Midnite Mine Superfund Site

100~~90~~ Percent Design

Appendix Q2 –
Site Wide Monitoring Quality Assurance Project Plan

June 2015

~~Note: This QAPP has been prepared to a 90-percent level. Minor edits to this plan are anticipated as the Midnite Mine Remedial Design is finalized.~~

~~July 31, 2014~~

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Gina Grepo-Grove	U.S. Environmental Protection Agency
Randy Connolly	Spokane Tribe of Indians
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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~~Ellen Hale~~. 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. ~~Currently, Mr. Lyle also is the DMC/Newmont Project Manager.~~

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, ~~Site Manager, consulting project manager and~~ other consultants and contractors, and the regulatory agencies. As the Supervising Contractor, Mr. Miller will:

- ~~Coordinate and schedule day-to-day activities necessary to complete project tasks, such that the objectives of each task are met~~
- Orient the project team concerning project requirements and special considerations
- ~~Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product~~
- 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~~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 ~~or the WTP~~ Monitoring and Standards section of the OM&M Plan. The ~~senior-most personnel in the field will generally assume the role of~~ 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) ~~Report directly to the Project Manager, providing the principal point of contact and control for matters concerning the field investigation implementation~~

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~~Project Manager~~ 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~~Project Manager~~ 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:

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

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

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 ~~and radiological analyses~~
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	All metals and general chemistry

Moscow, ID 83843
208-883-2839

~~GEI Consultants Inc.~~
~~Ecological Division~~
~~4601 DTC Boulevard, Suite 900~~
~~Denver, CO 80237~~
~~303-264-1120~~

~~Effluent Toxicity Testing~~

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:

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

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:

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

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

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 ~~and Project Manager~~ 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~~Lab~~ 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~~Project Manager~~ 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~~Project Manager~~ 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~~Project Manager~~ 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~~Project Manager~~ and appropriate supervisor in charge of the audited activities (Field Supervisor or Laboratory Project~~Lab~~ Manager). The Supervising Contractor~~Project Manager~~ 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~~Project Manager~~ 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~~Project Manager~~.

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~~Project Manager~~ 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.~~Project Manager.~~ If immediate corrective action is required, approvals secured by telephone from the Supervising Contractor~~Project Manager~~ 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~~Project Manager~~ 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~~Project Manager~~ 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.~~Project Manager.~~ 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~~Project Manager~~ 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~~Project Manager~~ 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

Figures

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~~July~~ 2014	100~~90~~% design submittal
Q2-A-2	Data Quality Objectives for Surface Water Impoundment Sampling	June~~July~~ 2014	100~~90~~% design submittal
Q2-A-3	Data Quality Objectives for Water Balance Data	June~~July~~ 2014	100~~90~~% design submittal
Q2-A-4	Data Quality Objectives for Alluvial Groundwater Controls and Hydraulic Containment Water Level Monitoring	June~~July~~ 2014	100~~90~~% 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

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
(Page 2 of 3)

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. **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.	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
	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 requirerequires 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 manageroperators. Alternative actions for health and safety procedures are at the discretion of the Company Site Safety ManagerOfficer (SSO) and the Company RadiationRemedial Action Contractor (RAC) Project Safety Officer.Officers (PSO).
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 impoundmentsimpoundment 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 manageroperators, and action levels for health and safety procedures are at the discretion of the Company Site Safety ManagerSSO and the Company Radiation Safety Officer.PSOs.
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.

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
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 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? ~~(accounting for losses to evaporation)?~~
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 ~~evaporation and~~ 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. ~~or if additional, regularly scheduled monitoring will be performed to confirm the positive water balance prior to implementing the Alternative Action (see Figure Q2-2).~~

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
Step 6: Specify Tolerance Limits on Decision Errors	
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.~~Increased risk to human health and the environment down gradient of the water management system.~~
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, ~~evaporation rates,~~ 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~~observation~~ wells) within the established operating~~design~~ ranges? Is drawdown occurring in the nearby redundant well (in Pits 3 and Pit 4) ~~wells~~ or observation wells (in the BPA) indicating that dewatering is occurring away from the pumping well?
Alternative Actions	If water levels ~~(combined with up-and down-gradient COC analytical data)~~ 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 ~~(combined with up-and down-gradient COC analytical data)~~ 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~~design~~ 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 ~~in conjunction with water quality data~~ 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

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 Q1-31.	Water level measurements in the wells listed on FSP Table Q1-31.
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~~2969~~ to 2967~~2962~~ ft amsl*. Pit 4 underdrain redundant well: TBD based on dewatering activities performed

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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~~XXXX~~ *to* 3004 ft amsl*.~~XXXX*~~ Pit 4 waste rock redundant well: TBD based on dewatering activities performed during RA construction. Pit 3 underdrain dewatering well: 2516~~2525~~ to 2523~~2518~~ ft amsl*. Pit 3 underdrain redundant well: TBD based on dewatering activities performed during RA construction. Pit 3 waste rock dewatering well: 2544~~XXXX~~ *to* 2549 ft amsl*.~~XXXX*~~ 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*.~~XXXX~~ * 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
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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.

Attachment Q2-C

Laboratory Quality Assurance Plans and NELAP Certifications

Provided electronically only.

Attachment Q2-D

Corrective Action Report 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