less than the fall distance;
- When a rig worker is on a derrick platform, the lanyard should be fastened to the derrick just above the derrick platform and to a structural member that is not attached to the platform;
- When a rig worker first arrives at a derrick platform, the platform should immediately be inspected for broken members, loose connections, and loose tools or other loose materials;
- Tools should be securely attached to the platform with safety lines;
- Loose tools and similar items should not be left on the derrick platform or on structural members of the derrick;
- A derrick platform over 4 feet above ground should have toe boards and safety railings in good condition;
- Use proper lifting procedures when lifting heavy objects; if it is too heavy assistance should be obtained;
- Verify a clear pathway and good footing prior to lifting a heavy object;
- Heavy objects should be moved with the aid of handcarts whenever possible;
- Drilling operations should be terminated during an electrical storm and the crew should move away from the drill rig.

SITE SPECIFIC HEALTH AND SAFETY PLANS

SSHSP Content

A site-specific health and safety plan (HASP) will be developed and implemented for each site where employees are potentially exposed to hazardous substances. The table of contents for a sample hazardous waste site is presented below:

1.0 Introduction
- 1.1 Scope and Applicability of the Site Health and Safety Plan
- 1.2 Visitors

2.0 Key Personnel/Identification of Health and Safety Personnel
- 2.1 Key Personnel
- 2.2 Site-Specific Health and Safety Personnel
- 2.3 Organizational Responsibility

3.0 Task Operation Safety and Health Risk Analysis
- 3.1 Historical Overview of Site
- 3.2 Task-by-Task Risk Analysis

4.0 Personnel Training Requirements
- 4.1 Pre-assignment and Annual Refresher Training
- 4.2 Site Supervisors Training
- 4.3 Training and Briefing Topics

5.0 Personal Protective Equipment to be Used
- 5.1 Levels of Protection
- 5.2 Level A PPE
- 5.3 Level B PPE
- 5.4 Level C PPE
- 5.5 Level D PPE
- 5.6 Reassessment of Protection Program
- 5.7 Work Mission Duration
- 5.8 Chemical Resistance and Integrity of Protective Material
- 5.9 SCBA Inspection and Checkout
- 5.10 Inspection of PPE

6.0 Medical Surveillance Requirements
- 6.1 Baseline or Pre-assignment Monitoring
- 6.2 Periodic Monitoring
- 6.3 Site-specific Medical Monitoring
- 6.4 Exposure/Injury/Medical Support
- 6.5 Exit Physical

7.0 Frequency and Types of Air Monitoring/Sampling
- 7.1 Direct-Reading Monitoring Instruments
- 7.2 Site Air Monitoring and Sampling Program

8.0 Site Control Measures
- 8.1 Buddy System
- 8.2 Site Communications Plan
- 8.3 Work Zone Definition

8.4 Nearest Medical Assistance
8.5 Safe Work Practices
8.6 Emergency Alarm Procedures
9.0 Decontamination Plan
9.1 Standard Operating Procedures
9.2 Levels of Decontamination Protection Required for Personnel
9.3 Equipment Decontamination
9.4 Disposition of Decontamination Wastes
10.0 Emergency Response/Contingency Plan
10.1 Pre-emergency Planning
10.2 Personnel Roles and Lines of Authority
10.3 Emergency Recognition/Prevention
10.4 Evacuation Routes/Procedures
10.5 Emergency Contact/Notification System
10.6 Emergency Medical Treatment Procedures
10.7 Fire or Explosion
10.8 Spills or Leaks
10.9 Emergency Equipment/Facilities
11.0 Confined Space Entry Procedures
11.1 Definitions
11.2 General Provisions
11.3 Procedure for Confined Space Entry
11.4 Confined Space Observer
12.0 Spill Containment Program
13.0 Hazard Communication

Subcontractor Use of SSHSP

Subcontractors retained work at hazardous waste sites will be given a briefing about the Site Specific Health and Safety Plan (SSHSP). The briefing will include instruction in wearing appropriate PPE, what chemical hazards are present at the site, site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified. All other appropriate safety and health precautions provided to SeaCrest employees will be used to ensure the safety and health of the subcontractors. The written Site Specific Safety and Health Plan will be made available to all subcontractors working at the site who will be involved with the hazardous waste operations.

BLOODBORNE PATHOGENS PROGRAM

Program Administration and Responsibilities

The OSHA Blood borne Pathogens Standard, 29CFR1910.1030, requires employers to perform an exposure determination concerning which employees may occur occupational exposure to blood or other potentially infectious materials. The SeaCrest Health and Safety Officer will be responsible for developing a program to limit exposure of the employees to blood and other potential infectious materials. The program will include providing training of employees in blood borne diseases, means of transmission, prevention of exposure, availability of vaccines to prevent development of disease, and use of warning labels to inform employees of potential for exposure.

All blood and other potentially infectious materials will be considered infectious and engineering and work practice controls will be utilized to eliminate or minimize exposure to employees.

All containers, refrigerators, and freezers used to store blood or other potentially infectious material will be labeled with the orange biohazard symbol or placed in a red bag.

Sources of Exposure

Blood borne pathogens can be transmitted from infectious materials, including blood, saliva, and other bodily fluids in several ways. They include:

- Contaminated needles;
- Contaminated reusable Sharps;
- Specimens of blood or other potentially infectious materials;
- Equipment contaminated with blood;
- Unfixed tissue or organs; and
- Experimental animals infected with Human Immunodeficiency virus (HIV) or Hepatitis B virus.

Training

The SeaCrest Health and Safety Officer will conduct training in blood borne diseases for prior to the beginning of an assignment where occupational exposure to blood or other potentially infectious materials may occur and annual training thereafter. Training will include:

- Discussion of the OSHA requirements;
- Discussion of the epidemiology and symptoms of blood borne diseases;
- Explanation of the modes of transmission of blood borne pathogens;
- Explanation of the SeaCrest Blood borne Pathogen Exposure Control Plan;
- Identification of work assignments that may involve potential exposure to blood borne pathogens;
- Explanation of the use and limitations of methods to reduce exposure, including engineering controls, work practices and PPE;
- Information on Hepatitis B vaccination, including efficacy, safety, method of administration, and benefits;
- Appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
- Location of hand washing facilities, antiseptic cleanser or antiseptic towelettes;
- Explanation of the procedures to follow if an exposure incident occurs, including the method of reporting and medical follow-up; and
- Explanation of warning signs, labels and color coding systems for blood borne pathogens.

Vaccinations, Post-exposure Evaluation, and Follow-up

Hepatitis B vaccination will be made available to all employees who have occupational exposure to blood within 10 working days of assignment at no cost to the employee under the supervision of a licensed physician/licensed healthcare professional. Employees will be given booster doses if recommended by the U.S. Public Health Service. Employees must sign a declination form if they choose not to be vaccinated.

Post-exposure evaluation and follow-up will be made available to all employees who have had an exposure incident. Laboratory tests that are needed will be conducted by an accredited laboratory at no cost to the employee. Follow-up will include a confidential medical evaluation documenting the circumstances of exposure, identifying the source individual, if feasible, testing ethe exposed employee's blood if he/she consents, post-exposure prophylaxis, counseling and evaluation of reported illnesses. All diagnoses will remain confidential.

Medical Recordkeeping

Medical records of each employee with occupational exposure will be maintained for the duration of employment plus 30 years. The records must be confidential and include name and social security number, hepatitis B vaccination status and dates, results of any medical examinations including dates, medical testing and follow-up procedures, a copy of the healthcare professional's written opinion, and a copy of information provided to the healthcare professional.

Training records will be maintained for three years and must include dates, contents of the training program, trainer's name and qualifications, names and job titles of all persons attending the training sessions.

LABORATORY CHEMICAL HYGIENE PROGRAM

Program Administration and Responsibilities

The ultimate responsibility for chemical hygiene in the laboratory lies with the SeaCrest CEO. Responsibility also lies with the Health and Safety Officer, laboratory manager, and laboratory workers. The laboratory manager has the overall responsibility for the chemical hygiene in the laboratory. The responsibilities include:

- Ensure that the laboratory workers know and follow the chemical hygiene rules;
- Ensure that protective equipment is available and in working order;
- Provide appropriate training in handling chemicals, storing chemicals, responding to a chemical spill or an accidental spill of chemicals on an employee;
- Know the current legal requirements concerning regulated substances;
- Determine the required levels of protective apparel and equipment;
- Ensure that facilities and training for use of any chemical ordered is adequate;
- Know proper disposal of chemicals.

Training

Training will be provided to the laboratory staff at a minimum annually. The training conducted includes the following:

- Information on chemicals in the laboratory, hazards, handling, protective equipment;
- Location of emergency equipment and proper use;
- Location of emergency exits;
- Location of emergency contact telephone numbers;
- Proper procedures for hazardous waste disposal or transportation to hazardous waste site; and
- First aid training.

Elements of a Chemical Hygiene Plan

The SeaCrest Chemical Hygiene Plan contains the following information:

- Basic rules and procedures chemical hygiene;
- Procurement, distribution and proper storage and disposal of chemicals;
- Proper segregation of toxic substances in storerooms and periodic examination of containers;

- Environmental monitoring of airborne concentrations when a highly toxic substance is stored or used;
- Maintenance of eye wash fountains, showers, respirators, and other safety equipment;
- Inspections of storage areas, chemicals, protective equipment, fire alarm and extinguishers;
- Medical surveillance required by OSHA regulations;
- Records of training, medical surveillance, and accidents;
- Prominent signs and labels for chemicals, location of showers and eyewash stations, emergency exits;
- Emergency Response Plan for spills and accidents with emergency telephone numbers of personnel, hospitals, fire stations, etc.;
- Waste disposal program for collection, segregation, storage, and transport of chemical wastes; and
- Training in handling chemicals, personal protection, and emergency response.

SITE SAFETY BRIEFINGS

Prior to the start of a job and on an as needed basis, it will be the responsibility of the site manager or site safety officer to conduct a safety meeting to inform and review the following information:

- Physical hazards which might be encountered at the site.
- Hazardous substances to which they might be exposed to while on the job site.
- Symptoms and effects of overexposure.
- Appropriate personal protective equipment and other precautions that they may take to lessen the possibility of exposure.
- Emergency response procedure.
- Emergency telephone numbers.
- Directions to nearest medical facility.
- Any special circumstances that may be encountered.

All safety meetings will be documented by the Health and Safety Officer or the Foreman on the appropriate form (see Appendix VI). The form will be filled out completely and forwarded to the Office Manager. A copy will be kept with the job file and a copy sent to Corporate Operations.

DECONTAMINATION

Program Responsibilities

Decontamination, the process of removing or neutralizing contaminants, is critical to health and safety at hazardous waste sites. It is the responsibility of the SeaCrest Health and Safety Officer to develop a site-specific decontamination plan as part of the Site Safety Plan in accordance with OSHA requirements [29CFR1910.120(k)]. Prior to entry to a hazardous waste site all employees that will be working at the site will be trained in proper decontamination procedures by the Health and Safety Officer. Training will include discussion of decontamination equipment and methods, procedures to prevent contamination of clean areas, proper removal of contaminated PPE, and proper disposal of clothing and equipment that may not be completely decontaminated.

Contamination Prevention

In order to prevent or minimize contamination the practices listed below should be followed:

- Stress work practices that minimize contact with hazardous substances (e.g., do not walk through areas with obvious contamination);
- Use remote sampling, handling, and container-opening techniques (e.g., drum grapplers);
- Protect monitoring and sampling instruments by placing in bags with openings for sample ports and sensors that must contact site materials;
- Wear disposable outer garments and use disposable equipment where appropriate;
- Cover equipment and tools with a strippable coating which can be removed during decontamination;
- Encase source of contaminants with plastic sheeting or overpacks.

Standard Operating Procedures will be developed that maximize employee protection. Proper procedures for dressing prior to entering the Exclusion Zone will minimize the potential for contaminants to bypass the protective clothing and escape decontamination (e.g., all junctures should be taped to prevent contaminants from running inside gloves, boots, and jackets).

PPE will be checked prior to each use to ensure that it contains no cuts or punctures that could expose the employees at the site to contaminated materials. Any cuts or scratches must be protected to prevent contaminants from penetrating the body.

Training will be conducted in the Standard Operating Procedures for minimizing contact with contaminated materials and maximizing work protection. The Site Safety Officer will make sure that procedures for preventing contamination are enforced.

Personal Decontamination

The three types of decontamination methods that will be used include:

- Physical removal of contaminants;
- Inactivation of contaminants by chemical detoxification or disinfection/sterilization; or
- Use of a combination of physical and chemical methods.

Physical Removal of Contaminants

- Loose contaminants, such as soil and dust can be removed with water or a liquid rinse;
- Adhering contaminants can be removed by solidification, freezing adsorption or absorption or melting;
- Volatile liquids can be removed by evaporation followed by water rinse. Care must be taken to prevent inhalation of the vaporized chemicals.
- Reusable clothing that has been decontaminated and cleaned will be laundered prior to reuse.

Chemical Removal of Contaminants

- A solvent solution that is chemically compatible with the personal protective clothing being cleaned (e.g., alcohols) can be used;
- Surfactants, such as detergents, can be used to remove contaminants;
- Chemical disinfectants can be used to inactivate infectious materials;
- Chemical reactions using polymerization catalysts and chemical reagents can be used to solidify contaminants;

If personal protective clothing becomes wetted with hazardous substances, the employee will immediately remove that clothing and proceed to shower. Showers will be placed in the contaminated area so as not to contaminate clean areas.

All decontamination procedures will be conducted in the Contamination Reduction Zone to minimize exposure of uncontaminated employees or equipment. The decontamination procedures will be monitored by the Site Safety Officer to determine their effectiveness. If decontamination procedures are found to be ineffective, appropriate measures will be taken to correct any deficiencies.

Equipment Decontamination

Portable equipment will also be decontaminated by use of physical and/or chemical means described in the section above, as appropriate.

Large equipment can be rinsed using pressurized sprayers for washing and rinsing. Long handled brushes rods, shovels can be used to dislodge contaminants and contaminated soil from the undersides of vehicles and equipment. Brooms and brushes will be used for cleaning inside vehicles and equipment.

Decontamination Equipment

Various procedures and equipment can be used to decontaminate personnel, personal protective clothing and equipment. They include:

- Drop cloths of plastic or other suitable material on which heavily contaminated equipment or outer protective clothing can be deposited;
- Collection containers, such as drums or lined trash cans, for storing disposable clothing and heavily contaminated personal protective clothing or equipment that will be discarded;
- Lined box with absorbents for wiping or rinsing off gross contaminants and liquid contaminants;
- Large galvanized tubs, tanks or wading pools to hold wash and rinse solutions. They should be large enough for the employee to place a booted foot in. They should have no drain or a drain connected to a collection tank or appropriate treatment system;
- Wash solutions selected to wash off and reduce the hazards associated with the contaminants;
- Rinse solutions selected to remove contaminants;
- Long-handled, soft-bristled brushes to help wash and rinse off contaminants;
- Paper or cloth towels to dry protective clothing and equipment;
- Lockers and cabinets for storage of decontaminated clothing and equipment;
- Metal or plastic cans or drums for contaminated wash and rinse solutions;
- Plastic sheeting, sealed pads with drains, or other appropriate methods for containing and collecting contaminated was and rinse solutions spilled during decontamination.
- Shower facilities for fill body wash or, at a minimum, personal wash sinks with drains connected to a collection tank or appropriate treatment system;
- Soap or wash solution, wash cloths, and towels for personnel;
- Lockers or closets for clean clothing and storage of personal belongings.

Disposal of Contaminated Materials

All equipment used for decontamination will be decontaminated and/or disposed of properly. Buckets, brushes, clothing, tools, and other contaminated equipment will be collected and placed in clearly labeled

containers. All spent solutions and wash water will be collected and disposed of properly. Clothing that is not completely decontaminated will be placed in plastic bags, pending further decontamination and/or disposal.

HEALTH AND SAFETY AUDITS

SeaCrest is committed to providing a safe working environment to all its employees through polices set forth in the Health and Safety Program. A goal of SeaCrest is to assure compliance with the Health and Safety Program and regulatory requirements, to identify deficiencies of the Program, and to satisfy client requirements. Health and Safety auditing is a key component in determining program effectiveness.

Health and Safety Audits include project administrative audits, office audits, and field audits. Audits can include visual evaluations with no written report, reports written in logbooks, and audits using standard forms. Written audit reports deliverable to the client may be required on certain projects.

Field audits will be conducted based on risks, level of site activity, employee concerns, and client or regulatory requirements. Audits of the office health and safety compliance will be conducted by the SeaCrest Health and Safety Officer. Field audits will be conducted periodically by the Site Safety Supervisor to evaluate compliance with the Site-specific Health and Safety Plan and regulatory or client requirements.

For field audits, a verbal review of concerns will be discussed with the SeaCrest Health and Safety Officer upon audit completion and documentation of the completed audit will be provided.

For office audits, a verbal review of the audit shall be completed with the Operations Manager and the audit report provided to the General Manager and CEO.

Corrective action will be taken for any health and safety deficiencies documented.

A sample audit checklist is provided in Appendix VII (App IV in 1998 plan).

HEAT STRESS MANAGEMENT PROGRAM

Program Administration and Responsibilities

Heat stress is one of the most common and potential serious illnesses at hazardous waste sites and will require regular monitoring of employees and other preventive measures. The SeaCrest Health and Safety Officer will be responsible for training of employees to prevent heat stress and to be aware of the early symptoms of heat stress and preventive measures to be taken. The HSO will need to consider heat stress when selecting PPE for the employees at a work site, the duration of work and rest schedules. The HSO will also take heat stress into consideration when establishing standard operating procedures for site activities and conducting medical monitoring.

Heat Stress Prevention

To aid in the prevention of heat stress the site workers will be trained on preventing heat stress and being aware of the early symptoms of heat stress. Heat stress will be taken into consideration in choosing the appropriate level of PPE. The Health and Safety Officer will take the following steps to prevent heat stress:

- Adjust work and rest schedules as needed;
- Provide shelter or shaded areas to protect personnel during rest periods;
- Provide easy access to water so that the workers' body fluids are maintained at normal levels. Daily fluid intake must equal the approximate amount of water lost from sweating;
- Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure; and
- Train workers to recognize the signs and symptoms of heat stress.

22.3 Heat Stress Monitoring

All workers, including those not wearing protective equipment will be monitored because the incidence of heat stress depends on a variety of factors and can affect any worker. Monitoring will be initiated before entry to the site. It will include measuring the heart rate and oral temperature.

To measure the heart rate count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute, the work cycle will be shortened by 1/3 while the rest cycle will remain the same. To measure the oral temperature a clinical thermometer will be used at

the end of the work period before drinking. The thermometer must remain for a minimum of three minutes under the tongue. If the oral temperature exceeds 99.6°F the next work cycle will be shortened by one-third. The frequency of physiological monitoring as suggested by NIOSH/OSHA/USCG/EPA, 1985 is shown in the Table below.

Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers (from OSHA Guidance Manual for Hazardous Waste Site Activities 1985).

ADJUSTED TEMPERATURE	NORMAL WORK ENSEM BLE	IMPERMEABLE ENSEMBLE
90 F. or above	After each 45 min. of work	After each 15 min of work
87.5-90 F.	After each 69 min. of work	After each 30 min of work
82.5-87.5 F.	After each 90 min. of work	After each 60 min of work
77.5-82.5 F.	After each 120 min. of work	After each 90 min. of work
72.5-77.5 F.	After each 150 min. of work	After each 120 min. of work

COLD STRESS MANAGEMENT

Program Administration and Responsibilities

Exposure to cold temperatures can impair the ability to work, and cause frostbite and hypothermia. Maintaining body temperature and recognizing the early signs and symptoms can help to prevent illness and injury due to cold exposure. The SeaCrest Health and Safety Officer will need to consider the potential for cold stress when making decisions regarding PPE selection and work duration. The potential for cold stress must also be considered when establishing standard operating procedures for site activities and conducting medical monitoring. The HSO will also be responsible for developing a program to prevent cold stress of the employees at hazardous waste sites.

Cold Stress Prevention

A program for preventing cold stress at hazardous waste sites will include the following elements:

- Employee training on cold stress, cold-induced illness and their symptoms, proper clothing, work practices, and first aid prior to going into the field in cold weather;
- Medical supervision of workers including pre-placement physicals that evaluate fitness, weight, cardiovascular system, and other conditions that might make workers susceptible to cold stress.
- Work-rest regimes that provided heated rest areas and enforced rest breaks,
- Scheduled drink breaks to maintain proper fluid levels;
- Monitoring of air temperature and wind speed to determine wind chill and adjust work/rest schedules accordingly;
- Use of proper clothing to retain body heat. The most important parts of the body to protect are head, hands, feet, and face;
- Reduction of cold stress through engineering and administrative controls and the use of PPE.

Cold Stress Monitoring

Recognition of the early signs and symptoms of cold stress can help prevent serious injury. Below are the most common types of cold stress and their symptoms:

- **Hypothermia** – The first symptoms of hypothermia are uncontrollable shivering; slower heartbeat, decrease in blood pressure, slurred speech, incoherence and drowsiness, fatigue even after rest, pain in the extremities, and lowering of core body temperature. If the body temperature drops below 85°F dangerous drops in blood pressure, pulse rate and respiration can occur. In some cases death may occur.

- Frostbite – can occur without hypothermia when the extremities do not receive sufficient heat from the central body stores. The first symptom of frostbite is an uncomfortable sensation of coldness followed by numbness and possibly aching, tingling, or cramping. The skin changes in color to white or grayish-yellow, then to reddish-violet, and then to black as the tissue dies. Blisters and peeling of skin may occur in later stages of frostbite. In cases of deep frostbite, the tissues are cold, pale and solid.

TRANSPORTATION OF HAZARDOUS MATERIALS AND SAMPLES

Program Responsibilities

Transportation of hazardous materials and samples will be in accordance with the U.S. Department of Transportation (DOT) regulations 49 CFR 100-185.

Training Requirements

The SeaCrest Health and Safety Officer will conduct training for all employees who are involved in handling, packaging, and shipping hazardous materials and samples. Training will cover the requirements of the DOT regulations on transportation of hazardous materials.

Training must include:

- General awareness/familiarization
- Function-specific
- Safety
- Driver training (for each employee who will operate a vehicle).

Initial training will be conducted upon assuming duties in transportation of hazardous materials. New training must be conducted every time the job functions change. Recurrent training is required at least every two years.

Training is required for the an employee that conducts the following tasks:

- Loads, unloads, or handles hazardous materials;
- Tests, reconditions, repairs, modifies, marks or otherwise prepared packages for use in the transportation of hazardous materials;
- Prepares hazardous materials for transportation;
- Is responsible for safety of transporting hazardous materials; or
- Operates a vehicle used to transport hazardous materials.

Reportable Quantities

The shipping manifest must specify if any of the materials in the package to be transported are above the Reportable Quantities of hazardous substances, as specified in the Comprehensive Environmental Response and Liability Act (CERCLA) section 103, extremely hazardous substances in EPCRA, section 304. The substances considered hazardous under CERCLA are based on CWA section 311 and 307(a); CAA section 112; RCRA section 3001; and TSCA section 7. The reportable quantities for hazardous substances are 1, 10, 100, 1000, and 5000 pounds. The reportable quantities for radionuclides are 0.001,0.01,0.1, 1, 10, 100, and 1000 Curies.

General Packaging Requirements

Hazardous materials and samples must be packaged so that the contents are retained during transport and not released to the environment in an uncontrolled manner. Information about the hazards and the contents of the package must be communicated to package handlers, transport personnel, and emergency responders.

The DOT requirements for labeling individual packages containing hazardous materials includes the following:

- Each label must be affixed to or printed on the surface of the package near the marked proper shipping name;
- Each label must be affixed to a background of contrasting color or have a dotted or solid line outer border;
- For hazardous materials that meet the definition of one or more hazards, warning labels representing each hazard (health, flammability, reactivity, and special information) are required and must be displayed next to each other;
- The DOT Emergency Response Guide number must be provided for each hazardous material being transported.

Shipping Papers

When hazardous materials are transported, the materials must be specifically identified on the shipping paper. The shipping paper will describe the shipping name of the hazardous material, its classification and its ID number. The DOT regulations require that shipping papers include:

- Shipper's name and address, and phone number;
- Name and EPA number of each transporter;
- Name, address, and EPA number of designated facility
- Description of the material to be transported (e.g., proper shipping name, Hazard Class, and ID number);
- Total quantity by weight or volume, and the type and number of containers being shipped;
- Certifications on the manifest that the materials have been properly classified, packaged, and labeled and are in proper condition for transportation according to the DOT and EPA regulations;
- Emergency response information (MSDS and the Emergency Response Guide number (ERG or equivalent);
- 24-hour emergency response telephone number.

Emergency Response Information

The DOT "Emergency Response Handbook" will be followed in situations where emergency response is required. It provides general emergency field information regarding potential hazards and emergency action to take.

If there is a spill (release) of the hazardous material during shipping, the transporter of the hazardous material will review the shipping manifest for the Emergency Response Guide number. The transporter will find the information on appropriate emergency response procedures in the Emergency Response Handbook and implement the emergency response based on the guidance in the handbook.

The MSDS of a hazardous chemical can also be used to provide emergency response information.

OPERATION OF OWNED, LEASED OR PERSONAL VEHICLES

All employees shall familiarize themselves with the safe driving practices adopted by SeaCrest to reduce the possibility of loss through injury or accident while driving company owned, leased or personal vehicles being used for company business and must comply with these rules. Operators of vehicles should be fully aware of circumstances for which a vehicle will be used so that an informed decision can be made whether the operator is qualified and holds a current operators license or certificate for the vehicle.

It will be the supervisor's responsibility to make certain that persons are properly licensed and qualified prior to allowing them to operate motor vehicles on public or private land.

During the operation of SCG owned, leased, or personal vehicles on SCG business, the operator will:

- Require all occupants to wear seat belts.
- Obey all local, state, federal and client traffic laws/rules.
- Not operate vehicles in "hazardous" areas or pass "do not enter" barricades.
- Use extreme caution around congested areas where personnel and/or equipment is working.
- Not leave engines running if vehicle is unattended.
- Lock vehicle unless prohibited by client (while on client's property only).
- Assure that transporting of samples or other items in vehicle will only be done in a safe manner and in accordance with 49 CFR.
- Not use personal vehicles to transport regulated materials and hazardous waste. 40 CFR and 49 CFR shall be consulted for the requirements.

Maintenance of company owned, leased or personal vehicles will be the responsibility of the operator. Prior to use, the operator shall visually inspect the vehicle to ascertain its road worthiness:

- All fluids (oil, water, etc.) are to proper levels.
- Vehicle is equipped with a fire extinguisher.
- Tires are free of cuts and adequate tread.
- Brakes, lights, horn, steering operational.

Employees shall not operate vehicles while abnormally fatigued, temporarily disabled or under the influence of drugs or alcohol.

Employees using their own vehicles for SCG business are required to have adequate insurance coverage. The policy should be reviewed to ensure coverage for incidental business use.

In case of accident, regardless of who is involved, injured or whose property is damaged:

- Stop
- Render aid accordingly to your capability
- Call local or state police
- Complete all accident forms accurately, including witnesses' names and addresses
- Notify supervisor as soon as possible

An accident reporting form for vehicular accidents shown in Appendix V will be completed.

As a provision of employment, SeaCrest Group may, at any time, request an employee to undergo a drug/alcohol screen. Failure to comply may be cause for dismissal or termination of employment.

APPENDIX I. STANDARDS OF CONDUCT AND SAFETY RULES

GENERAL SAFETY RULES

Each employee is expected to be thoroughly familiar with these rules and to work in accordance with the procedures outlined. Disciplinary action for violations will be in accordance with SCG's Field Personnel Policies and Procedure Manual.

Never undertake a job until you have received instructions on how to do it properly and have been authorized to perform the job.

ENTERING OR LEAVING THE PREMISES: Short cuts are dangerous. Follow designated walkways and aisles to and from work. Walk, don't run. Be alert for moving vehicles and equipment.

ENTERING BUILDINGS: When entering a building, stop and look around for possible movement of forklifts, overhead cranes and any other mobile equipment or pedestrians.

SIGNS: Pay attention to all signs. They are posted for your safety.

DRINKING WATER: Always drink from regular water fountains or approved water coolers. Water from any other source may be unsafe to drink. Only authorized personnel are to make repairs to drinking water lines and equipment.

SMOKING: Obey all smoking regulations. Smoking on job sites is restricted, to only authorized areas. These areas will be designated before work begins.

EATING: Eat only in designated areas and always wash your hands before eating.

HYGIENE: It is each employee's responsibility to maintain personal hygiene, particularly when working with hazardous chemicals.

HAZARD COMMUNICATION: All employees shall be familiar with, and comply with the OSHA Hazard Communication Standard, regarding hazardous substances and materials. Among other requirements, you must know the hazards of what you are working with, the necessary precautions and protection required and where the Material Safety Data Sheet (MSDS) are located and available. The MSDS sheets provide you with much pertinent information about the products you use in your job.

USE COMMON SENSE: Most accidents can be avoided by using common sense and concentrating on the job to be done. Always be aware of your surroundings and what is going on around you. Safety is a full time job.

PERSONAL

1. No one under the influence of drugs, alcohol or other intoxicating substances shall be allowed to work. Any employee violating this rule will be subject to automatic suspension and possible termination. Supervisors should immediately remove any employee under the influence from the work site.
2. The use of cold or allergy medication before working is strongly discouraged as these may cause drowsiness resulting in possible injury.
3. No employee shall knowingly be permitted or required to work while his ability or alertness is impaired by fatigue, illness or other causes to an extent that might expose the employee or others to injury.
4. Loose fitting or worn out clothing or long hair that might become entangled with rotating equipment is not permitted.

