Quality Assurance Project Plan

Former Schwartzwalder Mine Water Treatment Plant

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Prepared for:

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1.0 INTRODUCTION

The purpose of the *Quality Assurance Project Plan* (QAPP) is to document the procedures to be performed by Linkan Engineering (Linkan), required for project quality assurance (QA), quality control (QC), and data validation for all sampling and analysis activities related to water treatment at the former Schwartzwalder Mine Water Treatment Plant (SWTP) located at 8300 Glencoe Valley Road, Golden CO, 80403 in Jefferson County. The QAPP describes the specific QA procedures that will be followed for sampling, sample handling and storage, chain of custody (COC), and laboratory and field analysis. The goal of the QAPP is to identify and implement sampling and analytical methodologies that limit the introduction of error into analytical data. The QAPP provides the methodology to ensure that project data will be of adequate quantity, quality, and usability for their intended purpose, and further ensures that such data are authentic, appropriately documented, and technically defensible.

Quality assurance elements for a project are the procedures used to control those immeasurable components of a project such as using the proper sampling techniques, collecting a representative sample, specifying the proper analysis, etc. The documented procedures are used to establish adequate data quality. Examples of these procedures include generation of maintenance and calibration logs for all instruments and equipment, specification of materials acceptable for equipment and supplies, and documentation of sample collection and analysis. Although not measurable, quality assurance procedures are essential to produce quality information.

Quality control data are the data generated to estimate the magnitude of bias and variability in the processes for obtaining the relevant data. These processes may include both the field processes for obtaining the data and the laboratory processes of sample analysis.

Quality assessment is the overall process of assessing the quality of the environmental data by reviewing the application of the QA elements and the analysis of the QC data. Quality assessment encompasses both the measurable and immeasurable factors affecting the quality of the environmental data. Assessment of these factors may identify limitations that require modifications to procedures or protocols for sample collection and analysis or affect the desired interpretation and use of the environmental data.

All QA/QC procedures described in this QAPP comply with applicable professional technical standards, Colorado Department of Public Health and Environment (CDPHE) requirements, applicable governmental regulations and guidelines, and project-specific goals and requirements. This QAPP was prepared in accordance with United States Environmental Protection Agency (EPA) QAPP guidance documents, in particular the *EPA Guidance for Quality Assurance Program Plans, EPA QA/G-5*, (EPA/600/R- 98/018, February 1998).

The QAPP is a planning document only and may be changed as necessary to meet project requirements.

Radiation safety and dose control measures during sampling and analytical work are governed by the Radiation Protection Plan (RPP). This QAPP focuses on the quality of data outputs, not radiation exposure management.

2.0 PROJECT MANAGEMENT

2.1. Project/Task Organization

Sampling at the site will be performed by Linkan to determine the water quality and the activity of radioactive materials.

The following describes the management structure that will be in place during the project.

2.1.1. *Project Manager*

The Linkan Project Manager (PM) will have overall responsibility for ensuring that the project meets applicable DRMS, and CDPHE requirements, site specific data quality objectives (DQOs), and Site project requirements. In addition, the PM or their designated employee will be responsible for technical QC and project oversight. The PM will be responsible for the generation of project planning documents, procedures, and policies, and for ensuring that these plans, policies, and procedures are successfully implemented in the field.

2.1.2. *Lead Operator*

The Lead Operator will be responsible for the overall coordination of operational activities at the site and ensuring that all procedures outlined in the QAPP are properly implemented. This individual oversees daily operations, supervises sampling activities, and ensures that all collected data meets quality standards. The Lead Operator serves as the primary point of contact for any operational quality control issues and communicates regularly with the PM. Additionally, the Lead Operator ensures that all team members are adequately trained, understand their responsibilities, and follow established standard operating procedures (SOPs) and safety protocols.

The Lead Operator will be responsible for auditing the implementation of the QA program established in this QAPP. Specific duties include the following:

- Performing the project quality assessment;
- QA overview of the field operations and project report;
- Originate, review, and/or approve QA plans and procedures;
- Provide technical expertise for implementation of QA procedures; and
- Provide timely information to the PM with regard to conformance of project activities to the requirements of the QAPP, regulatory requirements, or corporate QA/QC policies and procedures.