HOUSEKEEPING

A neat and clean place to work is necessary for safety. Good housekeeping is an integral part of your job. In order to have a pleasant and safe place to work, everyone must do his or her part to keep the entire operation orderly and clean. The use of good housekeeping practices will help protect you and your c0-workers against slipping, tripping and other hazards. It also helps to increase your efficiency.

1. It is the responsibility of each operator to maintain the work site in a clean, safe condition.
2. Tools, materials and supplies should be located so they can be conveniently and safely handled without hitting or falling on anyone at the work site. Wrenches, hammers, etc., should not be left on the edge of the truck bed.
3. Work areas should be kept as clean as possible.
4. Only approved containers may be used to store fuels.
5. Fire extinguishers and first aid kits should be easily accessible and in good condition.
6. Controls, tools, guards, lights, etc., shall be kept clean and in good operating condition.
7. Return all tools and equipment to their proper storage places when finished with them.

PERSONAL PROTECTION AND HYGIENE

As part of your job, you are required to wear proper clothing and personal protective equipment for the work you do. Your supervisor will inform you of the personal safety equipment you must use for your job.

Daily, inspect all safety equipment for defects and before each use. If a defect is discovered, report it to your supervisor immediately.

The following equipment will be worn on all job sites:

1. Hard hats meeting specifications in ANSI Z89.1.
2. Safety boots with steel toe meeting specifications in ANSI Z41.1.
3. Safety glasses meeting specifications of ANSI Z87.1.
4. Hearing protection when sound levels exceed 85 decibels.

FACE SHIELDS: Face shields protect you from moderate dangers. They afford more ventilation than other types of eye wear. They are sometimes required with safety glasses or goggles for greater all around protection.

RESPIRATORS: Respirators are of many types. You will be given the right one for your job. Do not exchange it for someone else's respirator. Not only is this not sanitary, but the other respirator may be for different usage and not really of much benefit. Always follow the company respirator hygiene and maintenance program.

GLOVES: Gloves are needed for some work such as hot work or handling sheet metal, casting or chemicals. Check with your supervisor to make sure you have the proper hand protection.

PERSONAL HYGIENE: Keeping the body clean by washing or showering is important in helping prevent absorption or ingestion of hazardous material contacted during you job. It will also help eliminated offensive odors to your co-workers. Certain jobs may require washing or showering.

SAFETY BELTS: Protect yourself from falling if your required to work above floor or ground level. Safety belts and life lines are necessary if walkways, toe boards, guard railings or other safeguards cannot give full protection. When attaching lifelines, be sure to adjust to allow only a drop of six feet maximum in case of a fall.

VESTS: All employees who work in or near the public right of way shall wear florescent vests.

HAIR AND CLOTHING: Any employee working around moving machinery must keep his/her hair neatly trimmed or tucked under a proper fitting hat.

MACHINERY AND EQUIPMENT

1. Use only those machines that you are qualified and authorized to use.
2. Before you turn on a machine, make sure that everyone is in the clear and that guards and safety devices are in place and properly adjusted.
3. Never leave a machine running unattended.
4. When adjustments are necessary, turn off the power and wait until the machine has come to a standstill. Do not attempt to brake or slow down moving machinery with your hand or with some makeshift device. Remember, there are electrical, pneumatic (air), and hydraulic are three types of power used, among others. If the machine is of the type using more than one source of power, make sure that all sources of power are turned off and any residual pressure is bled off.

5. Keep all machines clean. If it becomes necessary to remove chips or scrap from a machine, do it with a brush or a stick and not your hands.
6. If the machine or equipment you are operating requires eye and or face protection, this protection must be worn while operating that machine.
7. If a machine doesn't work right, tell your supervisor. If it is unsafe to operate, the supervisor will have it marked "out of order" locked out to prevent injury.
8. Do not remove any lock, tag or flag unless you placed it and only after you are sure all personnel are in the clear. Do not remove any DANGER or CAUTION sign unless you placed it and then only after you are certain the dangerous condition has been corrected. If a lock, tag or flag must be removed and the person who placed it cannot be found, check with your supervisor who will take the proper steps.
9. Do not wear neckties, loose clothing or jewelry when operating machinery. Long hair must also be tied back, tucked under a cap or otherwise protected to keep from being caught in moving parts.

OPERATING EQUIPMENT SAFELY

Operators should immediately stop to correct any unsafe equipment, condition or work practice. Work should not resume until the work can be done safely.

1. Only authorized personnel, qualified by training or experience, may operate equipment. Everyone on site should be shown where the fire extinguisher, first aid kit and emergency engine shut off are located.
2. Power tools shall be inspected, tested and determined to be in safe operating condition prior to use.
3. Each operator is responsible for the inspection of his machinery and equipment daily and during use to make sure it is in safe operating condition.
4. Any machinery or equipment found by the operator or designated authority to be unsafe, shall be deadlined and its use prohibited until unsafe conditions have been corrected.
5. When necessary, all mobile equipment and the area in which they are operated, shall be adequately illuminated while work is in progress.
6. Equipment operated on the highway shall be equipped with turn signals visible from the front and rear.
7. All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, etc., shall be guarded when exposed to contact by persons or otherwise create a hazard.
8. Make sure other people are clear before starting or moving equipment.
9. The operator should only operate equipment from the position of the controls. Don't reach around from the other side. If the operator leaves the area of the controls, the machine must be placed in neutral. The engine must be shut down if the operator leaves the vicinity of the machinery.
10. Throwing tools is not permitted. Tools should be passed carefully hand to hand.
11. If operating equipment in a confined area, make sure exhaust fumes are conducted out of work area. Exhaust fumes are toxic and dangerous levels cannot always be detected by

smell.

12. Keep work area, especially around controls, clean. Slips and falls are one of the leading causes of injuries.
13. Be careful lifting heavy objects, lift with your legs. It is easy to injure yourself and you are more likely to fall if carrying a heavy object.
14. If something is too heavy to lift comfortably, get help or use a machine to lift it.
15. Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and not arched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and not arched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back. Be careful setting heavy objects down, they may bounce back up, causing injury or property damage.
16. If a heavy object must be moved some distance without the aid of machinery, keep your back straight and not arched. Change directions by moving your feet, not by twisting your body.
17. Move heavy objects with the aid of hand carts whenever possible.
18. Don't siphon fuel. Gasoline and diesel are toxic, even small amounts in your mouth and lungs can have serious health consequences. Use a pump to fill cans or tanks.
19. Never refuel any equipment while engine is running. On a small engine, give it a few minutes to cool down before refueling. Engine must be cool to touch before refueling.
20. Frayed or worn cables or hoses should be replaced immediately.
21. Never leave a load suspended in the air while away from the controls.
22. Keep your hands away from cable, hooks, shackles and other pinch points as slack is taken out of cable.
23. Always wear gloves when handling wire rope.

HAND AND POWER TOOLS

1. Keep tools clean and check the condition before you use them. If heads of striking tools become mushroomed or burred, have them dressed. If handles are splintered, broken or loose, have them replaced before you use the tool.
2. Use the proper tool for the job to be accomplished. If the tool requires too much exertion, it is not the right tool.
3. Position your hands so that your fingers do not get smashed if the wrench slips or the connection suddenly loosens or "breaks".
4. Carrying tools in your pockets is dangerous, especially if the tools are sharp or pointed. Always use a tool kit or tool belt when carrying tools.
5. Tools and equipment powered by electricity, compressed air or compressed gases can be dangerous to you and may cause serious to others if not properly handled. Only properly trained, authorized and qualified people are allowed to operate this equipment.
6. Guards shall be kept in place at all times except when making repairs. When making repairs or adjustments, all hand held power tools must be unplugged or disengaged from the power source. Stationary power tools must be properly locked out when making repairs or making adjustments.

7. Compressed air is extremely dangerous of improperly or carelessly used. Never direct it towards yourself or anyone else for any reason—IT CAN KILL. When compressed air is used for cleaning purposes, the pressure must be less than 30 PSI or effective pressure reducing tips used. Do not use air pressure to clean your clothing or your body.

WELDING AND CUTTING

1. General—All welding and cutting equipment and operations shall be accordance with standards and recommend practices of the 'American Welding Society, Safety in Welding and Cutting' ANSI Z.49.1 and the recommendations of the National Fire Protection Association.
2. Only trained and authorized personnel are permitted to use gas or electric cutting or welding equipment. They must wear welder's hood and/or goggles for their protection from flashes or sparks which may cause eye injury.
3. All welding equipment shall be inspected daily. Defective equipment shall be removed from service, replaced, or repaired and re inspected before again being replaced in service.
4. Compressed gas cylinders—storage and handling:
   a. Compressed gas cylinders shall be constructed, inspected and tested in accordance with MIL-STD 101B, Color Code for Pipelines and Compressed Gas Cylinders.
   b. Cylinders shall be stored in well ventilated locations. Cylinders containing oxygen, acetylene, or other fuel gas shall not be taken in confined spaces.
   c. Smoking is forbidden wherever cylinders are stored.
   d. Cylinders shall be protected from extremes of temperature, physical damage and electrical current.
   e. Cylinder valves shall be closed when cylinders are in storage, in transit and whenever regulator is not in place.
   f. Cylinder valve caps shall be in place when cylinders are in storage, in transit and whenever regulator is not in place.
   g. All compressed gas cylinders in service shall be secured in substantial fixed or portable racks or hand trucks.
5. When the welding, cutting or heating operation is in progress normal fire prevention precautions are not sufficient. Additional personnel shall be assigned to guard against fire and shall be instructed in anticipated fire hazards and how fire fighting equipment is to be used.
6. Never use oil or grease to lubricated any part of an oxygen, acetylene or gas cylinder or regulator. Do not touch them if you have oil or grease on your hands or gloves, as you risk a very serious fire hazard.
7. Always use a green hose for oxygen and the red hose for all fuel gas. Never use compressed air to blow out these hoses, use oxygen for the oxygen hose and fuel gas for the fuel gas hose.

FIRE AND CHEMICAL SAFETY

1. Fire extinguishers in good condition will be on all SCG vehicles.
2. All employees shall know the location of the FIRE fighting EXTINGUISHERS and how to use them properly.
3. CHEMICAL LABELS shall be read and followed, particularly those which contain instructions in the use of the chemical to avoid harmful exposure to the employee.
4. Do not remove, alter or deface any HAZARD WARNING LABELS.
5. Change your clothing immediately should it become soaked with any flammable liquid or chemical.
6. Never pour FLAMMABLE LIQUIDS down drains or sewers.
7. Store flammable liquids in proper containers in separate area with warning labels.
8. Use metal containers for disposal of rags soaked with flammable liquids.

TIRES, BATTERIES AND FUEL

Tires

Tires on the rig must be checked daily for safety and during extended travel for loss of air. They must be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be reinflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under-inflated tires are not as stable on firm ground as properly inflated tires. Air pressures should be maintained for travel on streets, roads and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

1. Missing or loose wheel lugs.
2. Objects wedged between duals or embedded in the tire casing.
3. Damaged or poorly fitting rims or rim flanges.
4. Abnormal or uneven wear and cuts, breaks or tears in the casing.

The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacturer's repair manual.

Batteries

Batteries contain strong acid. Use extreme caution when servicing batteries.

1. Batteries should be serviced in a ventilated area while wearing safety glasses.
2. When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
3. When installing a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charged leads to the battery posts. Cell caps should be loosened prior to charge to permit the escape of gas.
5. Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid should be immediately flushed off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
6. To avoid battery explosions, keep the cells filled with electrolytes and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

Fuel

Special precautions must be taken for handling fuel and refueling the rig or carrier.

1. Only use the type and quality of fuel recommended by the engine manufacturer.
2. Refuel in a well ventilated area.
3. Do not fill tanks while the engine is running. Turn off all electrical switches.
4. Do not spill fuel on hot surfaces. If the fuel tank is near the engine, the engine must be cool to touch prior to refueling. Clean any spillage before starting an engine.
5. Wipe up spilled fuel with cotton rags or cloths—do not use wool or metallic cloth.
6. Keep open lights, lighted smoking materials and flames or sparking equipment well away from the fueling area.
7. Turn off heaters in carrier cabs when refueling the carrier or the rig.
8. Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
9. Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
10. Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
11. Fuel containers and hoses should remain in contact with a metal surface during travel to prevent the buildup of static charge.

Safety Violation Policy and Warnings

__ First __ Second __ Third __ Fourth

Worker

If a worker violates a safety procedure:

Non-Life Threatening:

__ Verbal __ Written __ Time-off __ Removal

Life threatening violations may be cause for immediate dismissal.

Foreman

If a foreman commits a safety violation or permits a worker in his view to violate safety procedures, the foreman shall receive:

Non-Life Threatening:

__ Verbal __ Written __ Time-off __ Removal

Life threatening violations may be cause for immediate dismissal.

APPENDIX II. INFORMED CONSENT STATEMENT ON ALCOHOL AND DRUG ABUSE

I understand that as part of the pre-employment evaluation process and the update/periodic medical surveillance program with SeaCrest Group, I may be required to provide a body fluid specimen to be analyzed for the presence of a variety of "street drugs". I understand that the presence of any drugs not prescribed by a licensed professional could be cause for rejection of my employment application or termination of my employment.

During my employment, SeaCrest Group may for a variety of reasons require one or more of a number of drug tests, including random, post-accident, and reasonable cause tests. Whether these are given will depend on the nature of your work and the laws governing your work. All employees subject to Department of Transportation motor carrier regulations are by law subject to each of these tests.

Due to the nature of the work done here and the increasing prevalence of substance abuse in our population, SeaCrest Group tends to maintain a high level of health and safety to insure its employees a safe and health work place.

I have read the above and understand the content. I further understand that this authorization will remain in effect until my employment is terminated.

Employee Signature Date

Witness Signature Date

APPENDIX III. AUTHORIZATION TO RELEASE MEDICAL RECORD INFORMATION

I, _____, hereby authorize and request the staff of _____ to release to SeaCrest Group my medical records from _____.

In addition these medical records may be used for analysis of medical and/or exposure studies. Use of my medical records for medical and/or exposure studies is contingent upon the masking of all references to my identity, including name, address, employee number, social security number and any other identifying characteristics.

_____

Full Name of Employee Signature

_____

Full Name of Witness Signature

_____

Date

APPENDIX IV. ACCIDENT REPORT POLICY AND REPORT FORMS

In the event of an accident, incident or exposure at a job site or while working in the lab, it shall be the responsibility of the employee to notify his or her supervisor immediately.

It will then be the supervisor's responsibility to decide whether medical attention is needed. In the event medical attention is needed, the supervisor or SCG representative will accompany all employees to the medical facility.

If allowable by the doctor, the SCG representative will be present during examination and will consult with the doctor on employee's status of workability or what restrictions are put on the employee and for how long. The SCG representative will then contact either the Operations Manager or the Health and Safety Manager for further instructions.

In the event of a serious incident, accident or exposure, the Health and Safety Manager and Operations Manager will be notified by phone immediately no matter what time of day or night.

INCIDENT INVESTIGATION AND REPORTS

An incident, accident or exposure report shall be completed by the supervisor and turned into the Health and Safety Manager within 24 hours of occurrence. A separate report shall be turned in for each and every incident, accident or exposure.

It shall be the supervisor's responsibility to immediately correct any deficiencies or improper safety practices, training or equipment failures that were determined to cause or contribute to the incident. If the deficiencies cannot be corrected immediately, operations will cease in that area until the situation can be evaluated and resolved.

Upon receiving a report, the Health and Safety Manager or Branch Operations Manager will investigate the incident and follow up with a report that will answer the following questions:

- What happened?
- Why did the incident happen?
- What should be done to prevent reoccurrence?
- What action has been taken?

The accident, incident or exposure report, along with the investigation report will be placed in the employee file and kept by the Health and Safety Manager.

If an employee is found to have given false information or is found to have not been following safety regulations or SCG policy, which contributed, to the cause of the incident, accident or

exposure, this may be grounds for termination.

THE SEACREST SUPERVISOR'S REPORT OF

EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT

(A separate sheet is to be completed for each incident and submitted immediately to the Health and Safety Supervisor for consideration).

1. Employee Name _____
2. Office _____
3. Job # _____
4. Project Job Title _____
5. Incident:
   a. Location _____
   b. Date of incident _____
   c. Time of incident _____
   d. Date incident reported _____
   e. Person to whom incident was reported _____
   f. Time reported _____

6. Nature of the Exposure/Injury:
   a. State the nature of the exposure/injury in detail, list parts of body affected and how it occurred. (Attach extra sheets if necessary.)_____
   _____
   b. Was medical attention received? Yes _____ No _____
   c. If so, when? _____
   d. Name and address of medical facility _____
   Name of physician _____

7. Factors involved:

Check Unsafe Act (X)

__ Improper lifting, carrying or handling

__ Improper use of tools or equipment

__ Operating without authority

__ Taking an unsafe position

__ Failure to wear protection equipment

__ Cleaning, oiling, etc. Moving Mach.

Check Unsafe Conditions (X)

__ Slippery floors/stairs/areas

__ Defective floors/stairs/areas

__ Inadequate guarding

__ Lack of available PPE

__ Rough or uneven surfaces

__ Poor housekeeping, stacking or storage

__ Lack of knowledge, skill or capabilities

__ Failure to use safety devices present

__ Failure to use equipment provided (Other than PPE)

__ Other (injury or illness)

__ Windblown or flotation dust

__ Defective tools or equipment

__ Unsafe design, arrangement or procedure

__ Occupational health hazard

What was employee doing when exposure/injury occurred? (Describe briefly the phase of operation e.g. "Sampling", "Drilling", etc.)_____
_____

8. Corrective Action Taken (X)

__ Instructed Employee _____ others

__ Warned employee _____ others

__ Re-assigned employee

__ Transferred employee

__ Changed method

__ Other action

__ Eliminated Condition

__ Repaired Condition

__ Guarded hazard _____ how?

__ Warning issued _____ how?

__ Reported to _____

__ Other Action

A. Explain your corrective action checked above:

_____

9. Was the Health and Safety Supervisor Contacted? ___ Yes ___ No

When? _____

A. Has the employee returned to work? ___ Yes __ No

B. List name and title of persons who witnessed the exposure/injury accident:

_____

10. Attach any other relevant information regarding this incident including medical consultant's comments:

_____

(Supervisor Signature) (Date)

ACCIDENT REPORTING

Injury Incident Report completed by the Health and Safety Officer, signed by the foreman and forwarded to Corporate Operations for completion of the First Injury Report.

SEACREST GROUP

COLORADO

_____		_____
Laboratory manager	or	**Laboratory Director**
Shannon Phelps		Shannon Phelps

_____

HEALTH AND SAFETY OFFICER

_____

FOREMAN

_____

EMPLOYEE

APPENDIX V. VEHICULAR ACCIDENT REPORTING

The following is the minimum reporting guidelines for vehicular accidents.

DEPARTMENT OF TRANSPORTATION ACCIDENT REPORTING GUIDELINES

Definition of Reportable Accident - An occurrence involving a commercial motor vehicle engaged in the interstate, foreign, or intrastate operations of a motor carrier who is subject to the Department of Transportation (DOT) with an act resulting in:

a. Death of a human being
b. Bodily injury to a person who, as a result of the injury, immediately receives medical treatment away from the scene of the accident.
c. Total damage to all property aggregating 4,400 or more based upon actual costs or reliable estimates.

Reporting of Accidents

Within 30 days after a motor carrier learns or should have learned that a reportable accident occurred the motor carrier must file the original and two copies of forms MCS 50-T (property) or form MCS 50-B (passenger) completed with the Director of Regional Motor Carrier Safety Office of the Federal Highway Administration Region in which the carriers principal place of business is located.

Immediate Notification of Fatal Accidents

When a reportable accident involves the death of a person within 24 hours after the accident occurs, the motor carrier must inform by telephone or in person as soon as possible after the accident to the Motor Carrier safety office of the Federal Highway Administration Region in which the carriers principle place of business is located.

The following information is required:

1. Date and time of the accident.
2. Location of the accident.
3. Name of each motor carrier involved.
4. Number of persons killed.
5. Number of persons injured.
6. Estimate of total property damage.
7. Number and type of vehicles involved.

8. A very brief description of the accident.
9. Name of person making the report.
10. Telephone number at which the person making the report can be reached.
11. The results of a drug test performed in accordance with the instruction in 391.113.

Notice of Death after Filing Report

If a person dies as the result of an accident and after the motor carrier has filed his report, the motor carrier must, as soon as possible after the death and no later than 15 days, give written notice of the death to the Director Regional Motor Carrier Safety Office with whom he filed the accident report within 30 days after a the accident occurs.

Instructions for preparing accident reports are illustrated in the Federal Motor Carrier Safety Regulations 383, 390-397, 399 U.S. Department of Transportation Federal Highway Administration.

Record Keeping

All accident reports must be retained on file at the principle place of business for at least 3 years after the date of accident.

Reference: Federal Motor Carrier Safety Regulations Parts 383, 390-397, 399 --U.S. Department of Transportation Federal Highway Administration.

Attached: Accident or Loss Report

Life threatening violation may be cause for immediate dismissal.

INSTRUCTIONS: **ACCIDENT OR LOSS REPORT**

Complete report in detail and give to your supervisor. Supervisor is to send report immediately to the Risk Management Department.

Date of Accident:_____ Time of Day:_____ a.m. ___ p.m. ___

Location: _____

Light Conditions: ___ Daylight; ___ Darkness with street lights; ___ Darkness without lights; ___ Dusk or Twilight

Road Conditions: ___ Dry; ___ Wet; ___ Snowy or Icy; ___ Other Vehicle Speed:_____

Number of Vehicles Involved: _____. If more than 2, complete additional sheets

Company Vehicle or Equipment No.:_____ Year:_____ Make:_____ Model:_____

Vehicle License Plate Number:_____ State:_____ Vehicle ID Number:_____

Driver's Name:_____

Driver's Address:_____

Driver's Date of Birth:_____ Sex:_____ Driver's License Number:_____

Describe Nature of Damage to Vehicle or Equipment:_____

_____

_____

_____

Estimated Cost to Repair: $_____

Other Vehicle Involved In Accident: (If more than one (1), use another sheet of paper and attach to this one)

Does Driver of Vehicle Own It: ___Yes ___No (if not owner include driver's information also)

Owner's Name:_____

Owner's Address:_____

Driver's License Number of Driver:_____ License Plate Number:_____

Insurance Company:_____

Insurance Agents Name, Address and Telephone Number:_____

_____

Damage to Other Vehicle:_____

_____

Any Witnesses to Accident: ___Yes ___No (If yes, list names and address below)

_____

_____

_____

Were Police Called: ___Yes ___No

Officer's Name and Badge No.:_____

Citation Issued: ___Yes ___No (If yes, list to whom and citation cited)

_____

INJURIES: If you or any person was injured list nature of injury and if injuries were treated:_____

DRAW HERE HOW ACCIDENT HAPPENED

INDICATE NORTH BY ARROW

Use one of these outlines to sketch the scene of your accident, writing in street or highway names or numbers.

1. Number of each vehicle and show direction of travel by arrow:
2. Use solid line to show path before accident
3. Use dotted line to show path after accident
4. Show pedestrian by: ☺
5. Show railroad by: ≠
6. Show distance and directions to landmarks; identify landmarks by name or number.
7. Indicate north by arrow, as: ↑
8. Show all traffic sign or traffic lights by proper location by marking an "X".

Describe What Happened:

(In case of THEFT, list all items stolen and value of each item).

Reported: Verbally to: _____
Phoned to: _____

Driver: _____
(Signature) (Date)

Supervisor: _____
(Signature) (Date)

APPENDIX VI. TAIL GATE SAFETY MEETING

Location:_____

Remedial ___ Drilling ___ Emergency Response ___ Oil Field Services ___

Date _____ Time _____ Job No. _____ Lead/Sup _____

Customer _____ Address _____

Job Site Location _____

Description of Work _____

Vehicles/Equipment Required _____

Chemicals Present _____

Protective Clothing and Equipment _____

Hazards (chem/phys/bio) _____

Special Instructions

_____

Remarks

_____

Paramedic Phone _____ Fire Phone _____ Office Phone _____

Hospital _____ Address _____ Phone_____

Print Name	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting conducted by _____
Print Signature

_____ _____ _____

Supervisor Operations Manager Health and Safety

APPENDIX VII. SAFETY AUDIT CHECKLIST

HAZARDOUS IDENTIFICATION INSPECTION REPORT	Page ___ of ___
COMPANY:	
DEPARTMENT:	LOCATION:
DATE OF INSPECTION:	CONDUCTED BY:

AREA	SATISFACTORY		OBSERVATION
EGRESS			
1. All exits marked, lit			
2. All exits accessible			
3. Doors that are not exits clearly			
4. Exit doors swing out			
STAIRS			
1. Lighting adequate			
2. Non-slip surfaces			
3. Handrails secure			
RAMPS, CATWALKS			
1. Strong enough for use			
2. All surfaces clear of obstructions			
3. Handrail secure			
LADDERS			
1. Strong enough for use			
2. Regularly maintained			
3. Tops marked NO STEP			
4. Secured in use			

5. Metal ladders marked KEEP AWAY			

HAZARDOUS IDENTIFICATION INSPECTION REPORT Page ___ of ___

HOISTS, CRANES, CONVEYORS			
1. Guarded			
2. Capacities posted			
3. Instructions posted			
4. Inspected			
5. Maintenance records			
MACHINERY AND EQUIPMENT			
1. Moving parts guarded			
2. Point-of-operation guards in place			
3. Guards interlocked into power sources			

WORK AREAS			
1. Walking and working areas clear of			
2. Vertical openings guarded			
3. Work areas, store rooms and other			
4. Safety areas clearly marked around			
POWER HAND TOOLS			
1. Equipped only with constant-pressure			
2. Provided with functioning self-adjusting			
3. Double-insulated or grounded			

4. Powder-actuated tools provided with safety shield/guard; special training for operator			
5. Regular maintenance			
PRESSURE APPARATUS			
1. Inspection record posted			
2. Gas cylinders secured			
3. Compressors clear			

HAZARDOUS IDENTIFICATION INSPECTION REPORT Page ___ of ___

INDUSTRIAL LIFT TRUCKS			
1. Operated ONLY by authorized			
2. Inspected daily			
3. Drivers instructed in safe operation			
4. NO PASSENGERS rules enforced			
5. Adequate safety guards during			
ELECTRICAL			
1. Wiring clear of all combustibles			
2. Adequate clearance for control panels			
3. Switches clearly marked and identified			

4. Circuit breakers and fuses of proper rating			
5. “Lock-out” controls			
6. Use of extension cords restricted			
7. Plugs and receptacles not interchangeable between voltages			
8. Approved systems and fixtures for hazardous areas and environment			

SPECIAL HAZARDS			
1. Flammable liquids kept in approved			
2. NO SMOKING OR OPEN FLAME signs posted near flammable storage			
3. All hazardous gases stored and handled in approved manner and only			
4. Only UL approved booths and other			

HAZARDOUS IDENTIFICATION INSPECTION REPORT Page ___ of ___

FIRE PROTECTION			
1. Extinguishers: serviced, tagged, accessible, proper type for use, Employees trained in use. One per 3,000 sq. ft. and within 75 ft. of any point in protected area			
2. Hydrants accessible			
3. Sprinkler valves clear and open			

FIRST AID			
1. Supplies adequate, clean, accessible,			
2. Emergency phone numbers posted			
3. Emergency procedures posted			
4. Eye/Body wash facilities near			
ENVIRONMENTAL/HEALTH			
1. Exhaust ventilation for hazardous			
2. Monitors and controls for identified			
3. Adequate lighting for conditions, fixtures in good condition , cords for			

portable equipment in good condition			
4. Noise surveys made regularly			
5. Hearing conservation measures for			

HAZARDOUS IDENTIFICATION INSPECTION REPORT Page ___ of ___

PERSONAL PROTECTION			
1. Goggles or safety glasses			
2. Approved respirators or dust masks			
3. Safety footwear			
4. Face shields and hard hats			
5. Hearing protection			
6. Protective clothing and gloves			
7. All employees trained in proper uses			
8. Devices regularly maintained,			
SAFE PRACTICES/OPERATIONS			
1. Safe lifting procedures observed			
2. Separate containers for different			
3. Combustible scraps and waste			
4. Compressed air nozzles limited to 30			
5. All warning signs posted; regulations			

OTHER			

State of Utah

Department of Health

Environmental Laboratory Certification Program

Certification is hereby granted to

ACZ Laboratories, Inc.

2773 Downhill Drive
Steamboat Springs, CO 80487

Has conformed with the
2009 TNI Standard
Scope of accreditation is limited to the
State of Utah accredited fields that accompany
this Certificate

EPA Number: CO00028
Expiration Date: 7/31/2015
Certificate Number: CO000282015-10

Robyn M. Atkinson, Ph.D, HCLD
Director, Utah Public Health Laboratory

NELAP RECOGNIZED TNI ACCREDITATION BODY

Continued accredited status depends on successful ongoing participation in the program.

UTAH DEPARTMENT OF HEALTH

State of Utah
Gary R Herbert
Governor
Gregory S Bell
Lieutenant Governor

Utah Department of Health
W David Patton Ph D
Executive Director

Division of Disease Control and Prevention
Robyn M Atkinson, Ph D, HCLD
Director, Utah Public Health Laboratory

EPA Number: ***CO00028*** **Attachment to Certificate Number: CO000282015-10**

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: ***CWA (Non Potable Water)***			
Method ASTM D516-02			
Sulfate	5/1/2012	7/31/2015	UT
Method ASTM D516-07			
Sulfate	12/12/201	7/31/2015	UT
Method ASTM D6888-04			
Cyanide	5/1/2012	7/31/2015	UT
Method ASTM D6888-09			
Cyanide	12/12/201	7/31/2015	UT
Method ASTM D7065-06			
Nonyl phenol	5/1/2013	7/31/2015	UT
Nonylphenol diethoxylate	5/1/2013	7/31/2015	UT
Nonylphenol ethoxylate	5/1/2013	7/31/2015	UT
Method ASTM D7511-09e2			
Total cyanide	5/1/2013	7/31/2015	UT
Method EPA 160.4			
Residue-volatile	5/1/2012	7/31/2015	UT
Method EPA 1631E			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 1664A			
Oil & Grease	5/1/2012	7/31/2015	UT
Method EPA 180.1			
Turbidity	5/1/2012	7/31/2015	UT
Method EPA 200.7			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Boron	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Calcium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Iron	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Lithium	5/1/2012	7/31/2015	UT
Magnesium	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Phosphorus, total	5/1/2012	7/31/2015	UT
Potassium	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silica as SiO2	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Sodium	5/1/2012	7/31/2015	UT
Strontium	5/1/2012	7/31/2015	UT
Tin	5/1/2012	7/31/2015	UT
Titanium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 200.8			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Mercury	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Thorium	5/1/2012	7/31/2015	UT
Uranium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 245.1			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 300.0			
Bromide	5/1/2012	7/31/2015	UT
Chloride	5/1/2012	7/31/2015	UT
Fluoride	5/1/2012	7/31/2015	UT
Sulfate	5/1/2012	7/31/2015	UT
Method EPA 335.4			

ACZ Laboratories, Inc

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Cyanide	5/1/2012	7/31/2015	UT
Method EPA 350.1			
Ammonia as N	5/1/2012	7/31/2015	UT
Method EPA 351.2			
Kjeldahl nitrogen - total	5/1/2012	7/31/2015	UT
Method EPA 353.2			
Nitrate	5/1/2012	7/31/2015	UT
Nitrate-nitrite	5/1/2012	7/31/2015	UT
Nitrite as N	5/1/2012	7/31/2015	UT
Method EPA 365.1			
Orthophosphate as P	5/1/2012	7/31/2015	UT
Phosphorus, total	5/1/2012	7/31/2015	UT
Method EPA 375.4			
Sulfate	5/1/2012	7/31/2015	UT
Method EPA 410.4			
Chemical oxygen demand	5/1/2012	7/31/2015	UT
Method EPA 420.4			
Total phenolics	5/1/2012	7/31/2015	UT
Method EPA 624			
1,1,1-Trichloroethane	5/1/2012	7/31/2015	UT
1,1,2,2-Tetrachloroethane	5/1/2012	7/31/2015	UT
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1/1/2015	7/31/2015	UT
1,1,2-Trichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethylene	5/1/2012	7/31/2015	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	5/1/2012	7/31/2015	UT
1,2-Dichloroethane (Ethylene dichloride)	5/1/2012	7/31/2015	UT
1,2-Dichloropropane	5/1/2012	7/31/2015	UT
1,3-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,4-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,4-Dioxane (1,4- Diethyleneoxide)	1/1/2015	7/31/2015	UT
1-Chlorohexane	1/1/2015	7/31/2015	UT
2-Chloroethyl vinyl ether	5/1/2012	7/31/2015	UT
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	1/1/2015	7/31/2015	UT
Acetonitrile	1/1/2015	7/31/2015	UT
Acrolein (Propenal)	1/1/2015	7/31/2015	UT
Benzene	5/1/2012	7/31/2015	UT
Bromodichloromethane	5/1/2012	7/31/2015	UT
Bromoform	5/1/2012	7/31/2015	UT
Carbon tetrachloride	5/1/2012	7/31/2015	UT
Chlorobenzene	5/1/2012	7/31/2015	UT
Chlorodibromomethane	5/1/2012	7/31/2015	UT
Chloroethane (Ethyl chloride)	5/1/2012	7/31/2015	UT
Chloroform	5/1/2012	7/31/2015	UT
cis-1,3-Dichloropropene	5/1/2012	7/31/2015	UT
Ethylbenzene	5/1/2012	7/31/2015	UT
Iodomethane (Methyl iodide)	1/1/2015	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Methyl bromide (Bromomethane)	5/1/2012	7/31/2015	UT
Methyl chloride (Chloromethane)	5/1/2012	7/31/2015	UT
Methylene chloride (Dichloromethane)	5/1/2012	7/31/2015	UT
m-Xylene	5/1/2012	7/31/2015	UT
n-Hexane	1/1/2015	7/31/2015	UT
o-Xylene	5/1/2012	7/31/2015	UT
p-Xylene	5/1/2012	7/31/2015	UT
Tetrachloroethylene (Perchloroethylene)	5/1/2012	7/31/2015	UT
Toluene	5/1/2012	7/31/2015	UT
trans-1,2-Dichloroethylene	5/1/2012	7/31/2015	UT
trans-1,3-Dichloropropylene	5/1/2012	7/31/2015	UT
trans-1,4-Dichloro-2-butene	1/1/2015	7/31/2015	UT
Trichloroethene (Trichloroethylene)	5/1/2012	7/31/2015	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5/1/2012	7/31/2015	UT
Vinyl chloride	5/1/2012	7/31/2015	UT
Xylene (total)	5/1/2012	7/31/2015	UT
Method EPA 625			
1,2,4-Trichlorobenzene	5/1/2012	7/31/2015	UT
2,4,6-Trichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dimethylphenol	5/1/2012	7/31/2015	UT
2,4-Dinitrophenol	5/1/2012	7/31/2015	UT
2,4-Dinitrotoluene (2,4-DNT)	5/1/2012	7/31/2015	UT
2,6-Dinitrotoluene (2,6-DNT)	5/1/2012	7/31/2015	UT
2-Chloronaphthalene	5/1/2012	7/31/2015	UT
2-Chlorophenol	5/1/2012	7/31/2015	UT
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	5/1/2012	7/31/2015	UT
2-Nitrophenol	5/1/2012	7/31/2015	UT
3,3'-Dichlorobenzidine	5/1/2012	7/31/2015	UT
4-Bromophenyl phenyl ether	5/1/2012	7/31/2015	UT
4-Chloro-3-methylphenol	5/1/2012	7/31/2015	UT
4-Chlorophenyl phenylether	5/1/2012	7/31/2015	UT
4-Nitrophenol	5/1/2012	7/31/2015	UT
Acenaphthene	5/1/2012	7/31/2015	UT
Acenaphthylene	5/1/2012	7/31/2015	UT
Anthracene	5/1/2012	7/31/2015	UT
Benzo(a)anthracene	5/1/2012	7/31/2015	UT
Benzo(a)pyrene	5/1/2012	7/31/2015	UT
Benzo(b)fluoranthene	5/1/2012	7/31/2015	UT
Benzo(g,h,i)perylene	5/1/2012	7/31/2015	UT
Benzo(k)fluoranthene	5/1/2012	7/31/2015	UT
bis(2-Chloroethoxy)methane	5/1/2012	7/31/2015	UT
bis(2-Chloroethyl) ether	5/1/2012	7/31/2015	UT
bis(2-Chloroisopropyl) ether	5/1/2012	7/31/2015	UT
Butyl benzyl phthalate	5/1/2012	7/31/2015	UT
Chrysene	5/1/2012	7/31/2015	UT
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	5/1/2012	7/31/2015	UT
Dibenz(a,h) anthracene	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Diethyl phthalate	5/1/2012	7/31/2015	UT
Dimethyl phthalate	5/1/2012	7/31/2015	UT
Di-n-butyl phthalate	5/1/2012	7/31/2015	UT
Di-n-octyl phthalate	5/1/2012	7/31/2015	UT
Fluoranthene	5/1/2012	7/31/2015	UT
Fluorene	5/1/2012	7/31/2015	UT
Hexachlorobenzene	5/1/2012	7/31/2015	UT
Hexachlorobutadiene	5/1/2012	7/31/2015	UT
Hexachlorocyclopentadiene	5/1/2012	7/31/2015	UT
Hexachloroethane	5/1/2012	7/31/2015	UT
Indeno(1,2,3-cd) pyrene	5/1/2012	7/31/2015	UT
Isophorone	5/1/2012	7/31/2015	UT
Naphthalene	5/1/2012	7/31/2015	UT
Nitrobenzene	5/1/2012	7/31/2015	UT
n-Nitrosodimethylamine	5/1/2012	7/31/2015	UT
n-Nitrosodi-n-propylamine	5/1/2012	7/31/2015	UT
n-Nitrosodiphenylamine	5/1/2012	7/31/2015	UT
Pentachlorophenol	5/1/2012	7/31/2015	UT
Phenanthrene	5/1/2012	7/31/2015	UT
Phenol	5/1/2012	7/31/2015	UT
Pyrene	5/1/2012	7/31/2015	UT
Method EPA 900			
Gross-alpha	5/1/2012	7/31/2015	UT
Gross-beta	5/1/2012	7/31/2015	UT
Method EPA 901.1			
Cesium-134	5/1/2012	7/31/2015	UT
Cesium-137	5/1/2012	7/31/2015	UT
Method EPA 903			
Radium-226	5/1/2012	7/31/2015	UT
Total alpha radium	11/1/2012	7/31/2015	UT
Method EPA 903.1			
Radium-226	5/1/2012	7/31/2015	UT
Method EPA 904			
Radium-228	5/1/2012	7/31/2015	UT
Method OIA 1677-09			
Free cyanide	5/1/2013	7/31/2015	UT
Method SM 2310 B-1997			
Acidity, as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2310 B-2011			
Acidity, as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2320 B-1997			
Alkalinity as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2320 B-2011			
Alkalinity as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2340 B-1997			
Total hardness as CaCO3	5/1/2014	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Method SM 2340 B-2011			
Total hardness as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2510 B-1997			
Conductivity	5/1/2014	7/31/2015	UT
Method SM 2510 B-2011			
Conductivity	5/1/2014	7/31/2015	UT
Method SM 2540 B-1997			
Residue-total	5/1/2014	7/31/2015	UT
Method SM 2540 B-2011			
Residue-total	5/1/2014	7/31/2015	UT
Method SM 2540 C-1997			
Residue-filterable (TDS)	5/1/2014	7/31/2015	UT
Method SM 2540 C-2011			
Residue-filterable (TDS)	5/1/2014	7/31/2015	UT
Method SM 2540 D-1997			
Residue-nonfilterable (TSS)	5/1/2014	7/31/2015	UT
Method SM 2540 D-2011			
Residue-nonfilterable (TSS)	5/1/2014	7/31/2015	UT
Method SM 2540 F-1997			
Residue-settleable	5/1/2014	7/31/2015	UT
Method SM 2540 F-2011			
Residue-settleable	5/1/2014	7/31/2015	UT
Method SM 3114 B-1993			
Selenium	5/1/2014	7/31/2015	UT
Method SM 3114 B-2009			
Selenium	12/12/201	7/31/2015	UT
Method SM 3114 B-2011			
Selenium	5/1/2014	7/31/2015	UT
Method SM 3114 C-2009			
Selenium	12/12/201	7/31/2015	UT
Method SM 3114 C-2011			
Selenium	5/1/2014	7/31/2015	UT
Method SM 3500-Cr B-2009			
Chromium VI	12/12/201	7/31/2015	UT
Method SM 3500-Cr B-2011			
Chromium VI	5/1/2014	7/31/2015	UT
Method SM 3500-Cr D-1990			
Chromium VI	5/1/2012	7/31/2015	UT
Method SM 3500-Fe B-1997			
Iron-(II) (Ferrous Iron)	5/1/2014	7/31/2015	UT
Method SM 3500-Fe B-2011			
Iron-(II) (Ferrous Iron)	5/1/2014	7/31/2015	UT
Method SM 4500-Cl E-1997			

ACZ Laboratories, Inc

	Start Date	Expires	AB
Program/Matrix: *CWA (Non Potable Water)*			
Chloride	5/1/2014	7/31/2015	UT
Method SM 4500-Cl E-2011			
Chloride	5/1/2014	7/31/2015	UT
Method SM 4500-CN⁻ C-1999			
Total cyanide	5/1/2014	7/31/2015	UT
Method SM 4500-CN⁻ C-2011			
Total cyanide	5/1/2014	7/31/2015	UT
Method SM 4500-CN⁻ E-1999			
Cyanide	5/1/2014	7/31/2015	UT
Total cyanide	5/1/2014	7/31/2015	UT
Method SM 4500-CN⁻ E-2011			
Cyanide	5/1/2014	7/31/2015	UT
Total cyanide	5/1/2014	7/31/2015	UT
Method SM 4500-CN⁻ I-2011			
Weak Acid Dissociable Cyanide	5/1/2014	7/31/2015	UT
Method SM 4500-F⁻ C-1997			
Fluoride	5/1/2014	7/31/2015	UT
Method SM 4500-F⁻ C-2011			
Fluoride	5/1/2014	7/31/2015	UT
Method SM 4500-H+ B-2000			
pH	5/1/2014	7/31/2015	UT
Method SM 4500-H+ B-2011			
pH	5/1/2014	7/31/2015	UT
Method SM 4500-SO4⁻ D-1997			
Sulfate	5/1/2014	7/31/2015	UT
Method SM 4500-SO4⁻ D-2011			
Sulfate	5/1/2014	7/31/2015	UT
Method SM 5210 B-2001			
Biochemical oxygen demand	12/12/201	7/31/2015	UT
Carbonaceous BOD, CBOD	12/12/201	7/31/2015	UT
Method SM 5210 B-2011			
Biochemical oxygen demand	5/1/2014	7/31/2015	UT
Carbonaceous BOD, CBOD	5/1/2014	7/31/2015	UT
Method SM 5310 B-2000			
Total organic carbon	12/12/201	7/31/2015	UT

ACZ Laboratories, Inc.

Program/Matrix: *RCRA (Biological Tissue)*

	Start Date	Expires	AB
Method EPA 6010B			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Boron	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Calcium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Iron	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Lithium	5/1/2012	7/31/2015	UT
Magnesium	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Potassium	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Sodium	5/1/2012	7/31/2015	UT
Strontium	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Tin	5/1/2012	7/31/2015	UT
Titanium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 6020			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Uranium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Biological Tissue)***			
Zinc	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc

	Start Date	Expires	AB
Program/Matrix: *RCRA (Non Potable Water)*			
Method EPA 1010A			
Ignitability	5/1/2012	7/31/2015	UT
Method EPA 1311			
Toxicity Characteristic Leaching Procedure Metals	5/1/2012	7/31/2015	UT
Toxicity Characteristic Leaching Procedure Semi-Volatiles	5/1/2012	7/31/2015	UT
Toxicity Characteristic Leaching Procedure Volatiles	5/1/2012	7/31/2015	UT
Method EPA 1312			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3005A			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3010A			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3510C			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3520C			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 5030C			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 6010B			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Boron	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Calcium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Iron	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Lithium	5/1/2012	7/31/2015	UT
Magnesium	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Phosphorus, total	5/1/2012	7/31/2015	UT
Potassium	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silica as SiO2	5/1/2012	7/31/2015	UT
Silicon	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Sodium	5/1/2012	7/31/2015	UT
Strontium	5/1/2012	7/31/2015	UT
Tin	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *RCRA (Non Potable Water)*			
Titanium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 6020			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Uranium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 7196A			
Chromium VI	5/1/2012	7/31/2015	UT
Method EPA 7470A			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 8015D			
Diesel range organics (DRO)	5/1/2012	7/31/2015	UT
Gasoline range organics (GRO)	5/1/2012	7/31/2015	UT
Method EPA 8021B			
Benzene	5/1/2012	7/31/2015	UT
Ethylbenzene	5/1/2012	7/31/2015	UT
m-Xylene	5/1/2012	7/31/2015	UT
o-Xylene	5/1/2012	7/31/2015	UT
p-Xylene	5/1/2012	7/31/2015	UT
Toluene	5/1/2012	7/31/2015	UT
Xylene (total)	5/1/2012	7/31/2015	UT
Method EPA 8082A			
Aroclor-1016 (PCB-1016)	6/23/2014	7/31/2015	UT
Aroclor-1221 (PCB-1221)	6/23/2014	7/31/2015	UT
Aroclor-1232 (PCB-1232)	6/23/2014	7/31/2015	UT
Aroclor-1242 (PCB-1242)	6/23/2014	7/31/2015	UT
Aroclor-1248 (PCB-1248)	6/23/2014	7/31/2015	UT
Aroclor-1254 (PCB-1254)	6/23/2014	7/31/2015	UT
Aroclor-1260 (PCB-1260)	6/23/2014	7/31/2015	UT
Method EPA 8260B			

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Non Potable Water)***			
1,1,1,2-Tetrachloroethane	5/1/2012	7/31/2015	UT
1,1,1-Trichloroethane	5/1/2012	7/31/2015	UT
1,1,2,2-Tetrachloroethane	5/1/2012	7/31/2015	UT
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1/1/2015	7/31/2015	UT
1,1,2-Trichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethylene	5/1/2012	7/31/2015	UT
1,1-Dichloropropene	5/1/2012	7/31/2015	UT
1,2,3-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2,3-Trichloropropane	5/1/2012	7/31/2015	UT
1,2,4-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2,4-Trimethylbenzene	5/1/2012	7/31/2015	UT
1,2-Dibromo-3-chloropropane (DBCP)	5/1/2012	7/31/2015	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	5/1/2012	7/31/2015	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	5/1/2012	7/31/2015	UT
1,2-Dichloroethane (Ethylene dichloride)	5/1/2012	7/31/2015	UT
1,2-Dichloropropane	5/1/2012	7/31/2015	UT
1,3,5-Trimethylbenzene	5/1/2012	7/31/2015	UT
1,3-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,3-Dichloropropane	5/1/2012	7/31/2015	UT
1,4-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,4-Dioxane (1,4- Diethyleneoxide)	1/1/2015	7/31/2015	UT
1-Chlorohexane	1/1/2015	7/31/2015	UT
2,2-Dichloropropane	5/1/2012	7/31/2015	UT
2-Butanone (Methyl ethyl ketone, MEK)	5/1/2012	7/31/2015	UT
2-Chloroethyl vinyl ether	5/1/2012	7/31/2015	UT
2-Chlorotoluene	5/1/2012	7/31/2015	UT
2-Hexanone	5/1/2012	7/31/2015	UT
4-Chlorotoluene	5/1/2012	7/31/2015	UT
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	1/1/2015	7/31/2015	UT
4-Methyl-2-pentanone (MIBK)	5/1/2012	7/31/2015	UT
Acetone	5/1/2012	7/31/2015	UT
Acetonitrile	1/1/2015	7/31/2015	UT
Acrolein (Propenal)	1/1/2015	7/31/2015	UT
Acrylonitrile	5/1/2012	7/31/2015	UT
Benzene	5/1/2012	7/31/2015	UT
Bromobenzene	5/1/2012	7/31/2015	UT
Bromochloromethane	5/1/2012	7/31/2015	UT
Bromodichloromethane	5/1/2012	7/31/2015	UT
Bromoform	5/1/2012	7/31/2015	UT
Carbon disulfide	5/1/2012	7/31/2015	UT
Carbon tetrachloride	5/1/2012	7/31/2015	UT
Chlorobenzene	5/1/2012	7/31/2015	UT
Chlorodibromomethane	5/1/2012	7/31/2015	UT
Chloroethane (Ethyl chloride)	5/1/2012	7/31/2015	UT
Chloroform	5/1/2012	7/31/2015	UT
cis-1,2-Dichloroethylene	5/1/2012	7/31/2015	UT
cis-1,3-Dichloropropene	5/1/2012	7/31/2015	UT
Dibromomethane (Methylene bromide)	5/1/2012	7/31/2015	UT

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Non Potable Water)***			
Dichlorodifluoromethane (Freon-12)	5/1/2012	7/31/2015	UT
Ethylbenzene	5/1/2012	7/31/2015	UT
Hexachlorobutadiene	5/1/2012	7/31/2015	UT
Iodomethane (Methyl iodide)	1/1/2015	7/31/2015	UT
Isopropylbenzene	5/1/2012	7/31/2015	UT
Methyl bromide (Bromomethane)	5/1/2012	7/31/2015	UT
Methyl chloride (Chloromethane)	5/1/2012	7/31/2015	UT
Methyl tert-butyl ether (MTBE)	5/1/2012	7/31/2015	UT
Methylene chloride (Dichloromethane)	5/1/2012	7/31/2015	UT
m-Xylene	5/1/2012	7/31/2015	UT
Naphthalene	5/1/2012	7/31/2015	UT
n-Butylbenzene	5/1/2012	7/31/2015	UT
n-Hexane	1/1/2015	7/31/2015	UT
n-Propylbenzene	5/1/2012	7/31/2015	UT
o-Xylene	5/1/2012	7/31/2015	UT
p-Xylene	5/1/2012	7/31/2015	UT
sec-Butylbenzene	5/1/2012	7/31/2015	UT
Styrene	5/1/2012	7/31/2015	UT
tert-Butylbenzene	5/1/2012	7/31/2015	UT
Tetrachloroethylene (Perchloroethylene)	5/1/2012	7/31/2015	UT
Toluene	5/1/2012	7/31/2015	UT
trans-1,2-Dichloroethylene	5/1/2012	7/31/2015	UT
trans-1,3-Dichloropropylene	5/1/2012	7/31/2015	UT
trans-1,4-Dichloro-2-butene	1/1/2015	7/31/2015	UT
Trichloroethene (Trichloroethylene)	5/1/2012	7/31/2015	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5/1/2012	7/31/2015	UT
Vinyl acetate	5/1/2012	7/31/2015	UT
Vinyl chloride	5/1/2012	7/31/2015	UT
Xylene (total)	5/1/2012	7/31/2015	UT
Method EPA 8270C			
1,2,4-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	5/1/2012	7/31/2015	UT
1,3-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,4-Dichlorobenzene	5/1/2012	7/31/2015	UT
2,4,5-Trichlorophenol	5/1/2012	7/31/2015	UT
2,4,6-Trichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dimethylphenol	5/1/2012	7/31/2015	UT
2,4-Dinitrophenol	5/1/2012	7/31/2015	UT
2,4-Dinitrotoluene (2,4-DNT)	5/1/2012	7/31/2015	UT
2,6-Dinitrotoluene (2,6-DNT)	5/1/2012	7/31/2015	UT
2-Chloronaphthalene	5/1/2012	7/31/2015	UT
2-Chlorophenol	5/1/2012	7/31/2015	UT
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	5/1/2012	7/31/2015	UT
2-Methylnaphthalene	5/1/2012	7/31/2015	UT
2-Methylphenol (o-Cresol)	5/1/2012	7/31/2015	UT
2-Nitroaniline	5/1/2012	7/31/2015	UT
2-Nitrophenol	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Non Potable Water)***			
3,3'-Dichlorobenzidine	5/1/2012	7/31/2015	UT
3-Methylphenol (m-Cresol)	5/1/2012	7/31/2015	UT
3-Nitroaniline	5/1/2012	7/31/2015	UT
4-Bromophenyl phenyl ether	5/1/2012	7/31/2015	UT
4-Chloro-3-methylphenol	5/1/2012	7/31/2015	UT
4-Chloroaniline	5/1/2012	7/31/2015	UT
4-Chlorophenyl phenylether	5/1/2012	7/31/2015	UT
4-Methylphenol (p-Cresol)	10/7/2014	7/31/2015	UT
4-Nitroaniline	5/1/2012	7/31/2015	UT
4-Nitrophenol	5/1/2012	7/31/2015	UT
Acenaphthene	5/1/2012	7/31/2015	UT
Acenaphthylene	5/1/2012	7/31/2015	UT
Anthracene	5/1/2012	7/31/2015	UT
Azobenzene (1,2-Diphenylhydrazine)	5/1/2012	7/31/2015	UT
Benzo(a)anthracene	5/1/2012	7/31/2015	UT
Benzo(a)pyrene	5/1/2012	7/31/2015	UT
Benzo(b)fluoranthene	5/1/2012	7/31/2015	UT
Benzo(g,h,i)perylene	5/1/2012	7/31/2015	UT
Benzo(k)fluoranthene	5/1/2012	7/31/2015	UT
Benzoic acid	5/1/2012	7/31/2015	UT
Benzyl alcohol	5/1/2012	7/31/2015	UT
bis(2-Chloroethoxy)methane	5/1/2012	7/31/2015	UT
bis(2-Chloroethyl) ether	5/1/2012	7/31/2015	UT
bis(2-Chloroisopropyl) ether	5/1/2012	7/31/2015	UT
Butyl benzyl phthalate	5/1/2012	7/31/2015	UT
Chrysene	5/1/2012	7/31/2015	UT
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	5/1/2012	7/31/2015	UT
Dibenz(a,h) anthracene	5/1/2012	7/31/2015	UT
Dibenzofuran	5/1/2012	7/31/2015	UT
Diethyl phthalate	5/1/2012	7/31/2015	UT
Dimethyl phthalate	5/1/2012	7/31/2015	UT
Di-n-butyl phthalate	5/1/2012	7/31/2015	UT
Di-n-octyl phthalate	5/1/2012	7/31/2015	UT
Fluoranthene	5/1/2012	7/31/2015	UT
Fluorene	5/1/2012	7/31/2015	UT
Hexachlorobenzene	5/1/2012	7/31/2015	UT
Hexachlorobutadiene	5/1/2012	7/31/2015	UT
Hexachlorocyclopentadiene	5/1/2012	7/31/2015	UT
Hexachloroethane	5/1/2012	7/31/2015	UT
Indeno(1,2,3-cd) pyrene	5/1/2012	7/31/2015	UT
Isophorone	5/1/2012	7/31/2015	UT
Naphthalene	5/1/2012	7/31/2015	UT
Nitrobenzene	5/1/2012	7/31/2015	UT
n-Nitrosodimethylamine	5/1/2012	7/31/2015	UT
n-Nitrosodi-n-propylamine	5/1/2012	7/31/2015	UT
n-Nitrosodiphenylamine	5/1/2012	7/31/2015	UT
Pentachlorophenol	5/1/2012	7/31/2015	UT
Phenanthrene	5/1/2012	7/31/2015	UT
Phenol	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *RCRA (Non Potable Water)*			
Pyrene	5/1/2012	7/31/2015	UT
Method EPA 9012B			
Amenable cyanide	5/1/2012	7/31/2015	UT
Total cyanide	5/1/2012	7/31/2015	UT
Method EPA 9040C			
pH	5/1/2012	7/31/2015	UT
Method EPA 9070A			
Oil & Grease	5/1/2012	7/31/2015	UT
Method EPA 9310			
Gross alpha-beta	5/1/2012	7/31/2015	UT
Method EPA 9315			
Total alpha radium	5/1/2012	7/31/2015	UT
Method EPA 9320			
Radium-228	5/1/2012	7/31/2015	UT
Method SM 4500-CN^- C-1999			
Total cyanide	5/1/2013	7/31/2015	UT
Method SM 4500-CN^- E-1999			
Total cyanide	5/1/2013	7/31/2015	UT
Method SM 4500-CN^- I-2011			
Weak Acid Dissociable Cyanide	5/1/2014	7/31/2015	UT

ACZ Laboratories, Inc.