2.1.3. *Class A Operator*

The Class A operator is a senior, certified operator who supports the Lead Operator and is authorized to make key operational decisions in their absence. This individual is responsible for monitoring system performance, optimizing treatment processes, and ensuring that regulatory and quality objectives are met. The Class A Operator oversees the proper calibration, use, and maintenance of monitoring equipment and provides technical oversight to junior operators. They are also responsible for identifying and documenting any deviations from normal operating conditions or quality control procedures and implementing corrective actions as needed.

2.1.4. *Operator*

The Operator is responsible for executing routine operational tasks in accordance with the established procedures. These tasks include monitoring equipment, recording system parameters, making process adjustments, and assisting with field sampling activities as described in the Sampling and Analysis Plan (SAP) and QAPP. Operators are required to complete field logs and data sheets accurately and report any operational or equipment issues to supervisory personnel. They are expected to follow all site-specific safety, quality assurance, and radiation protection protocols at all times.

2.1.5. *Radiation Safety Officer (RSO) / Alternate Radiation Safety Officer (ARSO)*

The Radiation Safety Officer (RSO) / Alternate Radiation Safety Officer (ARSO) is responsible for ensuring compliance with all applicable radiation safety requirements, including those outlined in the project's Radioactive Materials License(s), as well as regulations established by the Occupational Safety and Health Administration (OSHA), the U.S. Nuclear Regulatory Commission (NRC), the Colorado Department of Public Health and Environment (CDPHE), and all relevant company policies and procedures. The RSO/ARSO oversees the safe handling, use, and storage of radioactive materials and is responsible for maintaining employee exposure to radioactivity as low as reasonably achievable (ALARA). In addition, the RSO/ARSO conducts radiation surveys, exposure assessments, and monitoring activities as required by the QAPP, RPP and regulatory guidelines. The RSO/ARSO also ensures that project personnel receive appropriate radiation safety training and use personal protective equipment and dosimetry correctly. Any incidents involving potential radiation exposure or contamination are thoroughly investigated and reported in accordance with regulatory requirements and internal protocols.

2.1.6. *Offsite Engineering Support*

Offsite Engineering Support provides technical assistance to the onsite team by addressing operational challenges and supporting engineering-related issues as they arise. This role involves reviewing system performance data, assisting with troubleshooting and optimization of treatment processes, and offering recommendations for process improvements or modifications. Offsite engineering personnel may also support equipment evaluations, design modifications, and response planning for operational upsets. Their expertise helps ensure the system operates efficiently, safely, and in accordance with project objectives and regulatory requirements.

2.1.7. *Offsite Environmental Support*

Offsite Environmental Support is responsible for reviewing laboratory and field analytical data to ensure it meets project-specific quality objectives and complies with applicable regulatory standards. This person evaluates sampling results, identifies trends or anomalies, and supports the interpretation of data in relation to treatment performance and environmental compliance. The Offsite Environmental Support role also assists in verifying that QA/QC procedures have been properly followed and ensures that any potential exceedances or issues are promptly communicated to the on-site team. This support helps maintain data integrity and provides an additional layer of quality oversight for the project.

2.2. Background

The purpose of this QAPP is the operation and maintenance of the Schwartzwalder Water Treatment Plant (SWTP) located in Section 25, Township 2 South, Range 71 West in Jefferson County at 8300 Glencoe Valley Road in Golden, Colorado. The Schwartzwalder Mine is approximately 20 miles northwest of Denver at an elevation of about 6,500 to 7,100 feet above sea level.

The SWTP treats uranium-contaminated water pumped from the mine workings to the surface using reverse osmosis and ion exchange system. Water is pumped to the surface from the mine pool to ensure that the mine pool elevation remains 150 feet below the Steve Level of the mine. Linkan will operate and maintain the SWTP in a safe, effective, and efficient manner, ensuring that the mine pool elevation always remains a minimum of 150 feet below the Steve Level.

The SWTP key processes to treat water includes pre-filtering, followed by reverse osmosis (RO) and a finishing polish of the water via ion exchange (IX). Three reagents are utilized during the process; first an anti-scale is injected into the raw mine influent just prior to the pre-filters to help reduce scaling of the RO membranes. A second reagent, barium chloride, is injected into the concentrate stream coming from the RO's to precipitate radium after it is injected underground. Finally, sodium hydroxide is injected into the discharge water to adjust the water pH to within the permit-defined range of 6.5-9.0 before it can flow to Ralston Creek. The SWTP is enclosed within a steel building allowing for operation.