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Start Date	Expires	AB
Method EPA 1010A			
Ignitability	5/1/2012	7/31/2015	UT
Method EPA 1311			
Toxicity Characteristic Leaching Procedure Metals	5/1/2012	7/31/2015	UT
Toxicity Characteristic Leaching Procedure Semi-Volatiles	5/1/2012	7/31/2015	UT
Toxicity Characteristic Leaching Procedure Volatiles	5/1/2012	7/31/2015	UT
Method EPA 1312			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3050B			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3051A			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3052			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3060A			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3540C			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3546			
Preparation/Extraction	5/1/2013	7/31/2015	UT
Method EPA 3550C			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 3580A			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 5035			
Preparation/Extraction	5/1/2012	7/31/2015	UT
Method EPA 6010B			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Boron	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Calcium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Iron	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Lithium	5/1/2012	7/31/2015	UT
Magnesium	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *RCRA (Solid & Hazardous Material)*			
Phosphorus, total	5/1/2012	7/31/2015	UT
Potassium	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silica as SiO2	5/1/2012	7/31/2015	UT
Silicon	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Sodium	5/1/2012	7/31/2015	UT
Strontium	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Tin	5/1/2012	7/31/2015	UT
Titanium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 6020			
Aluminum	5/1/2012	7/31/2015	UT
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Cobalt	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Molybdenum	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Uranium	5/1/2012	7/31/2015	UT
Vanadium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 7196A			
Chromium VI	5/1/2012	7/31/2015	UT
Method EPA 7471A			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 7473			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 8015D			
Diesel range organics (DRO)	5/1/2012	7/31/2015	UT
Gasoline range organics (GRO)	5/1/2012	7/31/2015	UT
Method EPA 8021B			
Benzene	5/1/2012	7/31/2015	UT
Ethylbenzene	5/1/2012	7/31/2015	UT
m-Xylene	5/1/2012	7/31/2015	UT
o-Xylene	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *RCRA (Solid & Hazardous Material)*			
p-Xylene	5/1/2012	7/31/2015	UT
Toluene	5/1/2012	7/31/2015	UT
Xylene (total)	5/1/2012	7/31/2015	UT
Method EPA 8082A			
Aroclor-1016 (PCB-1016)	6/23/2014	7/31/2015	UT
Aroclor-1221 (PCB-1221)	6/23/2014	7/31/2015	UT
Aroclor-1232 (PCB-1232)	6/23/2014	7/31/2015	UT
Aroclor-1242 (PCB-1242)	6/23/2014	7/31/2015	UT
Aroclor-1248 (PCB-1248)	6/23/2014	7/31/2015	UT
Aroclor-1254 (PCB-1254)	6/23/2014	7/31/2015	UT
Aroclor-1260 (PCB-1260)	6/23/2014	7/31/2015	UT
Method EPA 8260B			
1,1,1,2-Tetrachloroethane	5/1/2012	7/31/2015	UT
1,1,1-Trichloroethane	5/1/2012	7/31/2015	UT
1,1,2,2-Tetrachloroethane	5/1/2012	7/31/2015	UT
1,1,2-Trichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethane	5/1/2012	7/31/2015	UT
1,1-Dichloroethylene	5/1/2012	7/31/2015	UT
1,1-Dichloropropene	5/1/2012	7/31/2015	UT
1,2,3-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2,3-Trichloropropane	5/1/2012	7/31/2015	UT
1,2,4-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2,4-Trimethylbenzene	5/1/2012	7/31/2015	UT
1,2-Dibromo-3-chloropropane (DBCP)	5/1/2012	7/31/2015	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	5/1/2012	7/31/2015	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	5/1/2012	7/31/2015	UT
1,2-Dichloroethane (Ethylene dichloride)	5/1/2012	7/31/2015	UT
1,2-Dichloropropane	5/1/2012	7/31/2015	UT
1,3,5-Trimethylbenzene	5/1/2012	7/31/2015	UT
1,3-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,3-Dichloropropane	5/1/2012	7/31/2015	UT
1,4-Dichlorobenzene	5/1/2012	7/31/2015	UT
2,2-Dichloropropane	5/1/2012	7/31/2015	UT
2-Butanone (Methyl ethyl ketone, MEK)	5/1/2012	7/31/2015	UT
2-Chloroethyl vinyl ether	5/1/2012	7/31/2015	UT
2-Chlorotoluene	5/1/2012	7/31/2015	UT
2-Hexanone	5/1/2012	7/31/2015	UT
4-Chlorotoluene	5/1/2012	7/31/2015	UT
4-Methyl-2-pentanone (MIBK)	5/1/2012	7/31/2015	UT
Acetone	5/1/2012	7/31/2015	UT
Acrylonitrile	5/1/2012	7/31/2015	UT
Benzene	5/1/2012	7/31/2015	UT
Bromobenzene	5/1/2012	7/31/2015	UT
Bromochloromethane	5/1/2012	7/31/2015	UT
Bromodichloromethane	5/1/2012	7/31/2015	UT
Bromoform	5/1/2012	7/31/2015	UT
Carbon disulfide	5/1/2012	7/31/2015	UT
Carbon tetrachloride	5/1/2012	7/31/2015	UT

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***			
Chlorobenzene	5/1/2012	7/31/2015	UT
Chlorodibromomethane	5/1/2012	7/31/2015	UT
Chloroethane (Ethyl chloride)	5/1/2012	7/31/2015	UT
Chloroform	5/1/2012	7/31/2015	UT
cis-1,2-Dichloroethylene	5/1/2012	7/31/2015	UT
cis-1,3-Dichloropropene	5/1/2012	7/31/2015	UT
Dibromomethane (Methylene bromide)	5/1/2012	7/31/2015	UT
Dichlorodifluoromethane (Freon-12)	5/1/2012	7/31/2015	UT
Ethylbenzene	5/1/2012	7/31/2015	UT
Hexachlorobutadiene	10/7/2014	7/31/2015	UT
Isopropylbenzene	5/1/2012	7/31/2015	UT
Methyl bromide (Bromomethane)	5/1/2012	7/31/2015	UT
Methyl chloride (Chloromethane)	5/1/2012	7/31/2015	UT
Methyl tert-butyl ether (MTBE)	5/1/2012	7/31/2015	UT
Methylene chloride (Dichloromethane)	5/1/2012	7/31/2015	UT
m-Xylene	5/1/2012	7/31/2015	UT
Naphthalene	5/1/2012	7/31/2015	UT
n-Butylbenzene	5/1/2012	7/31/2015	UT
n-Propylbenzene	5/1/2012	7/31/2015	UT
o-Xylene	5/1/2012	7/31/2015	UT
p-Xylene	5/1/2012	7/31/2015	UT
sec-Butylbenzene	5/1/2012	7/31/2015	UT
Styrene	5/1/2012	7/31/2015	UT
tert-Butylbenzene	5/1/2012	7/31/2015	UT
Tetrachloroethylene (Perchloroethylene)	5/1/2012	7/31/2015	UT
Toluene	5/1/2012	7/31/2015	UT
trans-1,2-Dichloroethylene	5/1/2012	7/31/2015	UT
trans-1,3-Dichloropropylene	5/1/2012	7/31/2015	UT
Trichloroethene (Trichloroethylene)	5/1/2012	7/31/2015	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5/1/2012	7/31/2015	UT
Vinyl acetate	5/1/2012	7/31/2015	UT
Vinyl chloride	5/1/2012	7/31/2015	UT
Xylene (total)	5/1/2012	7/31/2015	UT
Method EPA 8270C			
1,2,4-Trichlorobenzene	5/1/2012	7/31/2015	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	5/1/2012	7/31/2015	UT
1,3-Dichlorobenzene	5/1/2012	7/31/2015	UT
1,4-Dichlorobenzene	5/1/2012	7/31/2015	UT
2,4,5-Trichlorophenol	5/1/2012	7/31/2015	UT
2,4,6-Trichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dichlorophenol	5/1/2012	7/31/2015	UT
2,4-Dimethylphenol	5/1/2012	7/31/2015	UT
2,4-Dinitrophenol	5/1/2012	7/31/2015	UT
2,4-Dinitrotoluene (2,4-DNT)	5/1/2012	7/31/2015	UT
2,6-Dinitrotoluene (2,6-DNT)	5/1/2012	7/31/2015	UT
2-Chloronaphthalene	5/1/2012	7/31/2015	UT
2-Chlorophenol	5/1/2012	7/31/2015	UT
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***			
2-Methylnaphthalene	5/1/2012	7/31/2015	UT
2-Methylphenol (o-Cresol)	5/1/2012	7/31/2015	UT
2-Nitroaniline	5/1/2012	7/31/2015	UT
2-Nitrophenol	5/1/2012	7/31/2015	UT
3,3'-Dichlorobenzidine	5/1/2012	7/31/2015	UT
3-Methylphenol (m-Cresol)	5/1/2012	7/31/2015	UT
3-Nitroaniline	5/1/2012	7/31/2015	UT
4-Bromophenyl phenyl ether	5/1/2012	7/31/2015	UT
4-Chloro-3-methylphenol	5/1/2012	7/31/2015	UT
4-Chloroaniline	5/1/2012	7/31/2015	UT
4-Chlorophenyl phenylether	5/1/2012	7/31/2015	UT
4-Methylphenol (p-Cresol)	5/1/2012	7/31/2015	UT
4-Nitroaniline	5/1/2012	7/31/2015	UT
4-Nitrophenol	5/1/2012	7/31/2015	UT
Acenaphthene	5/1/2012	7/31/2015	UT
Acenaphthylene	5/1/2012	7/31/2015	UT
Anthracene	5/1/2012	7/31/2015	UT
Azobenzene (1,2-Diphenylhydrazine)	5/1/2012	7/31/2015	UT
Benzo(a)anthracene	5/1/2012	7/31/2015	UT
Benzo(a)pyrene	5/1/2012	7/31/2015	UT
Benzo(b)fluoranthene	5/1/2012	7/31/2015	UT
Benzo(g,h,i)perylene	5/1/2012	7/31/2015	UT
Benzo(k)fluoranthene	5/1/2012	7/31/2015	UT
Benzoic acid	5/1/2012	7/31/2015	UT
Benzyl alcohol	5/1/2012	7/31/2015	UT
bis(2-Chloroethoxy)methane	5/1/2012	7/31/2015	UT
bis(2-Chloroethyl) ether	5/1/2012	7/31/2015	UT
bis(2-Chloroisopropyl) ether	5/1/2012	7/31/2015	UT
Butyl benzyl phthalate	5/1/2012	7/31/2015	UT
Chrysene	5/1/2012	7/31/2015	UT
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	5/1/2012	7/31/2015	UT
Dibenz(a,h) anthracene	5/1/2012	7/31/2015	UT
Dibenzofuran	5/1/2012	7/31/2015	UT
Diethyl phthalate	5/1/2012	7/31/2015	UT
Dimethyl phthalate	5/1/2012	7/31/2015	UT
Di-n-butyl phthalate	5/1/2012	7/31/2015	UT
Di-n-octyl phthalate	5/1/2012	7/31/2015	UT
Fluoranthene	5/1/2012	7/31/2015	UT
Fluorene	5/1/2012	7/31/2015	UT
Hexachlorobenzene	5/1/2012	7/31/2015	UT
Hexachlorobutadiene	5/1/2012	7/31/2015	UT
Hexachlorocyclopentadiene	5/1/2012	7/31/2015	UT
Hexachloroethane	5/1/2012	7/31/2015	UT
Indeno(1,2,3-cd) pyrene	5/1/2012	7/31/2015	UT
Isophorone	5/1/2012	7/31/2015	UT
Naphthalene	5/1/2012	7/31/2015	UT
Nitrobenzene	5/1/2012	7/31/2015	UT
n-Nitrosodimethylamine	5/1/2012	7/31/2015	UT
n-Nitrosodi-n-propylamine	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: ***RCRA (Solid & Hazardous Material)***			
n-Nitrosodiphenylamine	5/1/2012	7/31/2015	UT
Pentachlorophenol	5/1/2012	7/31/2015	UT
Phenanthrene	5/1/2012	7/31/2015	UT
Phenol	5/1/2012	7/31/2015	UT
Pyrene	5/1/2012	7/31/2015	UT
Method EPA 9012B			
Amenable cyanide	5/1/2012	7/31/2015	UT
Total cyanide	5/1/2012	7/31/2015	UT
Method EPA 903.1			
Radium-226	5/1/2012	7/31/2015	UT
Method EPA 9045D			
pH	5/1/2012	7/31/2015	UT
Method EPA 9071B			
Oil & Grease	5/1/2012	7/31/2015	UT
Method EPA 9310			
Gross alpha-beta	5/1/2012	7/31/2015	UT
Method EPA 9315			
Total alpha radium	5/1/2012	7/31/2015	UT
Method EPA 9320			
Radium-228	5/1/2012	7/31/2015	UT
Method SM 4500-CN^- C-1999			
Total cyanide	5/1/2013	7/31/2015	UT
Method SM 4500-CN^- E-1999			
Total cyanide	5/1/2013	7/31/2015	UT
Method SM 4500-CN^- I-2011			
Weak Acid Dissociable Cyanide	5/1/2014	7/31/2015	UT

ACZ Laboratories, Inc.

	Start Date	Expires	AB
Program/Matrix: *SDWA (Potable Water)*			
Method ASTM D6888-04			
Cyanide	5/1/2012	7/31/2015	UT
Method EPA 180.1			
Turbidity	5/1/2012	7/31/2015	UT
Method EPA 200.7			
Aluminum	5/1/2012	7/31/2015	UT
Calcium	5/1/2012	7/31/2015	UT
Iron	5/1/2012	7/31/2015	UT
Magnesium	5/1/2012	7/31/2015	UT
Manganese	5/1/2012	7/31/2015	UT
Silica as SiO2	5/1/2012	7/31/2015	UT
Sodium	5/1/2012	7/31/2015	UT
Strontium	5/1/2012	7/31/2015	UT
Zinc	5/1/2012	7/31/2015	UT
Method EPA 200.8			
Antimony	5/1/2012	7/31/2015	UT
Arsenic	5/1/2012	7/31/2015	UT
Barium	5/1/2012	7/31/2015	UT
Beryllium	5/1/2012	7/31/2015	UT
Cadmium	5/1/2012	7/31/2015	UT
Chromium	5/1/2012	7/31/2015	UT
Copper	5/1/2012	7/31/2015	UT
Lead	5/1/2012	7/31/2015	UT
Nickel	5/1/2012	7/31/2015	UT
Selenium	5/1/2012	7/31/2015	UT
Silver	5/1/2012	7/31/2015	UT
Thallium	5/1/2012	7/31/2015	UT
Uranium	5/1/2012	7/31/2015	UT
Method EPA 245.1			
Mercury	5/1/2012	7/31/2015	UT
Method EPA 300.0			
Bromide	5/1/2012	7/31/2015	UT
Chloride	5/1/2012	7/31/2015	UT
Fluoride	5/1/2012	7/31/2015	UT
Sulfate	5/1/2012	7/31/2015	UT
Method EPA 335.4			
Cyanide	5/1/2012	7/31/2015	UT
Method EPA 353.2			
Nitrate as N	5/1/2012	7/31/2015	UT
Nitrate-nitrite	5/1/2012	7/31/2015	UT
Nitrite as N	5/1/2012	7/31/2015	UT
Method EPA 900.0			
Gross-alpha	5/1/2012	7/31/2015	UT
Gross-beta	5/1/2012	7/31/2015	UT
Method EPA 903			
Radium-226	5/1/2012	7/31/2015	UT

ACZ Laboratories, Inc

	Start Date	Expires	AB
Program/Matrix: ***SDWA (Potable Water)***			
Total alpha radium	11/1/2012	7/31/2015	UT
Method EPA 903.1			
Radium-226	5/1/2012	7/31/2015	UT
Method EPA 904			
Radium-228	5/1/2012	7/31/2015	UT
Method SM 2320 B-1997			
Alkalinity as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2340 B-1997			
Total hardness as CaCO3	5/1/2014	7/31/2015	UT
Method SM 2510 B-1997			
Conductivity	5/1/2014	7/31/2015	UT
Method SM 2540 C-1997			
Residue-filterable (TDS)	5/1/2014	7/31/2015	UT
Method SM 4500-F^- C-1997			
Fluoride	5/1/2014	7/31/2015	UT
Method SM 4500-H+ B-1996			
pH	5/1/2014	7/31/2015	UT
Method SM 5310 B-1996			
Total organic carbon	5/1/2014	7/31/2015	UT

The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E87641

ENERGY LABORATORIES INC.
2393 SALT CREEK HWY
CASPER, WY 82602

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

DRINKING WATER - GROUP I UNREGULATED CONTAMINANTS, DRINKING WATER - GROUP II UNREGULATED CONTAMINANTS, DRINKING WATER - OTHER REGULATED CONTAMINANTS, DRINKING WATER - PRIMARY INORGANIC CONTAMINANTS, DRINKING WATER - SECONDARY INORGANIC CONTAMINANTS, DRINKING WATER - RADIOCHEMISTRY, DRINKING WATER - SYNTHETIC ORGANIC CONTAMINANTS, NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2014 Expiration Date: June 30, 2015

William H. Anderson, DHA, FACHE, Director
Division of Emergency Preparedness and Community Support
DH Form 1697, 7/04
NON-TRANSFERABLE E87641-31-07/01/2014
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/22/2009
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
1,2,3-Trichloropropane	EPA 504.1	Group II Unregulated Contaminants	NELAP	7/7/2009
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,2,4-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/22/2002
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/22/2002
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
3-Hydroxycarbofuran	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Aldicarb (Temik)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
Aldicarb sulfone	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
Aldicarb sulfoxide	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	7/22/2002
Aluminum	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Aluminum	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Antimony	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Arsenic	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Arsenic	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Arsenic	SM 3114 B	Primary Inorganic Contaminants	NELAP	7/22/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Barium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Beryllium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Boron	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Bromide	EPA 300.0	Primary Inorganic Contaminants	NELAP	7/7/2009
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Bromodichloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Bromoform	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Cadmium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Calcium	ELI-C-SOP 50-018-07/ICP-MS	Secondary Inorganic Contaminants	NELAP	1/12/2012
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/22/2002
Carbaryl (Sevin)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
Carbofuran (Furadan)	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/22/2002
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	7/22/2002
Chloride	SM 4500 Cl- B	Secondary Inorganic Contaminants	NELAP	7/22/2002
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/6/2012
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Chloroform	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	1/12/2012
Chromium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Color	SM 2120 B	Secondary Inorganic Contaminants	NELAP	1/12/2012
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	1/12/2012
Copper	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Copper	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Corrosivity (langlier index)	SM 2330 B	Secondary Inorganic Contaminants	NELAP	1/12/2012
Dibromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	7/22/2002
Dissolved organic carbon (DOC)	SM 5310 C	Primary Inorganic Contaminants	NELAP	1/12/2012
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	7/22/2002
Fluoride	SM 4500 F-C	Secondary Inorganic Contaminants	NELAP	7/22/2002
Glyphosate	EPA 547	Synthetic Organic Contaminants	NELAP	7/22/2002
Hardness	SM 2340 B	Secondary Inorganic Contaminants	NELAP	1/12/2012
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Iron	ELI-C-SOP 50-018-07/ICP-MS	Secondary Inorganic Contaminants	NELAP	1/12/2012
Iron	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Lead	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Magnesium	ELI-C-SOP 50-018-07/ICP-MS	Secondary Inorganic Contaminants	NELAP	1/12/2012
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/22/2002
Manganese	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Manganese	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Mercury	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	7/7/2009
Mercury	SM 3112 B	Primary Inorganic Contaminants	NELAP	7/22/2002
Methiocarb (Mesurol)	EPA 531.1	Group I Unregulated Contaminants	NELAP	1/12/2012
Methomyl (Lannate)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/22/2002
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Molybdenum	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Nickel	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Nitrate as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	7/22/2002
Nitrate as N	EPA 353.2	Primary Inorganic Contaminants	NELAP	7/22/2002
Nitrite as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	7/22/2002
Nitrite as N	SM 4500-NO2-B	Primary Inorganic Contaminants	NELAP	7/22/2002
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Orthophosphate as P	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/10/2009
Oxamyl	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/22/2002
pH	SM 4500-H B	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	7/22/2002
Potassium	ELI-C-SOP 50-018-07/ICP-MS	Secondary Inorganic Contaminants	NELAP	1/12/2012
Potassium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Propoxur (Baygon)	EPA 531.1	Group I Unregulated Contaminants	NELAP	1/12/2012
Residue-filterable (TDS)	SM 2540 C	Secondary Inorganic Contaminants	NELAP	7/22/2002
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Selenium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Selenium	SM 3114 B	Primary Inorganic Contaminants	NELAP	1/12/2012
Silica as SiO2	EPA 200.7	Primary Inorganic Contaminants	NELAP	5/12/2009
Silver	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Silver	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Sodium	ELI-C-SOP 50-018-07/ICP-MS	Secondary Inorganic Contaminants	NELAP	1/12/2012
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/22/2002
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Sulfate	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	7/22/2002
Sulfate	SM 4500 SO4-E	Secondary Inorganic Contaminants	NELAP	7/22/2002
Surfactants - MBAS	SM 5540 C	Secondary Inorganic Contaminants	NELAP	1/12/2012
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/7/2009
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Thallium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/22/2002
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	7/22/2002
Total nitrate-nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	7/22/2002
Total organic carbon	SM 5310 C	Primary Inorganic Contaminants	NELAP	7/22/2002
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
trans-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/22/2002
Turbidity	SM 2130 B	Secondary Inorganic Contaminants	NELAP	1/12/2012
Uranium	EPA 200.8	Radiochemistry	NELAP	2/17/2006

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/1/2014** **Expiration Date: 6/30/2015**

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vanadium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Vanadium	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	4/6/2012
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	7/22/2002
Zinc	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2009
Zinc	EPA 200.8	Primary Inorganic Contaminants	NELAP	7/7/2009

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	1/24/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/19/2010
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	1/24/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	1/24/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	1/24/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	1/24/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	1/24/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	1/24/2001
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acrylonitrile	EPA 624	Volatile Organics	NELAP	1/24/2001
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	1/24/2001
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Aluminum	EPA 200.7	Metals	NELAP	1/24/2001
Aluminum	EPA 200.8	Metals	NELAP	1/24/2001
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Ammonia as N	SM 4500-NH3 G	General Chemistry	NELAP	1/24/2001
Antimony	EPA 200.7	Metals	NELAP	7/7/2009
Antimony	EPA 200.8	Metals	NELAP	1/24/2001
Antimony	EPA 6010	Metals	NELAP	7/7/2009
Antimony	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	EPA 200.7	Metals	NELAP	9/2/2002
Arsenic	EPA 200.8	Metals	NELAP	1/24/2001
Arsenic	EPA 6010	Metals	NELAP	7/7/2009
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	SM 3114 B	Metals	NELAP	1/24/2001
Barium	EPA 200.7	Metals	NELAP	1/24/2001
Barium	EPA 200.8	Metals	NELAP	1/24/2001
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	7/1/2003
Benzene	EPA 624	Volatile Organics	NELAP	1/24/2001
Benzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Benzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	7/22/2002
Beryllium	EPA 200.8	Metals	NELAP	1/24/2001
Beryllium	EPA 6010	Metals	NELAP	7/7/2009
Beryllium	EPA 6020	Metals	NELAP	7/1/2003

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code:** WY00002 (307) 235-0515

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	1/24/2001
Boron	EPA 200.7	Metals	NELAP	7/22/2002
Boron	EPA 200.8	Metals	NELAP	1/12/2012
Boron	EPA 6010	Metals	NELAP	7/1/2003
Boron	EPA 6020	Metals	NELAP	1/12/2012
Bromide	EPA 300.0	General Chemistry	NELAP	1/24/2001
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	1/24/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromoform	EPA 624	Volatile Organics	NELAP	1/24/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Cadmium	EPA 200.7	Metals	NELAP	7/22/2002
Cadmium	EPA 200.8	Metals	NELAP	1/24/2001
Cadmium	EPA 6010	Metals	NELAP	7/7/2009
Cadmium	EPA 6020	Metals	NELAP	7/1/2003
Calcium	ELI-C-SOP 50-018-07/ICP-MS	Metals	NELAP	1/12/2012
Calcium	EPA 200.7	Metals	NELAP	1/24/2001
Calcium	EPA 6010	Metals	NELAP	7/1/2003
Calcium	EPA 6020	Metals	NELAP	1/12/2012
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	1/24/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	1/24/2001
Chemical oxygen demand	HACH 8000	General Chemistry	NELAP	1/24/2001
Chloride	EPA 300.0	General Chemistry	NELAP	1/24/2001
Chloride	SM 4500 Cl- B	General Chemistry	NELAP	1/24/2001
Chlorobenzene	EPA 624	Volatile Organics	NELAP	1/24/2001
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroethane	EPA 624	Volatile Organics	NELAP	1/24/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroform	EPA 624	Volatile Organics	NELAP	1/24/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chromium	EPA 200.7	Metals	NELAP	7/22/2002
Chromium	EPA 200.8	Metals	NELAP	1/24/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chromium	EPA 6010	Metals	NELAP	7/7/2009
Chromium	EPA 6020	Metals	NELAP	7/1/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	1/24/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Cobalt	EPA 200.7	Metals	NELAP	7/22/2002
Cobalt	EPA 200.8	Metals	NELAP	1/24/2001
Cobalt	EPA 6010	Metals	NELAP	7/7/2009
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Conductivity	SM 2510 B	General Chemistry	NELAP	1/24/2001
Copper	EPA 200.7	Metals	NELAP	7/22/2002
Copper	EPA 200.8	Metals	NELAP	1/24/2001
Copper	EPA 6010	Metals	NELAP	7/7/2009
Copper	EPA 6020	Metals	NELAP	7/1/2003
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	1/24/2001
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Diethyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethylbenzene	EPA 624	Volatile Organics	NELAP	1/24/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	1/24/2001
Fluoride	SM 4500 F-C	General Chemistry	NELAP	1/24/2001
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Hardness	SM 2340 B	Metals	NELAP	7/17/2002
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ignitability	EPA 1010	General Chemistry	NELAP	7/1/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Iron	EPA 200.7	Metals	NELAP	1/24/2001
Iron	EPA 200.8	Metals	NELAP	11/22/2010
Iron	EPA 6010	Metals	NELAP	7/1/2003
Iron	EPA 6020	Metals	NELAP	1/12/2012

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Lead	EPA 200.7	Metals	NELAP	7/22/2002
Lead	EPA 200.8	Metals	NELAP	1/24/2001
Lead	EPA 6010	Metals	NELAP	7/7/2009
Lead	EPA 6020	Metals	NELAP	7/1/2003
Magnesium	EPA 200.7	Metals	NELAP	1/24/2001
Magnesium	EPA 200.8	Metals	NELAP	11/22/2010
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Magnesium	EPA 6020	Metals	NELAP	1/12/2012
Manganese	EPA 200.7	Metals	NELAP	1/24/2001
Manganese	EPA 200.8	Metals	NELAP	1/24/2001
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Manganese	EPA 6020	Metals	NELAP	7/7/2009
Mercury	EPA 200.8	Metals	NELAP	1/24/2001
Mercury	EPA 245.1	Metals	NELAP	7/7/2009
Mercury	EPA 245.7	Metals	NELAP	1/12/2012
Mercury	EPA 6020	Metals	NELAP	1/12/2012
Mercury	EPA 7470	Metals	NELAP	7/1/2003
Mercury	SM 3112 B	Metals	NELAP	1/24/2001
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	1/24/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	1/24/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methylene chloride	EPA 624	Volatile Organics	NELAP	1/24/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Molybdenum	EPA 200.7	Metals	NELAP	7/22/2002
Molybdenum	EPA 200.8	Metals	NELAP	1/24/2001
Molybdenum	EPA 6010	Metals	NELAP	7/1/2003
Molybdenum	EPA 6020	Metals	NELAP	7/7/2009
Naphthalene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	7/22/2002

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nickel	EPA 200.8	Metals	NELAP	1/24/2001
Nickel	EPA 6010	Metals	NELAP	7/7/2009
Nickel	EPA 6020	Metals	NELAP	7/1/2003
Nitrate as N	EPA 300.0	General Chemistry	NELAP	1/24/2001
Nitrate as N	EPA 353.2	General Chemistry	NELAP	1/24/2001
Nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	1/24/2001
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	1/24/2001
Nitrite as N	EPA 300.0	General Chemistry	NELAP	1/24/2001
Nitrite as N	SM 4500-NO2-B	General Chemistry	NELAP	1/24/2001
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Oil & Grease	EPA 1664A	General Chemistry	NELAP	1/24/2001
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	1/24/2001
pH	EPA 9040	General Chemistry	NELAP	7/1/2003
pH	SM 4500-H+-B	General Chemistry	NELAP	1/24/2001
Phosphorus	EPA 6020	Metals	NELAP	1/12/2012
Phosphorus, total	EPA 200.7	Metals	NELAP	7/22/2002
Phosphorus, total	EPA 6010	Metals	NELAP	7/1/2003
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	ELI-C-SOP 50-018-07/ICP-MS	Metals	NELAP	1/12/2012
Potassium	EPA 200.7	Metals	NELAP	1/24/2001
Potassium	EPA 6010	Metals	NELAP	7/1/2003
Potassium	EPA 6020	Metals	NELAP	1/12/2012
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	1/24/2001
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	7/7/2009
Residue-total	SM 2540 B	General Chemistry	NELAP	1/12/2012
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	7/22/2002
Selenium	EPA 200.8	Metals	NELAP	1/24/2001
Selenium	EPA 6010	Metals	NELAP	7/1/2003
Selenium	EPA 6020	Metals	NELAP	7/7/2009
Selenium	EPA 7742	Metals	NELAP	1/12/2012
Selenium	SM 3114 B	Metals	NELAP	1/24/2001
Silicon	EPA 200.7	Metals	NELAP	1/24/2001
Silicon	EPA 6010	Metals	NELAP	7/1/2003
Silicon	EPA 6020	Metals	NELAP	1/12/2012

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Silver	EPA 200.7	Metals	NELAP	7/7/2009
Silver	EPA 200.8	Metals	NELAP	1/24/2001
Silver	EPA 6010	Metals	NELAP	7/7/2009
Silver	EPA 6020	Metals	NELAP	7/7/2009
Sodium	ELI-C-SOP 50-018-07/ICP-MS	Metals	NELAP	1/12/2012
Sodium	EPA 200.7	Metals	NELAP	1/24/2001
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Sodium	EPA 6020	Metals	NELAP	1/12/2012
Strontium	EPA 200.7	Metals	NELAP	7/7/2009
Strontium	EPA 200.8	Metals	NELAP	1/12/2012
Strontium	EPA 6010	Metals	NELAP	7/1/2003
Strontium	EPA 6020	Metals	NELAP	7/7/2009
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	1/24/2001
Sulfate	SM 4500 SO4-E	General Chemistry	NELAP	1/24/2001
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	1/24/2001
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrahydrofuran (THF)	ELI-C-SOP 50-073-05/GC-MS	Volatile Organics	NELAP	1/12/2012
Thallium	EPA 200.8	Metals	NELAP	1/24/2001
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thorium	EPA 200.8	Metals	NELAP	7/7/2009
Thorium	EPA 6020	Metals	NELAP	7/7/2009
Tin	EPA 200.8	Metals	NELAP	1/12/2012
Tin	EPA 6020	Metals	NELAP	7/7/2009
Titanium	EPA 200.7	Metals	NELAP	7/7/2009
Titanium	EPA 200.8	Metals	NELAP	1/12/2012
Titanium	EPA 6010	Metals	NELAP	7/7/2009
Titanium	EPA 6020	Metals	NELAP	7/7/2009
Toluene	EPA 624	Volatile Organics	NELAP	1/24/2001
Toluene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Toluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Total hardness as CaCO3	EPA 200.7	Metals	NELAP	1/24/2001
Total organic carbon	SM 5310 C	General Chemistry	NELAP	1/24/2001
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total Petroleum Hydrocarbons (TPH)	EPA 1664A	General Chemistry	NELAP	5/10/2010
Total phenolics	EPA 420.1	General Chemistry	NELAP	1/12/2012
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	1/24/2001
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	1/24/2001
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	1/24/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	1/24/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Uranium	EPA 200.8	Metals	NELAP	1/24/2001
Uranium	EPA 6020	Metals	NELAP	7/7/2009
Vanadium	EPA 200.7	Metals	NELAP	7/22/2002
Vanadium	EPA 200.8	Metals	NELAP	1/24/2001
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	7/7/2009
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 624	Volatile Organics	NELAP	1/24/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 624	Volatile Organics	NELAP	7/7/2009
Xylene (total)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Zinc	EPA 200.7	Metals	NELAP	7/22/2002
Zinc	EPA 200.8	Metals	NELAP	1/24/2001
Zinc	EPA 6010	Metals	NELAP	7/7/2009
Zinc	EPA 6020	Metals	NELAP	7/1/2003

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code:** WY00002 (307) 235-0515

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	3/16/2010
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/24/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	1/24/2001
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	1/24/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	1/24/2001
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	1/24/2001
2-Hexanone	EPA 8260	Volatile Organics	NELAP	1/24/2001
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	1/24/2001
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Acetone	EPA 8260	Volatile Organics	NELAP	1/24/2001
Acetonitrile	EPA 8260	Volatile Organics	NELAP	1/24/2001
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	1/24/2001
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Aluminum	EPA 6010	Metals	NELAP	1/24/2001
Aluminum	EPA 6020	Metals	NELAP	1/24/2001
Antimony	EPA 6010	Metals	NELAP	1/12/2012
Antimony	EPA 6020	Metals	NELAP	1/24/2001

Laboratory Scope of Accreditation

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Arsenic	EPA 6010	Metals	NELAP	7/7/2009
Arsenic	EPA 6020	Metals	NELAP	1/24/2001
Barium	EPA 6010	Metals	NELAP	1/24/2001
Barium	EPA 6020	Metals	NELAP	1/24/2001
Benzene	EPA 8021	Volatile Organics	NELAP	1/24/2001
Benzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Beryllium	EPA 6010	Metals	NELAP	7/7/2009
Beryllium	EPA 6020	Metals	NELAP	1/24/2001
Boron	EPA 6010	Metals	NELAP	1/24/2001
Boron	EPA 6020	Metals	NELAP	1/12/2012
Bromobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	1/24/2001
Cadmium	EPA 6010	Metals	NELAP	7/7/2009
Cadmium	EPA 6020	Metals	NELAP	1/24/2001
Calcium	EPA 6010	Metals	NELAP	1/24/2001
Calcium	EPA 6020	Metals	NELAP	1/12/2012
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	1/24/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	1/24/2001
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	1/24/2001
Chloroprene	EPA 8260	Volatile Organics	NELAP	7/22/2002
Chromium	EPA 6010	Metals	NELAP	7/7/2009
Chromium	EPA 6020	Metals	NELAP	1/24/2001
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/24/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Cobalt	EPA 6010	Metals	NELAP	7/7/2009
Cobalt	EPA 6020	Metals	NELAP	1/24/2001
Copper	EPA 6010	Metals	NELAP	7/7/2009
Copper	EPA 6020	Metals	NELAP	1/24/2001
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Dibromomethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	1/24/2001

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diethyl ether	EPA 8260	Volatile Organics	NELAP	1/24/2001
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	1/24/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	1/24/2001
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Extractable organic halides (EOX)	EPA 9023	General Chemistry	NELAP	1/24/2001
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	1/24/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Ignitability	EPA 1010	General Chemistry	NELAP	1/24/2001
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/22/2002
Iron	EPA 6010	Metals	NELAP	1/24/2001
Iron	EPA 6020	Metals	NELAP	1/12/2012
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Lead	EPA 6010	Metals	NELAP	7/7/2009
Lead	EPA 6020	Metals	NELAP	1/24/2001
Magnesium	EPA 6010	Metals	NELAP	1/24/2001
Magnesium	EPA 6020	Metals	NELAP	1/12/2012
Manganese	EPA 6010	Metals	NELAP	1/24/2001
Manganese	EPA 6020	Metals	NELAP	7/7/2009
Mercury	EPA 7471	Metals	NELAP	1/24/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	1/24/2001
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	1/24/2001
Molybdenum	EPA 6010	Metals	NELAP	1/24/2001
Molybdenum	EPA 6020	Metals	NELAP	7/7/2009
Naphthalene	EPA 8021	Volatile Organics	NELAP	1/24/2001
Naphthalene	EPA 8260	Volatile Organics	NELAP	1/24/2001
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Nickel	EPA 6010	Metals	NELAP	7/7/2009
Nickel	EPA 6020	Metals	NELAP	1/24/2001
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Paint Filter Liquids Test	EPA 9095	General Chemistry	NELAP	1/24/2001
p-Dioxane	EPA 8260	Volatile Organics	NELAP	1/24/2001
pH	EPA 9045	General Chemistry	NELAP	1/24/2001

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87641 **EPA Lab Code: WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Phosphorus, total	EPA 6010	Metals	NELAP	5/12/2009
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Potassium	EPA 6010	Metals	NELAP	1/24/2001
Potassium	EPA 6020	Metals	NELAP	1/12/2012
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	1/24/2001
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Selenium	EPA 6010	Metals	NELAP	1/24/2001
Selenium	EPA 6020	Metals	NELAP	7/7/2009
Selenium	EPA 7742	Metals	NELAP	1/12/2012
Silicon	EPA 6010	Metals	NELAP	1/24/2001
Silver	EPA 6010	Metals	NELAP	7/7/2009
Silver	EPA 6020	Metals	NELAP	7/7/2009
Sodium	EPA 6010	Metals	NELAP	1/24/2001
Sodium	EPA 6020	Metals	NELAP	1/12/2012
Strontium	EPA 6010	Metals	NELAP	1/24/2001
Strontium	EPA 6020	Metals	NELAP	7/7/2009
Styrene	EPA 8260	Volatile Organics	NELAP	1/24/2001
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Thallium	EPA 6010	Metals	NELAP	7/7/2009
Thallium	EPA 6020	Metals	NELAP	1/24/2001
Tin	EPA 6010	Metals	NELAP	7/7/2009
Tin	EPA 6020	Metals	NELAP	7/7/2009
Titanium	EPA 6010	Metals	NELAP	7/7/2009
Titanium	EPA 6020	Metals	NELAP	7/7/2009
Toluene	EPA 8021	Volatile Organics	NELAP	1/24/2001
Toluene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	1/24/2001
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	1/24/2001
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	1/24/2001
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	1/24/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	1/24/2001
Uranium	EPA 6020	Metals	NELAP	7/7/2009
Vanadium	EPA 6010	Metals	NELAP	1/24/2001
Vanadium	EPA 6020	Metals	NELAP	7/7/2009

Attachment to Certificate #: E87641-31, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87641** **EPA Lab Code:** **WY00002** **(307) 235-0515**

E87641
Energy Laboratories Inc.
2393 Salt Creek Hwy
Casper, WY 82602

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	1/24/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	1/24/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	1/24/2001
Xylene (total)	EPA 8260	Volatile Organics	NELAP	1/24/2001
Zinc	EPA 6010	Metals	NELAP	7/7/2009
Zinc	EPA 6020	Metals	NELAP	1/24/2001

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E871017

ENERGY LABORATORIES, INC. - CASPER #2
2325 KERZELL LANE
CASPER, WY 82601

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

DRINKING WATER - RADIOCHEMISTRY, NON-POTABLE WATER - RADIOCHEMISTRY

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2014 Expiration Date: June 30, 2015

William H. Anderson, DHA, FACHE, Director
Division of Emergency Preparedness and Community Support
DH Form 1697, 7/04
NON-TRANSFERABLE E871017-13-07/01/2014
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E871017-13, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871017 **EPA Lab Code:** WY00937 (307) 235-0515

E871017
Energy Laboratories, Inc. - Casper #2
2325 Kerzell Lane
Casper, WY 82601

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Gamma emitters	EPA 901.1	Radiochemistry	NELAP	11/21/2011
Gross-alpha	EPA 900.0	Radiochemistry	NELAP	5/23/2007
Gross-beta	EPA 900.0	Radiochemistry	NELAP	5/23/2007
Radium-226	EPA 903.0	Radiochemistry	NELAP	5/23/2007
Radium-228	EPA Ra-05	Radiochemistry	NELAP	5/23/2007
Radon-222	ASTM D5072-92	Radiochemistry	NELAP	11/21/2011
Strontium-90	EPA 905.0	Radiochemistry	NELAP	6/16/2009
Uranium	SM 7500-U C	Radiochemistry	NELAP	11/21/2011

Laboratory Scope of Accreditation

Attachment to Certificate #: E871017-13, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871017 **EPA Lab Code:** WY00937 (307) 235-0515

E871017
Energy Laboratories, Inc. - Casper #2
2325 Kerzell Lane
Casper, WY 82601

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Gross-alpha	EPA 900.0	Radiochemistry	NELAP	5/23/2007
Gross-beta	EPA 900.0	Radiochemistry	NELAP	5/23/2007
Strontium-90	EPA 905.0	Radiochemistry	NELAP	11/21/2011
Total radium	EPA 903.0	Radiochemistry	NELAP	5/23/2007
Uranium	EPA 908.0	Radiochemistry	NELAP	11/21/2011
Uranium	SM 7500-U C	Radiochemistry	NELAP	11/21/2011

Florida HEALTH

State of Florida

Department of Health, Bureau of Public Health Laboratories

This is to certify that

E871099

ANATEK LABS, INC. - SPOKANE
504 E. SPRAGUE STE. D
SPOKANE, WA 99202

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

DRINKING WATER - RADIOCHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - RADIOCHEMISTRY

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2014 Expiration Date: June 30, 2015

William H. Anderson, DHA, FACHE, Director
Division of Emergency Preparedness and Community Support
DH Form 1697, 7/04
NON-TRANSFERABLE E871099-03-07/01/2014
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E871099-03, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871099 **EPA Lab Code: WA00169** **(509) 838-3999**

E871099
Anatek Labs, Inc. - Spokane
504 E. Sprague Ste. D
Spokane, WA 99202

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Gross-alpha	EPA 900.0	Radiochemistry	NELAP	12/10/2012
Gross-beta	EPA 900.0	Radiochemistry	NELAP	12/10/2012

Laboratory Scope of Accreditation

Attachment to Certificate #: E871099-03, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871099 **EPA Lab Code: WA00169** **(509) 838-3999**

E871099
Anatek Labs, Inc. - Spokane
504 E. Sprague Ste. D
Spokane, WA 99202

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aluminum	EPA 200.8	Metals	NELAP	12/10/2012
Aluminum	EPA 6020	Metals	NELAP	12/10/2012
Antimony	EPA 200.8	Metals	NELAP	12/10/2012
Antimony	EPA 6020	Metals	NELAP	12/10/2012
Arsenic	EPA 200.8	Metals	NELAP	12/10/2012
Arsenic	EPA 6020	Metals	NELAP	12/10/2012
Barium	EPA 200.8	Metals	NELAP	12/10/2012
Barium	EPA 6020	Metals	NELAP	12/10/2012
Beryllium	EPA 200.8	Metals	NELAP	12/10/2012
Beryllium	EPA 6020	Metals	NELAP	12/10/2012
Cadmium	EPA 200.8	Metals	NELAP	12/10/2012
Cadmium	EPA 6020	Metals	NELAP	12/10/2012
Calcium	EPA 6020	Metals	NELAP	12/10/2012
Chromium	EPA 200.8	Metals	NELAP	12/10/2012
Chromium	EPA 6020	Metals	NELAP	12/10/2012
Cobalt	EPA 200.8	Metals	NELAP	12/10/2012
Cobalt	EPA 6020	Metals	NELAP	12/10/2012
Copper	EPA 200.8	Metals	NELAP	12/10/2012
Copper	EPA 6020	Metals	NELAP	12/10/2012
Lead	EPA 200.8	Metals	NELAP	12/10/2012
Lead	EPA 6020	Metals	NELAP	12/10/2012
Magnesium	EPA 6020	Metals	NELAP	12/10/2012
Manganese	EPA 200.8	Metals	NELAP	12/10/2012
Manganese	EPA 6020	Metals	NELAP	12/10/2012
Mercury	EPA 200.8	Metals	NELAP	12/10/2012
Mercury	EPA 6020	Metals	NELAP	12/10/2012
Molybdenum	EPA 200.8	Metals	NELAP	12/10/2012
Molybdenum	EPA 6020	Metals	NELAP	12/10/2012
Nickel	EPA 200.8	Metals	NELAP	12/10/2012
Nickel	EPA 6020	Metals	NELAP	12/10/2012
Potassium	EPA 6020	Metals	NELAP	12/10/2012
Selenium	EPA 200.8	Metals	NELAP	12/10/2012
Selenium	EPA 6020	Metals	NELAP	12/10/2012
Silver	EPA 200.8	Metals	NELAP	12/10/2012
Silver	EPA 6020	Metals	NELAP	12/10/2012
Sodium	EPA 6020	Metals	NELAP	12/10/2012

Laboratory Scope of Accreditation

Attachment to Certificate #: E871099-03, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E871099 **EPA Lab Code: WA00169** **(509) 838-3999**

E871099
Anatek Labs, Inc. - Spokane
504 E. Sprague Ste. D
Spokane, WA 99202

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Thallium	EPA 200.8	Metals	NELAP	12/10/2012
Thallium	EPA 6020	Metals	NELAP	12/10/2012
Total alpha	EPA 900.0	Radiochemistry	NELAP	12/10/2012
Total beta	EPA 900.0	Radiochemistry	NELAP	12/10/2012
Uranium	EPA 200.8	Metals	NELAP	12/10/2012
Uranium	EPA 6020	Metals	NELAP	12/10/2012
Vanadium	EPA 200.8	Metals	NELAP	12/10/2012
Vanadium	EPA 6020	Metals	NELAP	12/10/2012
Zinc	EPA 200.8	Metals	NELAP	12/10/2012
Zinc	EPA 6020	Metals	NELAP	12/10/2012

State of Florida
Department of Health, Bureau of Public Health Laboratories
This is to certify that

E87893

ANATEK LABS, INC.
1282 ALTURAS DR.
MOSCOW, ID 83843

has complied with Florida Administrative Code 64E-1,
for the examination of environmental samples in the following categories

DRINKING WATER - GROUP I UNREGULATED CONTAMINANTS, DRINKING WATER - GROUP II UNREGULATED CONTAMINANTS, DRINKING WATER - GROUP III UNREGULATED CONTAMINANTS, DRINKING WATER - OTHER REGULATED CONTAMINANTS, DRINKING WATER - PRIMARY INORGANIC CONTAMINANTS, DRINKING WATER - SECONDARY INORGANIC CONTAMINANTS, DRINKING WATER - RADIOCHEMISTRY, DRINKING WATER - SYNTHETIC ORGANIC CONTAMINANTS, NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Public Health Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

Date Issued: July 01, 2014 Expiration Date: June 30, 2015

William H. Anderson, DHA, FACHE, Director
Division of Emergency Preparedness and Community Support
DH Form 1697, 7/04
NON-TRANSFERABLE E87893-52-07/01/2014
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87893 EPA Lab Code: ID00013 (208) 883-2839

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,1,1,2-Tetrachloroethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,1,1-Trichloroethane	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,1,2,2-Tetrachloroethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,1,2-Trichloroethane	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,1-Dichloroethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,1-Dichloroethylene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,1-Dichloropropene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	12/19/2006
1,2,3-Trichlorobenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,2,3-Trichloropropane	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/7/2008
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,2,3-Trichloropropane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,2,4-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,2,4-Trichlorobenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,2,4-Trimethylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	4/1/2003
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,2-Dichlorobenzene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,2-Dichloroethane	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,2-Dichloropropane	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,3,5-Trimethylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
1,3-Dichlorobenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3-Dichloropropane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
1,4-Dichlorobenzene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
2,4,5-T	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005
2,4-D	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
2,4-DB	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005
2,4-Dinitrotoluene (2,4-DNT)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
2,6-Dinitrotoluene (2,6-DNT)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
2-Butanone (Methyl ethyl ketone, MEK)	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
2-Chlorotoluene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
2-Hexanone	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
3-Hydroxycarbofuran	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
4,4'-DDD	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
4,4'-DDE	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
4,4'-DDT	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
4-Chlorotoluene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
4-Isopropyltoluene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
4-Methyl-2-pentanone (MIBK)	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Acenaphthylene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Acetochlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Acetone	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Acifluorfen	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005
Acrylonitrile	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Alachlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Aldicarb (Temik)	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Aldicarb sulfone	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Aldicarb sulfoxide	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Aldrin	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	8/25/2005
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
alpha-Chlordane	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Aluminum	EPA 200.7	Secondary Inorganic Contaminants	NELAP	7/7/2010

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aluminum	EPA 200.8	Secondary Inorganic Contaminants	NELAP	4/1/2003
Anthracene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Antimony	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Aroclor-1016 (PCB-1016)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1221 (PCB-1221)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1232 (PCB-1232)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1242 (PCB-1242)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1248 (PCB-1248)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1254 (PCB-1254)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Aroclor-1260 (PCB-1260)	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Arsenic	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Arsenic	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Atrazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Barium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Benzene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Benzo(a)anthracene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Benzo(a)pyrene	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Benzo(b)fluoranthene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Benzo(g,h,i)perylene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Benzo(k)fluoranthene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Beryllium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Bromacil	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Bromoacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Bromobenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Bromochloroacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Bromochloromethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Bromodichloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Bromodichloromethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Bromoform	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Bromoform	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Butachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Butyl benzyl phthalate	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Cadmium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Carbaryl (Sevin)	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Carbofuran (Furadan)	EPA 531.2	Synthetic Organic Contaminants	NELAP	10/29/2012
Carbon disulfide	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Carbon disulfide	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Carbon tetrachloride	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Chlordane (tech.)	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	5/7/2003
Chloroacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Chlorobenzene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Chloroform	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Chloroform	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Chlorothalonil	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Chromium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Chrysene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
cis-1,2-Dichloroethylene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
cis-1,3-Dichloropropene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Color	SM 2120 B	Secondary Inorganic Contaminants	NELAP	11/26/2007
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	8/25/2005
Copper	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Copper	EPA 200.8	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	4/1/2003
Cyanazine (Bladex)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Dalapon	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
DCPA di acid degradate	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
delta-BHC	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Di(2-ethylhexyl)adipate	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Diazinon	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Dibenz(a,h)anthracene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Dibromoacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Dibromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Dibromochloromethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Dibromomethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Dicamba	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005
Dichloroacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Dichlorodifluoromethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Dichloroprop (Dichlorprop)	EPA 515.3	Group I Unregulated Contaminants	NELAP	8/25/2005
Dieldrin	EPA 505	Group I Unregulated Contaminants	NELAP	8/25/2005
Diethyl ether	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Diethyl ether	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Diethyl phthalate	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Dimethyl phthalate	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Di-n-butyl phthalate	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
Diquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Endothall	EPA 548.1	Synthetic Organic Contaminants	NELAP	4/1/2003
Endrin	EPA 505	Synthetic Organic Contaminants	NELAP	10/20/2006
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Ethylbenzene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Fluorene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	4/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003
gamma-Chlordane	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Glyphosate	EPA 547	Synthetic Organic Contaminants	NELAP	4/1/2003
Hardness	SM 2340 B	Secondary Inorganic Contaminants	NELAP	6/5/2013
Heptachlor	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Heptachlor epoxide	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003
Hexachlorobenzene	EPA 525.2	Synthetic Organic Contaminants	NELAP	5/7/2003
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Hexachlorobutadiene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Hexachlorocyclopentadiene	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Indeno(1,2,3-cd)pyrene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Iodomethane (Methyl iodide)	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
Iodomethane (Methyl iodide)	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Iron	EPA 200.7	Secondary Inorganic Contaminants	NELAP	7/7/2010
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	11/13/2006
Isopropylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Lead	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
m/p-Xylenes	EPA 524.2	Secondary Inorganic Contaminants	NELAP	7/7/2010
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Manganese	EPA 200.7	Secondary Inorganic Contaminants	NELAP	7/7/2010
Manganese	EPA 200.8	Secondary Inorganic Contaminants	NELAP	4/1/2003
Mercury	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Mercury	EPA 245.7	Primary Inorganic Contaminants	NELAP	11/26/2007
Methiocarb (Mesurol)	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Methomyl (Lannate)	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
Methoxychlor	EPA 505	Synthetic Organic Contaminants	NELAP	10/20/2006
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Methyl bromide (Bromomethane)	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Methyl chloride (Chloromethane)	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Methyl tert-butyl ether (MTBE)	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Methylene chloride	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Metolachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Metribuzin	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Molinate	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
m-Xylene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Naphthalene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
n-Butylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Nickel	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Nitrate as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/1/2003
Nitrate as N	SM 4500-NO3 F	Primary Inorganic Contaminants	NELAP	4/1/2003
Nitrate-nitrite	SM 4500-NO3 F	Primary Inorganic Contaminants	NELAP	7/7/2010
Nitrite	SM 4500-NO3 F	Primary Inorganic Contaminants	NELAP	4/1/2003
Nitrite as N	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/1/2003
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
n-Propylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Orthophosphate as P	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/1/2003
Oxamyl	EPA 531.1	Synthetic Organic Contaminants	NELAP	4/1/2003
Oxamyl	EPA 531.2	Synthetic Organic Contaminants	NELAP	10/29/2012
o-Xylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
o-Xylene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
PCBs	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003
Pentachlorophenol	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
Perchlorate	EPA 331.0	Secondary Inorganic Contaminants	NELAP	7/7/2010
pH	SM 4500-H+-B	Primary Inorganic Contaminants	NELAP	11/26/2007
Phenanthrene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
Picloram	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
Potassium	EPA 200.7	Secondary Inorganic Contaminants	NELAP	7/7/2010
Prometon	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Propachlor (Ramrod)	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Propoxur (Baygon)	EPA 531.1	Group I Unregulated Contaminants	NELAP	8/25/2005
Propoxur (Baygon)	EPA 531.2	Group I Unregulated Contaminants	NELAP	10/29/2012
p-Xylene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Pyrene	EPA 525.2	Group III Unregulated Contaminants	NELAP	8/25/2005
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
sec-Butylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Selenium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Silver	EPA 200.8	Secondary Inorganic Contaminants	NELAP	4/1/2003
Silvex (2,4,5-TP)	EPA 515.3	Synthetic Organic Contaminants	NELAP	4/1/2003
Simazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	4/1/2003
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	7/7/2010
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Styrene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Sulfate	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	4/1/2003
Surfactants - MBAS	SM 5540 C	Secondary Inorganic Contaminants	NELAP	7/7/2010
Tcrbacil	EPA 525.2	Group I Unrcgulatcd Contaminants	NELAP	8/25/2005
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	9/9/2010
tert-Butylbenzene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Tetrachloroethylene (Perchloroethylene)	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Thallium	EPA 200.8	Primary Inorganic Contaminants	NELAP	4/1/2003
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Toluene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Total cyanide	EPA 335.4	Primary Inorganic Contaminants	NELAP	8/25/2005
Total dissolved solids	SM 2540 C	Secondary Inorganic Contaminants	NELAP	11/26/2007
Total haloacetic acids (HAA5)	SM 6251 B	Synthetic Organic Contaminants	NELAP	4/1/2003
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	4/1/2003
Total organic carbon	SM 5310 B	Primary Inorganic Contaminants	NELAP	2/25/2013
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Toxaphene (Chlorinated camphene)	EPA 505	Synthetic Organic Contaminants	NELAP	4/1/2003
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
trans-1,2-Dichloroethylene	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
trans-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
trans-1,3-Dichloropropene	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
trans-1,4-Dichloro-2-butene	EPA 524.2	Group II Unregulated Contaminants	NELAP	8/25/2005
trans-Nonachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	8/25/2005
Trichloroacetic acid	SM 6251 B	Group I Unregulated Contaminants	NELAP	4/1/2003
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Trichloroethene (Trichloroethylene)	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	4/1/2003
Trichlorofluoromethane	EPA 524.3	Group II Unregulated Contaminants	NELAP	8/29/2013
Turbidity	EPA 180.1	Secondary Inorganic Contaminants	NELAP	3/12/2010
Uranium	EPA 200.8	Radiochemistry	NELAP	11/26/2007
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Vinyl chloride	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	4/1/2003
Xylene (total)	EPA 524.3	Other Regulated Contaminants	NELAP	8/29/2013
Zinc	EPA 200.8	Secondary Inorganic Contaminants	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	11/14/2003
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	11/14/2003
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	11/14/2003
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	8/25/2005
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	11/14/2003
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	11/14/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	8/25/2005
2,3,4,6-Tetrachlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
2,4,5-Trichlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2,4,6-Trichlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2,4-Dichlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2,4-Dimethylphenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2,4-Dinitrophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	4/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	8/25/2005
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	3/19/2012
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	3/19/2012
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	8/25/2005
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	11/14/2003
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	12/1/2011
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	12/1/2011
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2-Chlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	8/25/2005
2-Hexanone	EPA 8260	Volatile Organics	NELAP	8/25/2005
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	8/25/2005
2-Methylphenol (o-Cresol)	EPA 8270	Volatile Organics	NELAP	8/25/2005
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/25/2005
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
2-Nitrophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	4/1/2003
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	8/25/2005
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/25/2005
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	8/25/2005
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	8/25/2005
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	4/1/2003
4-Chloro-3-methylphenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	8/25/2005
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	8/25/2005
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	8/25/2005
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	8/25/2005
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	8/25/2005
4-Methylphenol (p-Cresol)	EPA 8270	Volatile Organics	NELAP	8/25/2005
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	8/25/2005
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
4-Nitrophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
Acenaphthene	EPA 625	Extractable Organics	NELAP	4/1/2003
Acenaphthene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Acenaphthylene	EPA 625	Extractable Organics	NELAP	4/1/2003
Acenaphthylene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Acetone	EPA 8260	Volatile Organics	NELAP	8/25/2005
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	8/25/2005
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Acrylonitrile	EPA 624	Volatile Organics	NELAP	8/25/2005
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	8/25/2005
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	1/6/2009
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aluminum	EPA 200.7	Metals	NELAP	7/7/2010
Aluminum	EPA 200.8	Metals	NELAP	4/1/2003
Aluminum	EPA 6010	Metals	NELAP	7/7/2010
Aluminum	EPA 6020	Metals	NELAP	8/25/2005
Ammonia as N	SM 4500-NH3 G	General Chemistry	NELAP	8/12/2003
Aniline	EPA 8270	Extractable Organics	NELAP	8/25/2005
Anthracene	EPA 625	Extractable Organics	NELAP	4/1/2003
Anthracene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Antimony	EPA 1638	Metals	NELAP	8/25/2005
Antimony	EPA 200.7	Metals	NELAP	7/7/2010
Antimony	EPA 200.8	Metals	NELAP	4/1/2003
Antimony	EPA 6010	Metals	NELAP	7/7/2010
Antimony	EPA 6020	Metals	NELAP	8/25/2005
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	12/19/2006
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	12/19/2006
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/3/2008
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/3/2008
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	4/1/2009
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/29/2007
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/29/2007
Arsenic	EPA 200.7	Metals	NELAP	7/7/2010
Arsenic	EPA 200.8	Metals	NELAP	4/1/2003
Arsenic	EPA 6010	Metals	NELAP	7/7/2010
Arsenic	EPA 6020	Metals	NELAP	8/25/2005
Azinphos-methyl (Guthion)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Barium	EPA 200.7	Metals	NELAP	7/7/2010
Barium	EPA 200.8	Metals	NELAP	4/1/2003
Barium	EPA 6010	Metals	NELAP	7/7/2010
Barium	EPA 6020	Metals	NELAP	8/25/2005

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzene	EPA 624	Volatile Organics	NELAP	11/14/2003
Benzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Benzidine	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(a)anthracene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(a)pyrene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(b)fluoranthene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(g,h,i)perylene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	4/1/2003
Benzo(k)fluoranthene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	8/25/2005
Beryllium	EPA 200.7	Metals	NELAP	7/7/2010
Beryllium	EPA 200.8	Metals	NELAP	4/1/2003
Beryllium	EPA 6010	Metals	NELAP	7/7/2010
Beryllium	EPA 6020	Metals	NELAP	8/25/2005
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	8/25/2005
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	8/25/2005
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	8/25/2005
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	8/25/2005
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	8/25/2005
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	8/25/2005
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	4/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	8/25/2005
Boron	EPA 200.7	Metals	NELAP	7/7/2010
Boron	EPA 6010	Metals	NELAP	7/7/2010
Bromobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	11/14/2003
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Bromoform	EPA 624	Volatile Organics	NELAP	11/14/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Bromoform	EPA 8260	Volatile Organics	NELAP	8/25/2005
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	4/1/2003
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	8/25/2005
Cadmium	EPA 1638	Metals	NELAP	8/25/2005
Cadmium	EPA 200.7	Metals	NELAP	7/7/2010
Cadmium	EPA 200.8	Metals	NELAP	4/1/2003
Cadmium	EPA 6010	Metals	NELAP	7/7/2010
Cadmium	EPA 6020	Metals	NELAP	8/25/2005
Calcium	EPA 200.7	Metals	NELAP	7/7/2010
Calcium	EPA 6010	Metals	NELAP	7/7/2010
Calcium	EPA 6020	Metals	NELAP	8/25/2005
Carbazole	EPA 8270	Extractable Organics	NELAP	8/25/2005
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	8/25/2005
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	11/14/2003
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	8/25/2005
Carbophenothion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Chloride	EPA 300.0	General Chemistry	NELAP	4/1/2003
Chlorobenzene	EPA 624	Volatile Organics	NELAP	11/14/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Chloroethane	EPA 624	Volatile Organics	NELAP	8/25/2005
Chloroethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Chloroform	EPA 624	Volatile Organics	NELAP	11/14/2003
Chloroform	EPA 8260	Volatile Organics	NELAP	7/7/2010
Chromium	EPA 200.7	Metals	NELAP	7/7/2010
Chromium	EPA 200.8	Metals	NELAP	4/1/2003
Chromium	EPA 6010	Metals	NELAP	7/7/2010
Chromium	EPA 6020	Metals	NELAP	8/25/2005
Chrysene	EPA 625	Extractable Organics	NELAP	4/1/2003
Chrysene	EPA 8270	Volatile Organics	NELAP	8/25/2005
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/25/2005
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	11/14/2003
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Cobalt	EPA 200.7	Metals	NELAP	7/7/2010
Cobalt	EPA 200.8	Metals	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Cobalt	EPA 6010	Metals	NELAP	7/7/2010
Cobalt	EPA 6020	Metals	NELAP	8/25/2005
Conductivity	SM 2510 B	General Chemistry	NELAP	1/6/2009
Copper	EPA 1638	Metals	NELAP	8/25/2005
Copper	EPA 200.7	Metals	NELAP	7/7/2010
Copper	EPA 200.8	Metals	NELAP	4/1/2003
Copper	EPA 6010	Metals	NELAP	7/7/2010
Copper	EPA 6020	Metals	NELAP	8/25/2005
Coumaphos	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Demeton-s	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Dibenz(a,h)anthracene	EPA 625	Extractable Organics	NELAP	4/1/2003
Dibenz(a,h)anthracene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	8/25/2005
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	11/14/2003
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Dibromomethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
Dichlorovos (DDVP, Dichlorvos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Diethyl ether	EPA 8260	Volatile Organics	NELAP	8/25/2005
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	4/1/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	8/25/2005
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	4/1/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	8/25/2005
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	4/1/2003
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	8/25/2005
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	4/1/2003
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	8/25/2005
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dioxathion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
EPN	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Ethylbenzene	EPA 624	Volatile Organics	NELAP	11/14/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Fensulfothion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Fenthion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Fluoranthene	EPA 625	Extractable Organics	NELAP	4/1/2003
Fluoranthene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Fluorene	EPA 625	Extractable Organics	NELAP	4/1/2003
Fluorene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Fluoride	EPA 300.0	General Chemistry	NELAP	4/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Hardness	SM 2340 B	General Chemistry,Metals	NELAP	8/25/2005
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	8/25/2005
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	4/1/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	8/25/2005
Hexachloroethane	EPA 625	Extractable Organics	NELAP	4/1/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	8/25/2005
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	4/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Iron	EPA 200.7	Metals	NELAP	7/7/2010
Iron	EPA 6010	Metals	NELAP	7/7/2010
Iron	EPA 6020	Metals	NELAP	8/25/2005
Isophorone	EPA 625	Extractable Organics	NELAP	4/1/2003
Isophorone	EPA 8270	Extractable Organics	NELAP	8/25/2005
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Kjeldahl nitrogen - total	SM 4500-NorgC	General Chemistry	NELAP	11/26/2007
Lead	EPA 1638	Metals	NELAP	8/25/2005
Lead	EPA 200.7	Metals	NELAP	7/7/2010
Lead	EPA 200.8	Metals	NELAP	4/1/2003
Lead	EPA 6010	Metals	NELAP	7/7/2010
Lead	EPA 6020	Metals	NELAP	8/25/2005
Lithium	EPA 200.7	Metals	NELAP	7/7/2010
Lithium	EPA 6010	Metals	NELAP	7/7/2010
m/p-Xylenes	EPA 8260	Volatile Organics	NELAP	7/7/2010
Magnesium	EPA 200.7	Metals	NELAP	7/7/2010
Magnesium	EPA 6010	Metals	NELAP	7/7/2010
Magnesium	EPA 6020	Metals	NELAP	8/25/2005
Malathion	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Manganese	EPA 200.7	Metals	NELAP	7/7/2010
Manganese	EPA 200.8	Metals	NELAP	4/1/2003
Manganese	EPA 6010	Metals	NELAP	7/7/2010
Manganese	EPA 6020	Metals	NELAP	8/25/2005
Mercury	EPA 1631	Metals	NELAP	4/7/2003
Mercury	EPA 200.8	Metals	NELAP	4/1/2003
Mercury	EPA 245.7	Metals	NELAP	11/26/2007
Mercury	EPA 6020	Metals	NELAP	8/25/2005

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methoxychlor	EPA 608.2	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	11/14/2003
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	11/14/2003
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/7/2010
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Methylene chloride	EPA 624	Volatile Organics	NELAP	7/7/2010
Methylene chloride	EPA 8260	Volatile Organics	NELAP	8/25/2005
Mevinphos	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Molybdenum	EPA 200.7	Metals	NELAP	7/7/2010
Molybdenum	EPA 200.8	Metals	NELAP	4/1/2003
Molybdenum	EPA 6010	Metals	NELAP	7/7/2010
Molybdenum	EPA 6020	Metals	NELAP	8/25/2005
Monocrotophos	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Naled	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Naphthalene	EPA 625	Extractable Organics	NELAP	4/1/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Naphthalene	EPA 8270	Volatile Organics	NELAP	8/25/2005
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Nickel	EPA 1638	Metals	NELAP	8/25/2005
Nickel	EPA 200.7	Metals	NELAP	7/7/2010
Nickel	EPA 200.8	Metals	NELAP	4/1/2003
Nickel	EPA 6010	Metals	NELAP	7/7/2010
Nickel	EPA 6020	Metals	NELAP	8/25/2005
Nitrate as N	EPA 300.0	General Chemistry	NELAP	4/1/2003
Nitrate as N	SM 4500-NO3 F	General Chemistry	NELAP	4/1/2003
Nitrate-nitrite	SM 4500-NO3 F	General Chemistry	NELAP	7/7/2010
Nitrite	SM 4500-NO3 F	General Chemistry	NELAP	4/1/2003
Nitrite as N	EPA 300.0	General Chemistry	NELAP	4/1/2003
Nitrobenzene	EPA 625	Extractable Organics	NELAP	4/1/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	8/25/2005
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	4/1/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	8/25/2005
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	4/1/2003

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	8/25/2005
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	4/1/2003
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	8/25/2005
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Oil & Grease	EPA 1664A	General Chemistry	NELAP	4/1/2003
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	4/1/2003
Orthophosphate as P	SM 4500-P F	General Chemistry	NELAP	4/1/2003
o-Xylene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	2/22/2010
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	4/1/2003
Pentachlorophenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
Perchlorate	EPA 6850	General Chemistry	NELAP	7/7/2010
pH	SM 4500-H+-B	General Chemistry	NELAP	11/26/2007
Phenanthrene	EPA 625	Extractable Organics	NELAP	4/1/2003
Phenanthrene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Phenol	EPA 625	Extractable Organics	NELAP	4/1/2003
Phenol	EPA 8270	Volatile Organics	NELAP	8/25/2005
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Phosmet (Imidan)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Phosphorus, total	SM 4500-P F	General Chemistry	NELAP	4/1/2003
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Potassium	EPA 200.7	Metals	NELAP	7/7/2010
Potassium	EPA 6010	Metals	NELAP	7/7/2010
Potassium	EPA 6020	Metals	NELAP	8/25/2005
Pyrene	EPA 625	Extractable Organics	NELAP	4/1/2003
Pyrene	EPA 8270	Volatile Organics	NELAP	8/25/2005
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	11/26/2007
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	11/26/2007
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/7/2010
Selenium	EPA 1638	Metals	NELAP	8/25/2005
Selenium	EPA 200.7	Metals	NELAP	7/7/2010
Selenium	EPA 200.8	Metals	NELAP	4/1/2003
Selenium	EPA 6010	Metals	NELAP	7/7/2010
Selenium	EPA 6020	Metals	NELAP	8/25/2005
Silver	EPA 1638	Metals	NELAP	8/25/2005
Silver	EPA 200.7	Metals	NELAP	7/7/2010

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Silver	EPA 200.8	Metals	NELAP	4/1/2003
Silver	EPA 6010	Metals	NELAP	7/7/2010
Silver	EPA 6020	Metals	NELAP	8/25/2005
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	11/26/2007
Sodium	EPA 200.7	Metals	NELAP	7/7/2010
Sodium	EPA 6010	Metals	NELAP	7/7/2010
Sodium	EPA 6020	Metals	NELAP	8/25/2005
Styrene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Sulfate	EPA 300.0	General Chemistry	NELAP	4/1/2003
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Terbufos	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	11/14/2003
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Tetrachlorvinphos (Stirophos, Gardona)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Thallium	EPA 1638	Metals	NELAP	8/25/2005
Thallium	EPA 200.7	Metals	NELAP	7/7/2010
Thallium	EPA 200.8	Metals	NELAP	4/1/2003
Thallium	EPA 6010	Metals	NELAP	7/7/2010
Thallium	EPA 6020	Metals	NELAP	8/25/2005
Tin	EPA 200.7	Metals	NELAP	7/7/2010
Tin	EPA 6010	Metals	NELAP	7/7/2010
Titanium	EPA 200.7	Metals	NELAP	11/30/2010
Titanium	EPA 6010	Metals	NELAP	11/30/2010
Toluene	EPA 624	Volatile Organics	NELAP	11/14/2003
Toluene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Total cyanide	EPA 335.4	General Chemistry	NELAP	8/25/2005
Total nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	6/9/2008
Total organic carbon	SM 5310 B	General Chemistry	NELAP	2/25/2013
Total phenolics	EPA 420.1	General Chemistry	NELAP	4/7/2003
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	8/25/2005
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	11/14/2003
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	8/25/2005
trans-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	11/14/2003
trans-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	8/25/2005

Laboratory Scope of Accreditation

Attachment to Certificate #: E87893-52, expiration date June 30, 2015. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87893** EPA Lab Code: **ID00013** **(208) 883-2839**

E87893
Anatek Labs, Inc.
1282 Alturas Dr.
Moscow, ID 83843

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	8/25/2005
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	11/14/2003
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	11/14/2003
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	8/25/2005
Turbidity	EPA 180.1	General Chemistry	NELAP	8/25/2005
Uranium	EPA 200.8	Metals	NELAP	4/1/2003
Vanadium	EPA 200.7	Metals	NELAP	7/7/2010
Vanadium	EPA 200.8	Metals	NELAP	4/1/2003
Vanadium	EPA 6010	Metals	NELAP	7/7/2010
Vanadium	EPA 6020	Metals	NELAP	8/25/2005
Vinyl chloride	EPA 624	Volatile Organics	NELAP	11/14/2003
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	8/25/2005
Xylene (total)	EPA 624	Volatile Organics	NELAP	11/14/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	8/25/2005
Zinc	EPA 1638	Metals	NELAP	8/25/2005
Zinc	EPA 200.7	Metals	NELAP	7/7/2010
Zinc	EPA 200.8	Metals	NELAP	4/1/2003
Zinc	EPA 6010	Metals	NELAP	7/7/2010
Zinc	EPA 6020	Metals	NELAP	8/25/2005

PERFORMANCE EVALUATION

Scheduled Study

WETT 34

WETT / DMRQA 34

21-Mar-2014 through 11-Jul-2014

RT1982
RTC Labcode

CO01007
US EPA Labcode

Participating Laboratory:

The SeaCrest Group
Shannon Phelps
1341 Cannon St
Louisville CO 80027

Thank you for participating in study WETT 34. Additional information about this study may be found online at www.rt-corp.com/reporting. If it is your first time to our website give me a call and I will simplify the initial registration process. If you have any questions or comments about this study please contact me:

Sigma-Aldrich, RTC Inc.
2931 Soldier Springs Rd.
Laramie, WY 82070 USA
1-307-742-5452
www.rt-corp.com

This report shall not be reproduced except in full, without written approval of the laboratory. The data and results reported in this document are the property of the participating laboratory and are confidential.If you wish to appeal an evaluation listed in this report please contact our QA Supervisor at 1(307) 742-5452 or RTCreports@sial.com

Sincerely,

Jennifer Duhon
Proficiency Testing Coordinator

Dataset

Dataset 1

RTC is accredited to perform PT programs for the scope of accreditation to ISO/IEC 17043 under ACLASS cerfticate AP-1469.

Test Code 13 / EPA Method 2000

Test Code 13 / EPA Method 2000 (DMRQA WET)

Method: EPA 2000.0 (2002)

Method Number 10264809

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Fathead Minnow Acute MHSF 25° - LC50 [1, 2, 3, 4] 754 / WET013-1EA - Lot LRAA3994	**21.35** %	**28.8**	12.1 to 45.5	**-0.89**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**

Test Code 15 / EPA Method 1000

Test Code 15 / EPA Method 1000 (DMRQA WET)

Method: EPA 1000

Method Number 10114600

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Fathead Minnow Chronic MHSF - Survival NOEC [1, 2, 3, 4] 756 / WET015-1EA - Lot LRAA3999	**6.25** %	**6.25**	<6.25 to 12.5	**0.00**	**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:25**
Fathead Minnow Chronic MHSF - Growth IC25 (ON) [1, 2, 3, 4] 808 / WET015-1EA - Lot LRAA3999	**6.54** %	**4.44**	0.345 to 11.1	**0.63**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**
Fathead Minnow Chronic MHSF - Growth NOEC (ON) [1, 2, 3, 4] 810 / WET015-1EA - Lot LRAA3999	**6.25** %	**6.25**	<6.25 to 12.5	**0.00**	**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:12.5**

Test Code 19 / EPA Method 2002

Test Code 19 / EPA Method 2002 (DMRQA WET)

Method: EPA 2000.0 (2002)

Method Number 10264809

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Ceriodaphnia Acute MHSF 25° - LC50 [1, 2, 3, 4] 764 / WET019-1EA - Lot LRAA4001	**100** %	**64.1**	10.0 to 125	**1.17**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**

Test Code 21 / EPA Method 1002

Test Code 21 / EPA Method 1002 (DMRQA WET)

Method: EPA 1002

Method Number 10115001

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Ceriodaphnia Chronic MHSF - Survival NOEC [1, 2, 3, 4] 766 / WET021-1EA - Lot LRAA4270	**25** %	**25.0**	12.5 to 50.0	**0.00**	**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:12.5**
Ceriodaphnia Chronic MHSF - Reproduction IC25 [1, 2, 3, 4] 767 / WET021-1EA - Lot LRAA4270	**33.32** %	**22.2**	1.50 to 43.2	**1.06**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**
Ceriodaphnia Chronic MHSF - Reproduction NOEC [1, 2, 3, 4] 768 / WET021-1EA - Lot LRAA4270	**25** %	**12.5**	6.25 to 50	**1.00**	**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:12.5**

Test Code 22 / EPA Method 1002

Test Code 22 / EPA Method 1002 (DMRQA WET)

Method: EPA 1002

Method Number 10115001

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Ceriodaphnia Chronic 20% DMW - Survival NOEC [1, 2, 3, 4] 769 / WET022-1EA - Lot LRAA4002	**<6.25** %	**6.25**	0 to 12.5		**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:12.5**
Ceriodaphnia Chronic 20% DMW - Reproduction IC25 [1, 2, 3, 4] 770 / WET022-1EA - Lot LRAA4002	**1.56** %	**1.24**	0 to 3.80	**0.32**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**
Ceriodaphnia Chronic 20% DMW - Reproduction NOEC [1, 2, 3, 4] 771 / WET022-1EA - Lot LRAA4002	**<6.25** %	**6.25**	<6.25 to 12.5		**Acceptable**
	Evaluation Criteria - **8**				*Evaluation Parameter* - **a:1, b:0, c:0, d:6.25**

Test Code 32 / EPA Method 2021

Test Code 32 / EPA Method 2021 (DMRQA WET)

Method: EPA 2021.0

Method Number 9954621

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Daphnia Magna Acute MHSF 25° - LC50 [1, 2, 3, 4] 788 / WET032-1EA - Lot LRAA4003	**8.69** %	**12.3**	0.780 to 24.7	**-0.58**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**

Test Code 38 / EPA Method 2021

Test Code 38 / EPA Method 2021 (DMRQA WET)

Method: EPA 2021.0

Method Number 9954621

	Result Units	Assigned Value	Accept. Window	Z	Evaluation
Daphnia Pulex MHSF 25° - LC50 [1, 2, 3, 4] 794 / WET038-1EA - Lot LRAA4003	**15.26** %	**15.8**	1.83 to 31.0	**-0.07**	**Acceptable**
	Evaluation Criteria - **5**				*Evaluation Parameter* - **deviations:2**

End of Dataset 1

Sample Information

Fathead Minnow Acute MHSF 25ºC

WET013-1EA / Lot LRAA3994

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Fathead Minnow Acute MHSF 25° - LC50 754 Test Code 13 / EPA Method 2000	%	33.4	28.8	8.36

Fathead Minnow, 7Day, MHSF

WET015-1EA / Lot LRAA3999

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Fathead Minnow Chronic MHSF - Survival NOEC 756 Test Code 15 / EPA Method 1000	%	6.25		
Fathead Minnow Chronic MHSF - Growth IC25 (ON) 808 Test Code 15 / EPA Method 1000	%	3.45	4.44	3.35
Fathead Minnow Chronic MHSF - Growth IC25 (SN) 809 Test Code 15 / EPA Method 1000	%	6.50	6.57	4.19
Fathead Minnow Chronic MHSF - Growth NOEC (ON) 810 Test Code 15 / EPA Method 1000	%	6.25		
Fathead Minnow Chronic MHSF - Growth NOEC (SN) 811 Test Code 15 / EPA Method 1000	%	6.25		

Ceriodaphnia Acute MHSF 25ºC

WET019-1EA / Lot LRAA4001

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Ceriodaphnia Acute MHSF 25° - LC50 764 Test Code 19 / EPA Method 2002	%	100	64.1	30.7

Ceriodaphnia Chronic MHSF

WET021-1EA / Lot LRAA4270

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Ceriodaphnia Chronic MHSF - Survival NOEC 766 Test Code 21 / EPA Method 1002	%	25.0 ± 1		
Ceriodaphnia Chronic MHSF - Reproduction IC25 767 Test Code 21 / EPA Method 1002	%	15.0 ± 1	22.2	10.5
Ceriodaphnia Chronic MHSF - Reproduction NOEC 768 Test Code 21 / EPA Method 1002	%	12.5 ± 1	17.0	9.36

Ceriodaphnia dubia, 7Day, 20%DMW

WET022-1EA / Lot LRAA4002

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Ceriodaphnia Chronic 20% DMW - Survival NOEC 769 Test Code 22 / EPA Method 1002	%	6.25		
Ceriodaphnia Chronic 20% DMW - Reproduction IC25 770 Test Code 22 / EPA Method 1002	%	3.45	1.24	0.997
Ceriodaphnia Chronic 20% DMW - Reproduction NOEC 771 Test Code 22 / EPA Method 1002	%	6.25		

Daphnia Magna Acute MHSF 25ºC

WET032-1EA / Lot LRAA4003

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Daphnia Magna Acute MHSF 25° - LC50 788 Test Code 32 / EPA Method 2021	%	7.80	12.3	6.20

Daphnia Pulex Acute MHSF 25ºC

WET038-1EA / Lot LRAA4003

	Units	Gravimetric Value	Study Mean	Study Std. Dev.
Daphnia Pulex MHSF 25° - LC50 794 Test Code 38 / EPA Method 2021	%	18.3	15.8	7.59

Definitions and Interpretation of Statistical Analysis:

Assigned Value: Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose. See ISO/IEC 17043 for additional information. In general the assigned value is the value used to assess proficiency and may or may not be the made to value (gravimetric value).

Accept. Window: The range of values that constitute acceptable performance for a laboratory participating in this PT study.

Z: A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control. Calculated as **Z = (Reported Value - Assigned Value) / Proficiency Std. Dev.**

Proficiency Std. Dev.: Standard deviation calculated based on **Evaluation Criteria.**

Study Mean: Statistical study mean calculated using a robust statisitical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation. NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Study Std. Dev.: Standard deviation calculated from study data using robust statisicals (Biweight).

Gravimetric Value: The 'prepared to' value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

Evaluation Criteria:

1 - Regression Equation - Acceptance windows based on TNI adopted equation of proficiency value +/- 3 proficiency standard deviations and check limits of proficiency value +/- 2 proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c, & d as proficiency value = a * gravimetric + b and proficiency standard deviation = c * gravimetric + d.

2 - Study Robust Mean and c,d regression - Acceptance windows based on TNI adopted equation of proficiency value +/- 3 proficiency standard deviations and check limits of proficiency value +/- 2 proficiency standard deviations. Proficiency value and proficiency standard deviation calculated from robust study mean and variables c & d as proficiency value = robust mean and proficiency standard deviation = c * proficiency value + d.

3 - Fixed Limits - Acceptance windows based on span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * percentage.

4 - Adjustable Fixed Limits - Acceptance windows base on a span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * lowPercentage where gravimetric < break and gravimetric +/- gravimetric * highPercentage where gravimetric >= break.

5 - Study Statistics - Acceptance windows based on a number of standard deviations span from the study mean as study mean +/- (deviations * standard deviation).

6 - Log Transform Statistics - Acceptance windows based on lognormal distributed data. Acceptance windows = mean(lognormal) +/- span * standard deviation(lognormal).

7 - Reserved

8 - Regression Equation 2SD - Acceptance windows based on EPA equation of proficiency value +/- 2 proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c, & d as proficiency value = a * gravimetric + b and proficiency standard deviation = c * gravimetric + d. Generally reserved for drinking water studies.

Proficiency Test Item Preparation, Homogeneity and Stability Assessment - RTC uses proprietary and published methods for the manufacture, homogeneity and stability testing of proficiency test items. RTC's proficiency test materials meet requirements of

ISO Guide 34. For more information contact RTC. Additionally RTC complies with TNI Volume 3 'General Requirements for Environmental Proficiency Test Providers', EL-V3-2009, 2009 for all TNI Fields of Proficiency Testing analytes.

Metrological Traceability - All preparations are made using balances calibrated annually traceable to NIST standards. Where appropriate analytical measurements are traceable through an unbroken chain to NIST standards, or a Certified Reference Material manufactured under ISO Guide 34 in conjunction with ISO/IEC 17025.

Statistical Analysis - RTC uses robust statistics to calculate study means and standard deviations - Reference - Kafadar, K, *A Biweight Approach to the One-Sample Problem*, Journal of the American Statistical Association, Vol. 77, No. 378, June, 1982, pp. 416-424.

Additional Information - Go to www.rt-corp.com/reporting for additional information on summary statistics for specific methods, advice on the interpretation of the statistical analysis, and additional comments/recommendations. If you failed an analyte it may be required to perform a corrective action and/or retest. RTC recommends that you contact your accreditation body for specific instruction.

Program analyte accrediting footnotes

[1] NELAC Compliant, covered by RTC's ACLASS Proficiency Testing Provider accreditation, Cert. AP-1469
[4] ISO 17043 Accredited, covered by RTC's ACLASS Proficiency Testing Provider accreditation, Cert AP-1469

Authorizing Officer: _____ Date: 7/31/2014
Patrick Brumfield, ASQ CQA
QA Manager

This section of the report is for informational purposes only.
If unsure about specific accreditation requirements please contact your state coordinator.

PASS RATE

Number of Reported Results:	**13**
Number of Passing Results:	**13**
Pass Rate:	**100.00%**

Attachment Q2-D

Corrective Action Report Form

CORRECTIVE ACTION REPORT (CAR)

Section1: (to be filled out by the Initiator)

Project/Location: _____ OPEN DATE: _____

Activity/Instrument: _____ Samples Affected: _____

Description of Non-Compliance (attach extra pages, data, chromatograms, etc., as necessary):

Signature: _____ Date: _____

Section 2: (To Project QA Manager)

Corrective Action:

Is data acceptable? Why?

Signature: _____ Date: _____

Section 3: (To Project Manager)

A) The variance is being handled to my satisfaction. Yes _____ No

B) Data will be accepted. Yes _____ No

C) Client Contacted. Yes _____ No

Contact: _____ Date: _____ Time: _____

D) Actions to be taken:

Signature: _____ Date: _____

Section 4: (To Project QA Manager)

Follow-up/Discussion:

Signature: _____ Date: _____

Attachment Q2-E

Indicator Parameters and Action Levels for Select Surface Water and Groundwater Locations

ATTACHMENT Q2-E

INDICATOR PARAMETERS AND ACTION LEVELS FOR GROUNDWATER AND SURFACE WATER LOCATIONS

This attachment to the *Midnite Mine Superfund Site - Site Wide Monitoring Quality Assurance Project Plan* (QAPP) describes the selection of indicator parameters and development of action levels for surface water and groundwater at site-wide monitoring locations. The action levels will be used to support decision making during the Remedial Action (RA) construction activities based on site-wide monitoring results. The action levels summarized in this attachment are intended to support the data quality objective (DQO) process for surface water and groundwater monitoring during the RA as described in QAPP Table Q2-A-1 (located in QAPP Attachment Q2-A). Note that the action levels described herein and on QAPP Table Q2-A-1 differ from the cleanup levels established in the Record of Decision (ROD; EPA, 2006) in that the action levels are intended for use during construction to provide indication that the RA activities may be releasing contaminants of concern (COCs) to down gradient locations. The action levels are thresholds that represent a statistically significant change from historical baseline ranges. The cleanup levels established in the ROD are the final (post RA) media-specific remediation goals. The cleanup levels are exceeded at some monitoring locations at the start of the RA, and therefore are not suitable for use as action levels during the RA.

This evaluation includes calculating descriptive statistics, testing for the presence of temporal trends using the Mann-Kendall test, and calculating upper prediction limits (UPLs) that are the action levels. The evaluation was performed using Microsoft Excel as well as Sanitas groundwater statistical software configured to settings in accordance with *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (EPA, 2009).

Selection of Indicator Parameters

The indicator parameters for surface water and groundwater were selected using two criteria: (1) the concentration of an indicator parameter must be elevated in mine-affected water relative to down gradient surface water and groundwater, and (2) the indicator constituent must be mobile in the environment. A review of historic Site water-quality monitoring data for metals and radionuclides collected between 1998 and 2014 indicated that a large percentage of aluminum, arsenic, cadmium, chromium, copper, iron, nickel, lead, and zinc concentrations were below detection (>50 percent of results) and are therefore poor indicator constituents. The historic concentrations of thorium-230 are elevated in mine-affected waters compared to down gradient surface water and groundwater, but thorium is generally immobile in natural waters (Langmuir and Herman, 1980) and is therefore an unreliable indicator constituent.

Several field parameters (pH and electrical conductivity) and remaining constituents (uranium, radium-226, manganese, and sulfate) were found to be relatively elevated in the mine-affected water and are also mobile in the environment, and were subsequently identified as mine-water indicator parameters. Selection of these parameters is also consistent with the documented exceedence of uranium and sulfate concentrations above background in the alluvial and shallow bedrock groundwater (EPA, 2005). Existing surface water and groundwater sampling locations

used for this evaluation are listed in the tables below and are shown on FSP Figures Q1-1, Q1-3 and Q1-4.

Evaluation Results

Data Treatment. The surface and groundwater quality data collected at the site from 1998 through early 2014 were evaluated to determine the UPL for each indicator parameter. Seasonal comparison analysis of the quarterly surface water and semi-annual groundwater data indicated seasonal difference for the majority of the locations and constituents, therefore the data were divided, analyzed and summarized by season. Quarterly sampling began in 2002 and therefore a consistent data set exists from 2002 through early 2014 for the four months January, April, July and October. Sampling occurred on a monthly basis prior to 2002 and so the pre-2002 dataset was culled to contain only the data from the quarterly sampling months. Next, outliers were identified with use of the EPA 1989 Outlier Test (EPA, 2009), and extreme values were removed before analysis. Table Q2-E-1 below provides a summary of the surface water quality data for the indicator parameters at the locations down gradient of the site, and includes the up gradient locations SW-4 and SW-4U for comparison.

Action levels for the Eastern Drainage surface water locations (SW-2 and SW-11) were developed upon the premise of two seasons: 1) the Water Treatment Plant discharging, and 2) the Water Treatment Plant not operating. The data summary and action levels for the Eastern Drainage surface water locations are found in Table Q2-E-2. Table Q2-E-3 provides a summary of the groundwater quality data for the indicator constituents at the locations down gradient of the site. The data include analytical results from samples collected by Shepherd Miller, Inc. from 1998-2002, by URS from 1999-2000, and by DMC from 2002-2013 and early 2014.

Descriptive Statistics*.* Descriptive statistics for the dataset were calculated and include number of samples, percent of non-detect results, minimum and maximum value, mean value, median value and the data distribution as determined by the Shapiro-Wilk test (EPA, 2009). The descriptive statistics are summarized below in Table Q2-E-1 (surface water other than Eastern Drainage), Table Q2-E-2 (Eastern Drainage surface water), and Table Q2-E-3 (groundwater).

Temporal Trends*.* Historical data for each constituent at each location were tested for temporal trends using the Mann-Kendal test at a 95 percent confidence interval (Hollander and Wolfe, 1973). The presence or absence of a temporal trend in a dataset is important because it has bearing on how future results for that constituent and location may be evaluated against an action level. For example, an exceedance of the UPL for a constituent and location that is experiencing an upward trend through time may not represent a change from pre-RA conditions, but rather is a consequence of the upward trend. Several statistically significant trends were identified for several parameters in both surface water and groundwater within the dataset. Therefore, evaluation of temporal trends will continue during the RA site-wide monitoring as the persistence of an existing trend or future identification of a trend may be cause for modification to an action level in the future.

Development of Action Levels. During the RA, a prediction limit approach will be used to make comparisons between pre-RA and RA-phase data. The interval is constructed from the historical baseline (pre-RA) data such that it proposes to contain future compliance observations with stated confidence in the absence of change. Therefore, if any future result exceeds the bounds of the prediction limit, it can be considered statistically significant evidence that that result is not representative of the baseline group and a change in conditions has occurred.

The action levels (UPLs) were calculated using Sanitas software configured to EPA Unified Guidance settings for UPLs. In order to determine whether a parametric or nonparametric prediction limit should be used, the distribution of the data was evaluated by applying the Shapiro-Wilk or Shapiro-Francia tests for normality to the raw data or, when applicable to the ladder of powers (Helsel and Hirsch, 1992) transformed data. A parametric prediction limit was constructed if the background data all follow a normal or transformed-normal distribution. If the data are other than normally distributed, a nonparametric prediction limit was used. When the background data are not normal, transformed-normal, or greater than 50 percent of the background data are non-detect, a nonparametric prediction limit was constructed. Specifically, the highest value from the background data is used as the upper limit of the nonparametric prediction limit.

Censored data (data set containing non-detects) were treated in the software as follows. If less than 15 percent of the background observations were non-detects, these were replaced with one half of the method detection limit prior to running the analysis (EPA, 2009). If more than 15 percent but less than 50 percent of the background data were non-detect, the data's sample mean and sample standard deviation were adjusted according to the method of Cohen, Aitchison or Kaplan-Meier (EPA, 2009). If more than 50 percent of the background data were non-detect, the highest value from the background data is used as the upper limit.

Use of Action Levels during Site Wide Monitoring

The action levels will be used during the RA construction as described in the DQO process included on QAPP Table Q2-A-1 (located in QAPP Attachment Q2-A). Comparison of future constituent values should be performed by 1) testing the whole dataset for the presence of a trend, and 2) comparing the recent sample result to the UPL. A concentration exceeding the UPL indicates statistical evidence of changing conditions, and verification sampling or alternative actions may be warranted.

ATTACHMENT Q2-E REFERENCES

Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold

Hollander and Wolfe. 1973. Nonparametric Statistical Methods. John Wiley & Sons.

Helsel, D.R. and Hirsch, R.M., 1992. Statistical Methods in Water Resources. Elsevier.

Langmuir, D. and J.S. Herman. 1980. The mobility of thorium in natural waters at low temperatures. Geochimica et Cosmochimica Acta. 44:1753-1766.

U.S. EPA, April 1989. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance*. Office of Solid Waste Management Division, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency (EPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery Program Implementation and Information Division, U.S. Environmental Protection Agency. March, 2009.

U.S. EPA, 2006. Midnite Mine Superfund Site Spokane Indian Reservation, Washington Record of Decision. Prepared by the Office of Environmental Cleanup, EPA Region 10. September.

Table Q2-E-1. Surface Water Data Summary for Indicator Constituents (Page 1 of 3).

Location	Analyte	Season	%ND	Distribution/Prediction Limit Method[1]	N	Mean	StDev	Median	Min	Max	Action Level[2]
SW-4	Conductivity (UMHOS/CM)	1	0	Param. Normal	17	180.0	68.07	159.0	47.90	311.0	–
SW-4	Conductivity (UMHOS/CM)	2	0	Param. Normal	14	113.4	33.03	102.7	76.40	181.6	–
SW-4	Conductivity (UMHOS/CM)	3	0	Param. Normal	15	241.0	158.4	177.0	98.70	627.0	–
SW-4	Conductivity (UMHOS/CM)	4	0	Param. Normal	16	375.2	242.5	335.5	122.2	1,169	–
SW-4	Managanese, Total (MG/L)	1	24	NP (Cohens/xform)	17	*0.026*	*0.021*	0.023	0.004	0.080	–
SW-4	Managanese, Total (MG/L)	2	19	Param. Normal	16	0.021	0.009	0.020	0.005	0.035	–
SW-4	Managanese, Total (MG/L)	3	13	Param. Normal	15	0.031	0.018	0.030	0.005	0.073	–
SW-4	Managanese, Total (MG/L)	4	31	NP (Cohens/xform)	16	*0.026*	*0.026*	0.015	0.005	0.090	–
SW-4	pH (PH UNITS)	1	0	Param. Normal	16	7.27	0.773	7.32	5.98	8.40	–
SW-4	pH (PH UNITS)	2	0	Param. Normal	16	7.47	0.767	7.58	5.84	8.90	–
SW-4	pH (PH UNITS)	3	0	Param. Normal	15	7.52	0.301	7.57	7.03	8.09	–
SW-4	pH (PH UNITS)	4	0	Param. Normal	16	7.45	0.480	7.59	6.51	8.10	–
SW-4	Radium-226, Total (PCI/L)	1	50	NP (Cohens/xform)	12	*0.263*	*0.390*	0.100	-0.020	1.30	–
SW-4	Radium-226, Total (PCI/L)	2	30	Param. Normal	10	0.457	0.277	0.525	0.075	0.900	–
SW-4	Radium-226, Total (PCI/L)	3	55	NP (NDs)	11			0.160	0.100	0.530	–
SW-4	Radium-226, Total (PCI/L)	4	50	Param. Normal	12	0.133	0.074	0.100	0.040	0.300	–
SW-4	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	15	33.07	23.83	22.00	5.80	76.40	–
SW-4	Sulfate, Dissolved (MG/L)	2	8	Param. Normal	13	11.38	9.63	9.00	0.050	33.50	–
SW-4	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	13	56.94	68.55	31.30	2.10	230.0	–
SW-4	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	12	98.68	55.50	79.95	23.00	184.0	–
SW-4	Uranium, Total (MG/L)	1	15	Param. Normal	13	0.004	0.001	0.004	0.003	0.005	–
SW-4	Uranium, Total (MG/L)	2	18	Param. Normal	11	0.004	0.001	0.004	0.002	0.006	–
SW-4	Uranium, Total (MG/L)	3	30	NP (Cohens/xform)	10	*0.004*	*0.001*	0.004	0.002	0.005	–
SW-4	Uranium, Total (MG/L)	4	17	Param. Normal	12	0.004	0.001	0.003	0.002	0.005	–
SW-4U	Conductivity (UMHOS/CM)	1	0	Ins. Data	3	127.5	42.26	107.9	98.60	176.0	–
SW-4U	Conductivity (UMHOS/CM)	2	0	Ins. Data	3	97.37	20.50	99.00	76.10	117.0	–
SW-4U	Conductivity (UMHOS/CM)	3	0	Ins. Data	2	95.20	9.19	95.20	88.70	101.7	–
SW-4U	Conductivity (UMHOS/CM)	4	0	Ins. Data	3	104.4	6.63	101.0	100.1	112.0	–
SW-4U	Managanese, Total (MG/L)	1	0	Ins. Data	3	0.205	0.329	0.021	0.009	0.585	–
SW-4U	Managanese, Total (MG/L)	2	0	Ins. Data	3	0.020	0.003	0.019	0.019	0.023	–
SW-4U	Managanese, Total (MG/L)	3	0	Ins. Data	3	0.020	0.006	0.021	0.013	0.025	–
SW-4U	Managanese, Total (MG/L)	4	0	Ins. Data	3	0.056	0.074	0.015	0.012	0.141	–
SW-4U	pH (PH UNITS)	1	0	Ins. Data	3	7.63	0.766	7.40	7.00	8.48	–
SW-4U	pH (PH UNITS)	2	0	Ins. Data	3	6.33	0.624	6.62	5.61	6.75	–
SW-4U	pH (PH UNITS)	3	0	Ins. Data	2	7.25	0.438	7.25	6.94	7.56	–
SW-4U	pH (PH UNITS)	4	0	Ins. Data	3	7.07	1.30	6.72	5.98	8.51	–
SW-4U	Radium-226, Total (PCI/L)	1	33	Ins. Data	3	0.212	0.113	0.200	0.105	0.330	–
SW-4U	Radium-226, Total (PCI/L)	2	0	Ins. Data	3	0.673	0.040	0.650	0.650	0.720	–
SW-4U	Radium-226, Total (PCI/L)	3	33	Ins. Data	3	0.268	0.108	0.260	0.165	0.380	–
SW-4U	Radium-226, Total (PCI/L)	4	0	Ins. Data	3	0.260	0.142	0.210	0.150	0.420	–
SW-4U	Sulfate, Dissolved (MG/L)	1	0	Ins. Data	3	2.03	0.068	2.05	1.95	2.08	–
SW-4U	Sulfate, Dissolved (MG/L)	2	0	Ins. Data	2	1.97	0.467	1.97	1.64	2.30	–
SW-4U	Sulfate, Dissolved (MG/L)	3	0	Ins. Data	3	1.39	0.291	1.36	1.11	1.69	–
SW-4U	Sulfate, Dissolved (MG/L)	4	0	Ins. Data	3	1.40	0.079	1.37	1.34	1.49	–
SW-4U	Uranium, Total (MG/L)	1	33	Ins. Data	3	0.002	0.000	0.003	0.002	0.003	–
SW-4U	Uranium, Total (MG/L)	2	0	Ins. Data	3	0.002	0.000	0.002	0.002	0.003	–
SW-4U	Uranium, Total (MG/L)	3	33	Ins. Data	3	0.002	0.001	0.002	0.001	0.003	–
SW-4U	Uranium, Total (MG/L)	4	0	Ins. Data	3	0.014	0.021	0.002	0.002	0.037	–
SW-5	Conductivity (UMHOS/CM)	1	0	Param. Normal	15	947.0	81.96	974.0	821.0	1,051	1,078
SW-5	Conductivity (UMHOS/CM)	2	0	Param. Normal	17	694.2	467.6	603.0	146.0	1,699	1,534
SW-5	Conductivity (UMHOS/CM)	3	0	Param. Normal	14	2,184	356.8	2,310	1,625	2,710	2,838
SW-5	Conductivity (UMHOS/CM)	4	0	NP (normality)	17			1,251	248.0	3,060	3,060
SW-5	Managanese, Total (MG/L)	1	0	Param. Normal	18	0.383	0.288	0.236	0.090	1.20	0.979
SW-5	Managanese, Total (MG/L)	2	0	Param. Normal	17	0.130	0.106	0.087	0.025	0.460	0.325
SW-5	Managanese, Total (MG/L)	3	0	Param. Normal	16	0.307	0.188	0.260	0.063	0.753	0.687
SW-5	Managanese, Total (MG/L)	4	0	Param. Normal	17	0.284	0.141	0.303	0.070	0.500	0.537
SW-5	pH (PH UNITS)	1	0	Param. Normal	18	7.31	0.678	7.15	6.09	8.57	<5.845
SW-5	pH (PH UNITS)	2	0	Param. Normal	17	7.33	0.608	7.31	6.50	8.60	<6.004
SW-5	pH (PH UNITS)	3	0	Param. Normal	16	7.36	0.212	7.35	6.87	7.67	<6.893
SW-5	pH (PH UNITS)	4	0	Param. Normal	17	7.36	0.522	7.28	6.22	8.09	<6.217
SW-5	Radium-226, Total (PCI/L)	1	62	NP (NDs)	13			0.100	0.030	0.600	0.600
SW-5	Radium-226, Total (PCI/L)	2	17	Param. Normal	12	0.415	0.217	0.430	0.100	0.820	0.828
SW-5	Radium-226, Total (PCI/L)	3	33	Param. Normal	12	0.353	0.213	0.375	0.100	0.700	0.732
SW-5	Radium-226, Total (PCI/L)	4	31	NP (Cohens/xform)	13	*0.228*	*0.148*	0.200	0.080	0.500	0.500
SW-5	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	15	438.7	88.46	433.0	249.0	585.0	599.7
SW-5	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	14	301.1	235.0	272.0	28.10	839.0	816.1
SW-5	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	13	1,355	323.9	1,330	785.0	1,850	1,954
SW-5	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	15	1,237	682.4	1,430	410.0	2,217	2,230
SW-5	Uranium, Total (MG/L)	1	0	Param. Normal	13	0.029	0.011	0.029	0.016	0.057	0.049
SW-5	Uranium, Total (MG/L)	2	15	NP (Cohens)	13	*0.008*	*0.004*	0.007	0.004	0.015	0.015
SW-5	Uranium, Total (MG/L)	3	0	Param. Normal	12	0.017	0.010	0.017	0.004	0.041	0.037
SW-5	Uranium, Total (MG/L)	4	0	Param. Normal	14	0.028	0.016	0.024	0.009	0.068	0.058

Table Q2-E-1. Surface Water Data Summary for Indicator Constituents (Page 2 of 3).

Location	Analyte	Season	%ND	Distribution/Prediction Limit Method[1]	N	Mean	StDev	Median	Min	Max	Action Level[2]
SW-6	Conductivity (UMHOS/CM)	1	0	Param. Normal	17	2,163	120.5	2,168	1,932	2,378	2,379
SW-6	Conductivity (UMHOS/CM)	2	0	Param. Normal	17	2,344	387.2	2,390	1,509	2,970	3,039
SW-6	Conductivity (UMHOS/CM)	3	0	Param. Normal	16	2,891	366.2	2,955	2,077	3,770	3,552
SW-6	Conductivity (UMHOS/CM)	4	0	Param. Normal	16	2,731	380.6	2,820	2,220	3,460	3,419
SW-6	Managanese, Total (MG/L)	1	0	NP (normality)	17			2.71	0.745	4.20	4.20
SW-6	Managanese, Total (MG/L)	2	0	Param. Normal	17	1.25	0.916	0.880	0.187	3.30	3.09
SW-6	Managanese, Total (MG/L)	3	0	Param. Normal	15	0.554	0.223	0.500	0.302	1.11	0.977
SW-6	Managanese, Total (MG/L)	4	0	Param. Normal	17	1.19	0.798	0.700	0.393	3.01	2.86
SW-6	pH (PH UNITS)	1	0	Param. Normal	16	7.37	0.465	7.39	6.29	8.08	<6.35
SW-6	pH (PH UNITS)	2	0	Param. Normal	17	7.22	0.575	7.40	5.74	7.90	<5.873
SW-6	pH (PH UNITS)	3	0	Param. Normal	16	7.27	0.267	7.29	6.80	7.75	<6.683
SW-6	pH (PH UNITS)	4	0	Param. Normal	17	7.19	0.523	7.34	6.21	8.02	<6.051
SW-6	Radium-226, Total (PCI/L)	1	25	NP (Cohens)	12	*0.182*	*0.212*	0.155	-0.320	0.500	0.500
SW-6	Radium-226, Total (PCI/L)	2	17	NP (Cohens/xform)	12	*0.698*	*0.744*	0.540	0.080	2.90	2.90
SW-6	Radium-226, Total (PCI/L)	3	8	Param. Normal	12	0.770	0.435	0.815	0.100	1.40	1.58
SW-6	Radium-226, Total (PCI/L)	4	8	Param. Normal	13	0.534	0.307	0.540	0.100	1.10	1.10
SW-6	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	15	1,297	165.1	1,300	992.0	1,510	1,597
SW-6	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	14	1,473	286.8	1,542	823.0	1,981	1,998
SW-6	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	14	2,034	280.9	1,990	1,520	2,670	2,548
SW-6	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	15	1,890	418.1	1,970	1,200	2,571	2,651
SW-6	Uranium, Total (MG/L)	1	0	Param. Normal	12	0.091	0.014	0.093	0.071	0.120	0.118
SW-6	Uranium, Total (MG/L)	2	0	NP (normality)	13			0.033	0.018	0.097	0.097
SW-6	Uranium, Total (MG/L)	3	0	Param. Normal	12	0.030	0.022	0.022	0.008	0.083	0.073
SW-6	Uranium, Total (MG/L)	4	0	Param. Normal	14	0.081	0.068	0.074	0.021	0.270	0.217
SW-7	Conductivity (UMHOS/CM)	1	0	Param. Normal	13	965.2	91.27	978.0	779.0	1,099	1,134
SW-7	Conductivity (UMHOS/CM)	2	0	Param. Normal	17	656.5	431.2	575.0	164.0	1,618	1,524
SW-7	Conductivity (UMHOS/CM)	3	0	Param. Normal	15	1,774	665.6	1,912	482.0	2,560	2,985
SW-7	Conductivity (UMHOS/CM)	4	0	NP (normality)	17			1,844	773.0	2,930	2,930
SW-7	Managanese, Total (MG/L)	1	12	Param. Normal	17	0.033	0.032	0.022	0.003	0.120	0.097
SW-7	Managanese, Total (MG/L)	2	6	Param. Normal	17	0.071	0.039	0.070	0.005	0.150	0.142
SW-7	Managanese, Total (MG/L)	3	6	Param. Normal	16	0.047	0.026	0.045	0.010	0.113	0.094
SW-7	Managanese, Total (MG/L)	4	29	Param. Normal	17	0.020	0.013	0.016	0.005	0.045	0.042
SW-7	pH (PH UNITS)	1	0	Param. Normal	17	7.52	0.775	7.58	6.22	8.84	<5.829
SW-7	pH (PH UNITS)	2	0	Param. Normal	17	7.15	0.610	7.19	6.08	8.41	<5.821
SW-7	pH (PH UNITS)	3	0	Param. Normal	16	7.34	0.414	7.44	6.35	7.91	<6.425
SW-7	pH (PH UNITS)	4	0	Param. Normal	17	7.41	0.493	7.45	6.43	8.28	<6.337
SW-7	Radium-226, Total (PCI/L)	1	54	NP (NDs)	13			0.105	-0.360	0.900	0.900
SW-7	Radium-226, Total (PCI/L)	2	25	NP (Cohens)	12	*0.350*	*0.235*	0.305	0.100	0.720	0.720
SW-7	Radium-226, Total (PCI/L)	3	58	NP (NDs)	12			0.100	0.080	0.630	0.630
SW-7	Radium-226, Total (PCI/L)	4	62	NP (NDs)	13			0.100	0.065	0.450	0.450
SW-7	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	14	445.1	102.2	450.5	271.0	669.0	632.5
SW-7	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	14	292.4	220.8	237.0	34.90	823.0	762.7
SW-7	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	14	1,292	596.0	1,390	212.0	2,331	2,384
SW-7	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	15	1,181	612.7	1,220	387.0	2,102	2,295
SW-7	Uranium, Total (MG/L)	1	0	Param. Normal	12	0.034	0.011	0.037	0.008	0.047	0.055
SW-7	Uranium, Total (MG/L)	2	8	Param. Normal	13	0.011	0.004	0.010	0.005	0.018	0.019
SW-7	Uranium, Total (MG/L)	3	0	Param. Normal	12	0.021	0.009	0.021	0.007	0.034	0.037
SW-7	Uranium, Total (MG/L)	4	0	Param. Normal	14	0.029	0.009	0.027	0.016	0.048	0.046
SW-12	Conductivity (UMHOS/CM)	1	0	Param. Normal	18	3,213	142.9	3,240	2,870	3,400	3,468
SW-12	Conductivity (UMHOS/CM)	2	0	Param. Normal	19	2,910	431.9	2,996	2,243	3,963	3,679
SW-12	Conductivity (UMHOS/CM)	3	0	Param. Normal	17	2,922	259.1	2,890	2,431	3,495	3,388
SW-12	Conductivity (UMHOS/CM)	4	0	Param. Normal	17	3,033	169.2	3,020	2,700	3,380	3,337
SW-12	Managanese, Total (MG/L)	1	0	Param. Normal	19	57.64	21.64	57.10	24.40	93.00	96.14
SW-12	Managanese, Total (MG/L)	2	0	Param. Normal	19	46.15	14.11	46.00	24.30	78.00	71.26
SW-12	Managanese, Total (MG/L)	3	0	Param. Normal	17	48.29	15.98	48.90	24.60	80.00	76.99
SW-12	Managanese, Total (MG/L)	4	0	Param. Normal	18	53.87	17.48	52.90	28.80	87.00	85.12
SW-12	pH (PH UNITS)	1	0	Param. Normal	19	5.29	0.567	5.36	3.97	6.09	<4.066
SW-12	pH (PH UNITS)	2	0	Param. Normal	19	5.31	0.483	5.33	4.21	6.50	<4.267
SW-12	pH (PH UNITS)	3	0	Param. Normal	17	5.54	0.399	5.59	4.62	6.36	<4.675
SW-12	pH (PH UNITS)	4	0	Param. Normal	18	5.66	0.349	5.59	5.08	6.41	<4.9
SW-12	Radium-226, Total (PCI/L)	1	7	Param. Normal	14	0.467	0.240	0.410	0.100	0.900	0.908
SW-12	Radium-226, Total (PCI/L)	2	21	NP (Cohens/xform)	14	*0.399*	*0.326*	0.295	0.100	1.20	1.20
SW-12	Radium-226, Total (PCI/L)	3	23	Param. Normal	13	0.424	0.252	0.400	0.100	0.960	0.916
SW-12	Radium-226, Total (PCI/L)	4	14	Param. Normal	14	0.442	0.363	0.400	0.100	1.52	1.15
SW-12	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	17	2,385	391.4	2,350	1,690	3,478	3,100
SW-12	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	16	2,027	345.5	2,080	1,495	2,616	2,651
SW-12	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	15	2,089	218.9	2,046	1,680	2,590	2,487
SW-12	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	16	2,151	290.3	2,160	1,560	2,640	2,676
SW-12	Uranium, Total (MG/L)	1	0	Param. Normal	14	0.679	0.150	0.630	0.518	1.07	0.956
SW-12	Uranium, Total (MG/L)	2	0	Param. Normal	14	0.619	0.082	0.619	0.498	0.827	0.769
SW-12	Uranium, Total (MG/L)	3	0	Param. Normal	12	0.589	0.055	0.597	0.498	0.677	0.692
SW-12	Uranium, Total (MG/L)	4	0	Param. Normal	14	0.585	0.132	0.570	0.412	0.933	0.827

Table Q2-E-1. Surface Water Data Summary for Indicator Constituents (Page 3 of 3).

Location	Analyte	Season	%ND	Distribution/Prediction Limit Method[1]	N	Mean	StDev	Median	Min	Max	Action Level[2]
WDAC	Conductivity (UMHOS/CM)	1	0	Param. Normal	16	2,917	187.0	2,930	2,550	3,160	3,255
WDAC	Conductivity (UMHOS/CM)	2	0	Param. Normal	20	2,164	639.0	2,235	1,234	3,050	3,296
WDAC	Conductivity (UMHOS/CM)	3	0	Param. Normal	17	2,731	319.0	2,660	2,234	3,280	3,304
WDAC	Conductivity (UMHOS/CM)	4	0	Param. Normal	17	3,055	174.5	3,055	2,730	3,350	3,369
WDAC	Managanese, Total (MG/L)	1	0	Param. Normal	18	8.42	3.53	8.68	2.62	14.60	14.73
WDAC	Managanese, Total (MG/L)	2	0	Param. Normal	20	4.52	2.87	3.80	1.48	9.78	11.36
WDAC	Managanese, Total (MG/L)	3	0	Param. Normal	17	7.30	4.10	6.33	2.48	17.30	14.67
WDAC	Managanese, Total (MG/L)	4	0	Param. Normal	17	10.16	4.49	10.90	2.74	20.50	18.22
WDAC	pH (PH UNITS)	1	0	Param. Normal	18	5.72	0.908	5.76	4.27	7.50	<3.747
WDAC	pH (PH UNITS)	2	0	Param. Normal	20	6.16	0.579	6.20	5.05	7.26	<4.919
WDAC	pH (PH UNITS)	3	0	NP (normality)	17			5.76	4.86	7.85	<4.86
WDAC	pH (PH UNITS)	4	0	Param. Normal	18	5.67	0.573	5.59	4.82	7.24	<4.426
WDAC	Radium-226, Total (PCI/L)	1	14	Param. Normal	14	0.464	0.231	0.430	0.100	0.800	0.887
WDAC	Radium-226, Total (PCI/L)	2	25	NP (normality)	16			0.310	0.000	16.20	16.20
WDAC	Radium-226, Total (PCI/L)	3	15	NP (Cohens/xform)	13	*0.548*	*0.376*	0.500	0.100	1.60	1.60
WDAC	Radium-226, Total (PCI/L)	4	0	Param. Normal	15	0.607	0.215	0.610	0.310	1.00	0.999
WDAC	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	15	2,075	140.1	2,050	1,780	2,250	2,330
WDAC	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	17	1,352	496.6	1,390	750.0	2,170	2,244
WDAC	Sulfate, Dissolved (MG/L)	3	0	Param. Normal	15	1,899	296.4	1,800	1,460	2,410	2,438
WDAC	Sulfate, Dissolved (MG/L)	4	0	Param. Normal	16	2,307	338.8	2,275	1,760	3,010	2,919
WDAC	Uranium, Total (MG/L)	1	0	Param. Normal	13	0.044	0.024	0.040	0.019	0.090	0.089
WDAC	Uranium, Total (MG/L)	2	0	Param. Normal	14	0.028	0.012	0.023	0.015	0.052	0.051
WDAC	Uranium, Total (MG/L)	3	0	Param. Normal	12	0.040	0.017	0.044	0.014	0.069	0.073
WDAC	Uranium, Total (MG/L)	4	0	Param. Normal	14	0.061	0.034	0.056	0.021	0.130	0.124

Notes:

- Surface water seasons are defined as follows: Season 1 = January, Season 2 = April, Season 3 = July, Season 4 = October.
-Eastern Drainage seasons are defined as follows: ON = April and July, OFF = October and January.
-Groundwater seasons are defined as follows: Season 1 = April, Season 2 = October.

[1] Distribution determined before calculation of the UPL using the Shapiro-Wilk test. For normal or transformed-normal data a parametric UPL is presented. For non-normal or non-transformed normal data a non-parametric UPL is presented. If more than 15 percent but less than 50 percent of the background data were non-detect and data were not normal, the data's sample mean and sample standard deviation were adjusted according to the method of Cohen, Aitchison or Kaplan-Meier (EPA, 2009) and a non-parametric UPL is presented. If more than 50 percent of the background data were non-detect, a non-parametric UPL is presented (highest value).

[2] The 95% UPL is presented based on data distribution and percent non-detects. The 95% LPL is presented for pH data. Action levels are not presented for SW-4 and SW-4U because these are background reference locations.

Table Q2-E-2. Eastern Drainage Surface Water Data Summary (Page 1 of 1).

Location	Analyte	Season	%ND	Distribution/Prediction Limit Method[1]	N	Mean	StDev	Median	Min	Max	Action Level[2]
SW-2	Conductivity (UMHOS/CM)	OFF	0	NP (normality)	33			1,222	750.0	3,590	3,590
SW-2	Conductivity (UMHOS/CM)	ON	0	Param. Normal	33	2,571	676.9	2,810	1,046	3,240	3,232
SW-2	Managanese, Total (MG/L)	OFF	12	Param. Normal	33	0.052	0.068	0.020	0.002	0.290	0.172
SW-2	Managanese, Total (MG/L)	ON	0	Param. Normal	32	0.081	0.063	0.070	0.018	0.320	0.191
SW-2	pH (PH UNITS)	OFF	0	NP (normality)	33			7.87	6.15	8.63	<6.15
SW-2	pH (PH UNITS)	ON	0	Param. Normal	33	7.20	0.562	7.20	6.11	8.50	<6.04
SW-2	Radium-226, Total (PCI/L)	OFF	8	Param. Normal	25	0.575	0.406	0.400	0.050	1.40	1.42
SW-2	Radium-226, Total (PCI/L)	ON	0	Param. Normal	19	1.54	0.407	1.50	0.990	2.40	2.26
SW-2	Sulfate, Dissolved (MG/L)	OFF	0	NP (normality)	29			650.0	203.0	2,716	2,716
SW-2	Sulfate, Dissolved (MG/L)	ON	0	Param. Normal	24	1,937	313.9	1,895	1,430	2,530	2,486
SW-2	Uranium, Total (MG/L)	OFF	0	Param. Normal	27	0.053	0.028	0.050	0.017	0.140	0.103
SW-2	Uranium, Total (MG/L)	ON	0	Param. Normal	25	0.033	0.022	0.026	0.009	0.099	0.073
SW-11	Conductivity (UMHOS/CM)	OFF	0	NP (normality)	32			1,775	985.0	3,470	3,470
SW-11	Conductivity (UMHOS/CM)	ON	0	Param. Normal	32	2,531	548.7	2,710	1,409	3,200	3,189
SW-11	Managanese, Total (MG/L)	OFF	32	NP (Cohens/xform)	31	*0.028*	*0.041*	0.010	0.001	0.180	0.180
SW-11	Managanese, Total (MG/L)	ON	9	Param. Normal	33	0.078	0.072	0.050	0.005	0.260	0.217
SW-11	pH (PH UNITS)	OFF	0	Param. Normal	31	7.63	0.559	7.72	6.42	8.52	<6.474
SW-11	pH (PH UNITS)	ON	0	Param. Normal	31	7.45	0.498	7.36	6.43	8.60	<6.414
SW-11	Radium-226, Total (PCI/L)	OFF	4	NP (normality)	25			0.490	-0.070	2.03	2.03
SW-11	Radium-226, Total (PCI/L)	ON	0	Param. Normal	21	1.44	0.475	1.30	0.700	2.70	2.32
SW-11	Sulfate, Dissolved (MG/L)	OFF	0	NP (normality)	28			964.0	530.0	2,600	2,600
SW-11	Sulfate, Dissolved (MG/L)	ON	0	Param. Normal	28	1,709	470.8	1,750	737.0	2,550	2,525
SW-11	Uranium, Total (MG/L)	OFF	0	Param. Normal	25	0.061	0.032	0.059	0.013	0.158	0.122
SW-11	Uranium, Total (MG/L)	ON	0	Param. Normal	25	0.039	0.035	0.026	0.009	0.138	0.111

Notes:

- Surface water seasons are defined as follows: Season 1 = January, Season 2 = April, Season 3 = July, Season 4 = October.
-Eastern Drainage seasons are defined as follows: ON = April and July, OFF = October and January.
-Groundwater seasons are defined as follows: Season 1 = April, Season 2 = October.

[1] Distribution determined before calculation of the UPL using the Shapiro-Wilk test. For normal or transformed-normal data a parametric UPL is presented. For non-normal or non-transformed normal data a non-parametric UPL is presented. If more than 15 percent but less than 50 percent of the background data were non-detect and data were not normal, the data's sample mean and sample standard deviation were adjusted according to the method of Cohen, Aitchison or Kaplan-Meier (EPA, 2009) and a non-parametric UPL is presented. If more than 50 percent of the background data were non-detect, a non-parametric UPL is presented (highest value).

[2] The 95% UPL is presented based on data distribution and percent non-detects. The 95% LPL is presented for pH data. Action levels are not presented for SW-4 and SW-4U because these are background reference locations.

Table Q2-E-3. Groundwater Data Summary for Indicator Constituents (Page 1 of 1).

Location	Analyte	Season	%ND	Distribution/Prediction Limit Method[1]	N	Mean	StDev	Median	Min	Max	Action Level[2]
GW-19	Conductivity (UMHOS/CM)	1	0	Param. Normal	16	2571	156	2615	2340	2810	2854
GW-19	Conductivity (UMHOS/CM)	2	0	Param. Normal	15	2,569	289.1	2,590	2,130	3,090	3,095
GW-19	Manganese, Dissolved (MG/L)	1	0	Param. Normal	17	33.54	3.92	33.00	27.40	40.50	40.58
GW-19	Manganese, Dissolved (MG/L)	2	0	Param. Normal	17	36.97	9.32	36.10	22.00	61.80	53.71
GW-19	pH (PH UNITS)	1	0	Param. Normal	17	6.34	0.252	6.35	5.83	6.86	<5.792
GW-19	pH (PH UNITS)	2	0	Param. Normal	17	6.34	0.459	6.24	5.51	7.13	<5.339
GW-19	Radium-226, Dissolved (PCI/L)	1	14	Param. Normal	14	0.266	0.125	0.275	0.070	0.510	0.494
GW-19	Radium-226, Dissolved (PCI/L)	2	38	NP (Cohens/xform)	13	*0.246*	*0.172*	0.180	0.065	0.500	0.500
GW-19	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	18	1,579	162.7	1,572	1,270	1,850	1,870
GW-19	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	16	1,688	299.7	1,656	1,190	2,240	2,230
GW-19	Uranium, Dissolved (MG/L)	1	0	Param. Normal	17	0.117	0.063	0.098	0.043	0.242	0.240
GW-19	Uranium, Dissolved (MG/L)	2	0	NP (normality)	16			0.109	0.068	0.480	0.480
GW-35A	Conductivity (UMHOS/CM)	1	0	Param. Normal	15	2,871	289.4	2,890	2,232	3,250	3,397
GW-35A	Conductivity (UMHOS/CM)	2	0	NP (normality)	16			3,290	3,036	3,380	3,380
GW-35A	Manganese, Dissolved (MG/L)	1	0	Param. Normal	17	21.78	5.89	21.00	13.90	32.00	32.36
GW-35A	Manganese, Dissolved (MG/L)	2	0	Param. Normal	16	30.64	5.63	30.75	23.00	39.60	40.82
GW-35A	pH (PH UNITS)	1	0	Param. Normal	16	4.70	0.178	4.72	4.24	4.93	<4.307
GW-35A	pH (PH UNITS)	2	0	Param. Normal	17	4.55	0.189	4.62	4.06	4.77	<4.127
GW-35A	Radium-226, Dissolved (PCI/L)	1	0	Param. Normal	14	1.15	0.313	1.20	0.500	1.60	1.72
GW-35A	Radium-226, Dissolved (PCI/L)	2	0	Param. Normal	15	1.56	0.354	1.60	0.900	2.20	2.20
GW-35A	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	17	1,946	299.2	1,970	1,280	2,358	2,483
GW-35A	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	16	2,396	219.4	2,395	2,110	2,820	2,793
GW-35A	Uranium, Dissolved (MG/L)	1	0	Param. Normal	16	0.820	0.231	0.766	0.546	1.40	1.24
GW-35A	Uranium, Dissolved (MG/L)	2	0	Param. Normal	16	1.21	0.360	1.08	0.694	1.90	1.86
GW-36A	Conductivity (UMHOS/CM)	1	0	Param. Normal	15	2,155	156.0	2,170	1,863	2,490	2,439
GW-36A	Conductivity (UMHOS/CM)	2	0	Param. Normal	16	2,347	156.6	2,330	2,120	2,750	2,630
GW-36A	Manganese, Dissolved (MG/L)	1	0	Param. Normal	17	23.39	7.24	24.40	11.00	33.00	36.39
GW-36A	Manganese, Dissolved (MG/L)	2	0	Param. Normal	17	29.08	9.55	28.30	16.20	47.00	46.23
GW-36A	pH (PH UNITS)	1	0	Param. Normal	16	6.51	0.330	6.56	5.81	7.09	<5.783
GW-36A	pH (PH UNITS)	2	0	Param. Normal	17	6.59	0.261	6.58	6.06	6.92	<6.02
GW-36A	Radium-226, Dissolved (PCI/L)	1	38	NP (Cohens/xform)	16	*0.245*	*0.207*	0.185	0.070	0.860	0.860
GW-36A	Radium-226, Dissolved (PCI/L)	2	31	NP (Cohens/xform)	16	*0.283*	*0.266*	0.180	0.085	1.10	1.10
GW-36A	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	17	1,206	203.5	1,210	766.0	1,580	1,571
GW-36A	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	16	1,488	174.4	1,465	1,150	1,710	1,803
GW-36A	Uranium, Dissolved (MG/L)	1	0	Param. Normal	16	6.07	2.84	6.83	1.30	11.80	11.21
GW-36A	Uranium, Dissolved (MG/L)	2	0	Param. Normal	16	8.52	3.24	9.05	3.50	13.40	14.37
GW-50	Conductivity (UMHOS/CM)	1	0	Param. Normal	14	916.8	78.03	920.0	758.0	1,062	1,060
GW-50	Conductivity (UMHOS/CM)	2	0	Param. Normal	13	933.2	82.21	940.0	780.0	1,071	1,085
GW-50	Manganese, Dissolved (MG/L)	1	0	Param. Normal	14	0.227	0.125	0.185	0.040	0.436	0.457
GW-50	Manganese, Dissolved (MG/L)	2	0	Param. Normal	13	0.212	0.142	0.186	0.038	0.570	0.474
GW-50	pH (PH UNITS)	1	0	Param. Normal	14	7.23	0.491	7.22	6.02	7.84	<6.13
GW-50	pH (PH UNITS)	2	0	Param. Normal	13	7.31	0.380	7.37	6.65	7.84	<6.447
GW-50	Radium-226, Dissolved (PCI/L)	1	0	Param. Normal	14	3.89	0.902	3.80	2.40	5.40	5.55
GW-50	Radium-226, Dissolved (PCI/L)	2	0	Param. Normal	12	4.42	0.968	4.35	3.10	6.20	6.23
GW-50	Sulfate, Dissolved (MG/L)	1	0	Param. Normal	14	304.9	57.93	294.5	217.0	428.0	411.1
GW-50	Sulfate, Dissolved (MG/L)	2	0	Param. Normal	12	304.4	55.60	301.0	233.0	399.0	408.4
GW-50	Uranium, Dissolved (MG/L)	1	0	Param. Normal	11	0.053	0.013	0.050	0.037	0.084	0.078
GW-50	Uranium, Dissolved (MG/L)	2	0	NP (normality)	12			0.047	0.037	0.100	0.100
GW-51	Conductivity (UMHOS/CM)	1	0	NP (normality)	15			963.0	882.0	1,279	1,279
GW-51	Conductivity (UMHOS/CM)	2	0	Param. Normal	13	975.8	103.8	927.0	877.0	1,218	1,171
GW-51	Manganese, Dissolved (MG/L)	1	7	Param. Normal	15	0.097	0.109	0.064	0.003	0.388	0.322
GW-51	Manganese, Dissolved (MG/L)	2	0	Param. Normal	14	0.109	0.089	0.079	0.012	0.310	0.284
GW-51	pH (PH UNITS)	1	0	Param. Normal	15	7.23	0.403	7.03	6.72	8.10	<6.339
GW-51	pH (PH UNITS)	2	0	Param. Normal	14	7.33	0.242	7.26	6.91	7.78	<6.791
GW-51	Radium-226, Dissolved (PCI/L)	1	0	Param. Normal	13	0.593	0.160	0.550	0.390	0.980	0.895
GW-51	Radium-226, Dissolved (PCI/L)	2	15	NP (Cohens/xform)	13	*0.916*	*0.819*	0.800	0.100	3.40	3.40
GW-51	Sulfate, Dissolved (MG/L)	1	0	NP (normality)	14			305.5	238.0	580.0	580.0
GW-51	Sulfate, Dissolved (MG/L)	2	0	NP (normality)	13			299.0	243.0	560.0	560.0
GW-51	Uranium, Dissolved (MG/L)	1	0	Param. Normal	14	0.072	0.019	0.067	0.038	0.114	0.109
GW-51	Uranium, Dissolved (MG/L)	2	0	Param. Normal	12	0.068	0.006	0.068	0.060	0.078	0.078

Notes:

- Surface water seasons are defined as follows: Season 1 = January, Season 2 = April, Season 3 = July, Season 4 = October.
-Eastern Drainage seasons are defined as follows: ON = April and July, OFF = October and January.
-Groundwater seasons are defined as follows: Season 1 = April, Season 2 = October.

[1] Distribution determined before calculation of the UPL using the Shapiro-Wilk test. For normal or transformed-normal data a parametric UPL is presented. For non-normal or non-transformed normal data a non-parametric UPL is presented. If more than 15 percent but less than 50 percent of the background data were non-detect and data were not normal, the data's sample mean and sample standard deviation were adjusted according to the method of Cohen, Aitchison or Kaplan-Meier (EPA, 2009) and a non-parametric UPL is presented. If more than 50 percent of the background data were non-detect, a non-parametric UPL is presented (highest value).

[2] The 95% UPL is presented based on data distribution and percent non-detects. The 95% LPL is presented for pH data. Action levels are not presented for SW-4 and SW-4U because these are background reference locations.

Attachment Q2-F

Indicator Parameters and Action Levels for Select Sediment Locations

ATTACHMENT Q2-F
INDICATOR PARAMETERS AND ACTION LEVELS FOR SELECT SEDIMENT LOCATIONS

This attachment to the *Midnite Mine Superfund Site - Site Wide Monitoring Quality Assurance Project Plan* (QAPP) describes the selection of indicator parameters and development of action levels for sediment at site-wide monitoring locations. The action levels will be used to support decision making during the Remedial Action (RA) construction activities based on site-wide monitoring results. The action levels summarized in this attachment are intended to support the data quality objective (DQO) process for sediment monitoring during the RA as described in QAPP Table Q2-A-1 (located in QAPP Attachment Q2-A). Note that the action levels described herein and on QAPP Table Q2-A-1 differ from the cleanup levels established in the Record of Decision (ROD; EPA, 2006) in that the action levels are intended for use during construction to provide indication that the RA activities may be releasing contaminants of concern (COCs) to down gradient locations. The action levels are thresholds that represent a statistically significant change from historical baseline ranges. The cleanup levels established in the ROD are the final (post RA) media-specific remediation goals. The cleanup levels are exceeded at some monitoring locations at the start of the RA, and therefore are not suitable for use as action levels during the RA.

This evaluation includes calculating descriptive statistics, testing for the presence of temporal trends using the Mann-Kendall test, and calculating upper prediction limits (UPLs) that are the action levels. The evaluation was performed using Microsoft Excel as well as Sanitas groundwater statistical software configured to settings in accordance with *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (EPA, 2009).

Selection of Indicator Parameters

The indicator parameters selected for development of sediment action levels are those parameters for which a cleanup level has been determined in the ROD and that are identified in Table Q2-4 of the QAPP. These nine parameters are chromium, manganese, selenium, uranium, vanadium, radium-226, lead-210, uranium-234 and uranium-238. Eight historical sediment sample locations exist in the Upper Blue Creek drainages and all were evaluated for each of the nine parameters for data quantity and statistical viability in determining action levels to be used for sediment chemistry monitoring during the RA. The existing sediment sampling locations used in the evaluation are SW-7 at the confluence of Blue Creek and Oyachen Creek; SW-5, SW-6, and SW-12 within the Central Mine Drainage; WDAC in the Western Mine Drainage; SW-11 in the Eastern Mine Drainage; and background locations SW-4 and SW-4U in Blue Creek to the east of the Site (see SMP Figure Q1-1).

Evaluation Results

Descriptive Statistics. Descriptive statistics for the dataset were calculated and include number of samples, sample date range, percent of non-detect results, minimum and maximum

value, mean value, median value and the data distribution as determined by the Shapiro-Wilk test (EPA, 2009). The descriptive statistics are summarized below in Table Q2-F-1.

The primary observation in the existing dataset is that the numbers of samples at each location range from a single sample event up to five events between 2009 and 2013. This number of samples is generally too small for meaningful baseline characterization and future statistical testing. Additionally, mean constituent concentrations at each sediment sampling location are highly variable. Due to this spatial variability, assigning one action level for sediment constituent concentrations at all locations would result in a low level of sensitivity for the monitoring program to detect change. Therefore, unique action levels were calculated for each sampling location and constituent where data were sufficient to do so.

Temporal Trends. Historical data for each constituent at each location were tested for temporal trends using the Mann-Kendal test at a 95 percent confidence interval (Hollander and Wolfe, 1973). The presence or absence of a temporal trend in a dataset is important because it has bearing on what methods may be appropriate to use to calculate action levels for that constituent and location. For example, an exceedance of the UPL for a constituent and location that is experiencing an upward trend through time may not represent a change from pre-RA conditions, but rather is a consequence of the upward trend. No upward or downward trends were identified in the historical sediment data. However, evaluation of temporal trends will continue during the RA site-wide monitoring as the future identification of a trend may be cause for modification to an action level in the future.

Development of Action Levels. A prediction limit approach will be used to determine whether a single observation is statistically different from a group of reference observations. During the RA, a prediction limit approach will be used to make comparisons between pre-RA and RA-phase data. The interval is constructed from the historical baseline (pre-RA) data such that it proposes to contain future compliance observations with stated confidence in the absence of change. Therefore, if any future result exceeds the bounds of the prediction limit, it can be considered statistically significant evidence that that result is not representative of the baseline group and a change in conditions has occurred.

Because temporal trends were not identified in the baseline data, 95% UPLs were calculated to serve as an action level for each constituent at each location. The action levels (UPLs) were calculated using Sanitas software configured to EPA Unified Guidance settings for UPLs. In some instances, less than four baseline samples were available and UPLs were not calculated (see Table Q2-F-1 below). These locations/constituents will require additional sampling to bring the number of baseline samples to a minimum of four before action levels (UPLs) can be calculated. For locations with four or more baseline data points, the calculated action level (UPL) is presented in Table Q2-F-1.

In order to determine whether a parametric or nonparametric prediction limit should be used, the distribution of the data was evaluated by applying the Shapiro-Wilk or Shapiro-Francia tests for normality to the raw data or, when applicable to the ladder of powers (Helsel and Hirsch, 1992)

transformed data. A parametric prediction limit was constructed if the background data all follow a normal or transformed-normal distribution. If the data are other than normally distributed, a nonparametric prediction limit was used. When the background data are not normal, transformed-normal, or greater than 50 percent of the background data are non-detect, a nonparametric prediction limit was constructed. Specifically, the highest value from the background data is used as the upper limit of the nonparametric prediction limit.

Censored data (data set containing non-detects) were treated in the software as follows. If less than 15 percent of the background observations were non-detects, these were replaced with one half of the method detection limit prior to running the analysis (EPA, 2009). If more than 15 percent but less than 50 percent of the background data were non-detect, the data's sample mean and sample standard deviation were adjusted according to the method of Cohen, Aitchison or Kaplan-Meier (EPA, 2009). If more than 50 percent of the background data were non-detect, the highest value from the background data is used as the upper limit (e.g., selenium at SW-5, SW-7 and SW-11).

Use of Action Levels during Site Wide Monitoring

The action levels will be used during the RA construction as described in the DQO process included on QAPP Table Q2-A-1 (located in QAPP Attachment Q2-A). Locations/constituents with insufficient data should have their respective UPLs calculated when enough data are available. Comparison of future sediment constituent values should be performed by 1) testing the whole dataset for the presence of a trend, and 2) comparing the recent sample result to the UPL. A concentration exceeding the UPL indicates statistical evidence of changing conditions, and verification sampling or alternative actions may be warranted.

ATTACHMENT Q2-F REFERENCES

Hollander and Wolfe. 1973. Nonparametric Statistical Methods. John Wiley & Sons.

Helsel, D.R. and Hirsch, R.M., 1992. Statistical Methods in Water Resources. Elsevier.

U.S. Environmental Protection Agency (EPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Resource Conservation and Recovery Program Implementation and Information Division, U.S. Environmental Protection Agency. March, 2009.

U.S. EPA, 2006. Midnite Mine Superfund Site Spokane Indian Reservation, Washington Record of Decision. Prepared by the Office of Environmental Cleanup, EPA Region 10. September.

Table Q2-F-1 Historical Sediment Chemistry Data Descriptive Statistics and Action Levels
(Page 1 of 2)

Well	Constituent Name (Units)	Sample Date Range			N	Percent Non-Detects	Minimum	Maximum	Mean	Median	Standard Deviation	Standard Error	Distribution[1]	UPL[2] (Action Level)
SW-4	Chromium (mg/kg)	10/9/2009	-	9/28/2011	3	0	1.9	2.2	2.1	2.2	0.173	0.100	Ins. Data	--
	Lead-210 (pCi/g)	10/9/2009	-	9/28/2011	3	33.3	*1.0*	1.6	1.2	1.0	0.318	0.183	Ins. Data	--
	Manganese (mg/kg)	10/9/2009	-	9/28/2011	3	0	250	316	279	271	33.7	19.5	Ins. Data	--
	Radium-226 (pCi/g)	10/9/2009	-	9/28/2011	3	0	1.5	2.3	2.0	2.3	0.462	0.267	Ins. Data	--
	Selenium (mg/kg)	10/9/2009	-	9/28/2010	2	50	*0.118*	0.280	0.199	0.199	0.115	0.081	Ins. Data	--
	Uranium (mg/kg)	10/9/2009	-	9/28/2011	3	0	4.6	8.2	6.8	7.7	2.0	1.1	Ins. Data	--
	Uranium-234 (pCi/g)	10/9/2009	-	9/28/2011	3	0	2.1	4.0	2.8	2.3	1.0	0.603	Ins. Data	--
	Uranium-238 (pCi/g)	10/9/2009	-	9/28/2011	3	0	1.6	3.5	2.4	2.1	0.985	0.569	Ins. Data	--
	Vanadium (mg/kg)	10/9/2009	-	9/28/2011	3	0	6.0	8.3	7.2	7.3	1.2	0.666	Ins. Data	--
SW-4U	Chromium (mg/kg)	9/25/2012	-	9/30/2013	2	0	2.7	9.3	6.0	6.0	4.7	3.3	Ins. Data	--
	Lead-210 (pCi/g)	9/25/2012	-	9/30/2013	2	0	1.1	2.3	1.7	1.7	0.849	0.600	Ins. Data	--
	Manganese (mg/kg)	9/25/2012	-	9/30/2013	2	0	292	855	574	574	398	282	Ins. Data	--
	Radium-226 (pCi/g)	9/25/2012	-	9/30/2013	2	0	1.5	5.3	3.4	3.4	2.7	1.9	Ins. Data	--
	Selenium (mg/kg)	9/25/2012	-	9/30/2013	2	100	*0.250*	*0.250*	*0.250*	*0.250*	0.000	0.000	Ins. Data	--
	Uranium (mg/kg)	9/25/2012	-	9/30/2013	2	0	6.5	18.1	12.3	12.3	8.2	5.8	Ins. Data	--
	Uranium-234 (pCi/g)	9/25/2012	-	9/30/2013	2	0	2.2	6.1	4.2	4.2	2.8	2.0	Ins. Data	--
	Uranium-238 (pCi/g)	9/25/2012	-	9/30/2013	2	0	2.0	5.1	3.6	3.6	2.2	1.6	Ins. Data	--
	Vanadium (mg/kg)	9/25/2012	-	9/30/2013	2	0	7.2	23.0	15.1	15.1	11.2	7.9	Ins. Data	--
SW-5	Chromium (mg/kg)	10/9/2009	-	9/30/2013	5	0	2.8	11.9	5.6	4.4	3.8	1.7	normal	14.4
	Lead-210 (pCi/g)	10/9/2009	-	9/30/2013	5	20	*1.2*	3.2	2.1	1.9	0.793	0.355	normal	4.8
	Manganese (mg/kg)	10/9/2009	-	9/30/2013	5	0	3,020	10,600	6,070	4,650	3,451	1,543	normal	14,129
	Radium-226 (pCi/g)	10/9/2009	-	9/30/2013	5	0	3.5	6.1	5.0	5.2	0.976	0.437	normal	7.2
	Selenium (mg/kg)	10/9/2009	-	9/30/2013	4	75	*0.123*	0.430	0.263	0.250	0.126	0.063	normal	0.430
	Uranium (mg/kg)	10/9/2009	-	9/30/2013	5	0	11.2	28.4	21.4	25.3	7.4	3.3	normal	38.7
	Uranium-234 (pCi/g)	10/9/2009	-	9/30/2013	5	0	2.9	11.0	7.3	8.7	3.2	1.5	normal	14.9
	Uranium-238 (pCi/g)	10/9/2009	-	9/30/2013	5	0	2.9	9.3	6.9	8.5	3.0	1.3	normal	13.8
	Vanadium (mg/kg)	10/9/2009	-	9/30/2013	5	0	9.8	31.5	16.5	14.2	8.7	3.9	Lognormal	36.9
SW-6	Chromium (mg/kg)	9/28/2011	-	9/28/2011	1	0	8.0	8.0	8.0	8.0	0	0	Ins. Data	Ins. Data
	Lead-210 (pCi/g)	9/28/2011	-	9/28/2011	1	0	4.0	4.0	4.0	4.0	0	0	Ins. Data	Ins. Data
	Manganese (mg/kg)	9/28/2011	-	9/28/2011	1	0	15,000	15,000	15,000	15,000	0	0	Ins. Data	Ins. Data
	Radium-226 (pCi/g)	9/28/2011	-	9/28/2011	1	0	11.5	11.5	11.5	11.5	0	0	Ins. Data	Ins. Data
	Uranium (mg/kg)	9/28/2011	-	9/28/2011	1	0	29.9	29.9	29.9	29.9	0	0	Ins. Data	Ins. Data
	Uranium-234 (pCi/g)	9/28/2011	-	9/28/2011	1	0	8.7	8.7	8.7	8.7	0	0	Ins. Data	Ins. Data
	Uranium-238 (pCi/g)	9/28/2011	-	9/28/2011	1	0	8.4	8.4	8.4	8.4	0	0	Ins. Data	Ins. Data
	Vanadium (mg/kg)	9/28/2011	-	9/28/2011	1	0	17.0	17.0	17.0	17.0	0	0	Ins. Data	Ins. Data

Table Q2-F-1 Historical Sediment Chemistry Data Descriptive Statistics and Action Levels
(Page 2 of 2)

Well	Constituent Name (Units)	Sample Date Range			N	Percent Non-Detects	Minimum	Maximum	Mean	Median	Standard Deviation	Standard Error	Distribution[1]	UPL[2] (Action Level)
SW-7	Chromium (mg/kg)	10/9/2009	-	9/30/2013	5	0	2.6	8.3	4.3	3.4	2.3	1.0	normal	10.1
	Lead-210 (pCi/g)	10/9/2009	-	9/30/2013	5	20	*1.1*	2.1	1.4	1.3	0.418	0.187	normal	4.1
	Manganese (mg/kg)	10/9/2009	-	9/30/2013	5	0	685	1,180	922	942	213	95.2	normal	1,419
	Radium-226 (pCi/g)	10/9/2009	-	9/30/2013	5	0	1.6	7.0	3.2	2.4	2.2	0.981	Lognormal	8.9
	Selenium (mg/kg)	10/9/2009	-	9/30/2013	4	75	*0.119*	0.270	0.222	0.250	0.069	0.035	unknown	0.270
	Uranium (mg/kg)	10/9/2009	-	9/30/2013	5	0	10.3	27.4	18.3	20.0	6.6	2.9	normal	33.7
	Uranium-234 (pCi/g)	10/9/2009	-	9/30/2013	5	0	3.5	9.4	6.9	8.4	2.8	1.3	normal	13.5
	Uranium-238 (pCi/g)	10/9/2009	-	9/30/2013	5	0	3.2	8.9	6.5	7.2	2.6	1.2	normal	12.6
	Vanadium (mg/kg)	10/9/2009	-	9/30/2013	5	0	7.7	22.0	11.9	9.5	5.8	2.6	normal	26.6
SW-11	Chromium (mg/kg)	10/9/2009	-	9/30/2013	5	0	8.7	13.9	10.3	9.2	2.1	0.949	Lognormal	15.3
	Lead-210 (pCi/g)	10/9/2009	-	9/30/2013	5	20	*1.6*	3.8	2.0	1.6	1.1	0.479	Lognormal	5.7
	Manganese (mg/kg)	10/9/2009	-	9/30/2013	5	0	401	850	631	639	177	79.2	normal	1,045
	Radium-226 (pCi/g)	10/9/2009	-	9/30/2013	5	0	1.7	4.5	2.9	2.9	1.0	0.467	normal	5.3
	Selenium (mg/kg)	10/9/2009	-	9/30/2013	4	75	*0.120*	0.320	0.235	0.250	0.083	0.042	normal	0.320
	Uranium (mg/kg)	10/9/2009	-	9/30/2013	5	0	6.9	9.8	8.4	8.3	1.1	0.493	normal	11.0
	Uranium-234 (pCi/g)	10/9/2009	-	9/30/2013	5	0	1.2	3.3	2.3	2.3	0.896	0.401	normal	4.4
	Uranium-238 (pCi/g)	10/9/2009	-	9/30/2013	5	0	1.5	6.8	3.2	2.6	2.2	0.980	normal	8.3
	Vanadium (mg/kg)	10/9/2009	-	9/30/2013	5	0	12.0	21.0	14.4	12.4	3.8	1.7	unknown	24.5
SW-12	Chromium (mg/kg)	9/28/2010	-	9/30/2013	4	0	9.9	21.6	13.9	12.1	5.2	2.6	normal	27.7
	Lead-210 (pCi/g)	9/28/2010	-	9/30/2013	4	0	2.4	5.1	3.2	2.7	1.3	0.629	unknown	7.1
	Manganese (mg/kg)	9/28/2010	-	9/30/2013	4	0	923	4,470	2,211	1,725	1,559	779	normal	6,312
	Radium-226 (pCi/g)	9/28/2010	-	9/30/2013	4	0	2.1	2.8	2.5	2.6	0.294	0.147	normal	3.3
	Selenium (mg/kg)	9/28/2010	-	9/30/2013	3	0	0.600	0.900	0.700	0.600	0.173	0.100	Ins. Data	Ins. Data
	Uranium (mg/kg)	9/28/2010	-	9/30/2013	4	0	488	1,720	1,280	1,455	557	278	normal	2,745
	Uranium-234 (pCi/g)	9/28/2010	-	9/30/2013	4	0	292	540	414	411	102	50.9	normal	682
	Uranium-238 (pCi/g)	9/28/2010	-	9/30/2013	4	0	293	512	396	390	90.8	45.4	normal	635
	Vanadium (mg/kg)	9/28/2010	-	9/30/2013	4	0	13.0	36.5	21.4	18.1	10.5	5.2	normal	49.0
WDAC	Chromium (mg/kg)	9/28/2010	-	9/30/2013	4	0	3.3	10.2	7.7	8.6	3.0	1.5	unknown	15.6
	Lead-210 (pCi/g)	9/28/2010	-	9/30/2013	4	0	1.8	5.1	4.0	4.6	1.5	0.761	normal	8.0
	Manganese (mg/kg)	9/28/2010	-	9/30/2013	4	0	106	832	409	349	315	158	normal	1,238
	Radium-226 (pCi/g)	9/28/2010	-	9/30/2013	4	0	2.7	9.2	5.7	5.4	3.1	1.6	normal	13.8
	Selenium (mg/kg)	9/28/2010	-	9/30/2013	3	66.6	*0.250*	0.400	0.300	0.250	0.087	0.050	Ins. Data	Ins. Data
	Uranium (mg/kg)	9/28/2010	-	9/30/2013	4	0	75.4	217	158	170	62.4	31.2	normal	322
	Uranium-234 (pCi/g)	9/28/2010	-	9/30/2013	4	0	17.0	72.0	51.0	57.5	25.2	12.6	normal	117
	Uranium-238 (pCi/g)	9/28/2010	-	9/30/2013	4	0	15.0	66.0	47.8	55.0	23.2	11.6	normal	109
	Vanadium (mg/kg)	9/28/2010	-	9/30/2013	4	0	9.1	20.8	16.5	18.1	5.4	2.7	normal	30.6

Table Q2-F-1 Historical Sediment Chemistry Data Descriptive Statistics and Action Levels (Definitions)

--	Action level not applicable because sample location is a background location.
1	Data normality tested by Shapiro-Wilk test in Sanitas software at Alpha = 0.05 (95%).
2	Upper 95% prediction limit.
Ins. Data	Insufficient data size to perform normality test or calculate UPL.
Value	Minimum value represents constituent not detected. Value shown is 1/2 the method detection limit (MDL).