2.3. Project/Task Description and Schedule

The Site confirmation phase of the project will include the following field operations:

- Perform monitoring required to measure and control worker exposure and the members of the public to radioactivity during the performance of water treatment operations in accordance with the HSP and RPP;
- Removal of improperly stored radiological impacted materials (if applicable), which is further defined in the RPP;
- Load impacted materials and other operations derived waste into waste containment system (if applicable);
- Decontamination verification of equipment, and personnel;
- Transport impacted materials to disposal facility (if applicable);
- Perform radioactivity surveys, as defined further in the RPP;
- Various oversight and project management functions including sampling and analysis, radiation surveys, and project documentation including a completion and disposal report (if applicable)

All activities must be performed in accordance with health and safety requirements. Samples and measurements necessary to quantify radiological exposure is part of the RPP.

Documentation for the water treatment sampling and operations will include calibration records of field meters, gamma survey results, sample positions, laboratory analytical data, and chain of custody (COC) forms. The analytical data will be reviewed and evaluated to determine if project objectives have been met and published in a sampling data report.

2.4. Data Quality Objectives and Criteria for Measurement Data

Data collected for the operational phase of the project will be used to:

- Document all exposures during field operations;
- Generate the required data to determine waste characterization and material designation;
- Generate the required data to determine the activity level of waste material;
- Water quality monitoring and reporting;
- Mine pool water level measurement and management;
- Make decisions about the proper disposal site selection; and
- Determine the amount of material that needs to be removed from the Site to achieve ALARA objectives.

Data necessary to support these objectives includes field meter screening data (gamma survey), analytical laboratory data, sample positional data, and health and safety monitoring data.

The overall quality objective is to develop and implement procedures for field sampling, laboratory analysis, and reporting that will provide results which are technically sound, and legally defensible in a court of law. Specific procedures for sampling, laboratory instruments calibration, laboratory analysis, documentation, reporting of data, internal quality control, QC audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP and the RPP.

2.4.1. *Decisions*

Several questions (decisions) must be answered for the proper conduction of the field operations. The questions include:

- Were sufficient safeguards in place to protect the on-site workers?
- Was sufficient information gathered to determine the total extent of contamination?
- Was sufficient information collected to properly perform the Site risk assessment?

2.4.2. *Inputs to the Decision*

Inputs to the decision include the following data sources (and the corresponding affected decision):

- Portable radiation meter survey data (waste characterization, gamma survey);
- Laboratory analytical data (water quality, waste characterization, risk assessment);
- Survey data, and
- Analytical review (operational and waste characterization).

2.4.3. *Decision Rules*

A number of decision rules were used to determine the requirements for the Site operations.

2.4.3.1. Occupational Health Requirements

See Site Specific HSP and RPP.

2.4.3.2. Water Treatment Analytical Evaluation and Actions

Samples collected as part of the SWTP operation will be analyzed by the accredited laboratory(s) for the verification of compliance with plant operation and Water Quality Control certification and reporting.

2.4.3.3. Waste Acceptance Criteria

Waste Disposal selection will be completed after the completion of operations seasonally or as needed to meet ALARA objectives.

2.4.3.4. Radiological – Waste Acceptance Criteria

Radiological samples shall be collected in accordance with the SAP and RPP. The analytical results will be compared to TSDF waste acceptance criteria to determine the appropriate disposal location.

2.5. Measurement Performance Criteria

Procedures established in the QAPP are designed to ensure the generation of accurate and precise data, which demonstrates that project goals have been met. Controls must be in place to minimize bias and variability in the data.

A number of factors must be addressed to ensure the data accurately represents the actual project operation.

2.5.1. *Sample Collection*

Sample must be collected from representative material, using clean sampling equipment and containers. The samples must be properly stored, transported, and documented. The Lead Operator will supervise sampling personnel to verify sampling, storage, and transportation procedures are followed. If discrepancies are noted, corrective action will be initiated, which may include retraining, alternative sample containers, or revised procedures.

2.5.2. *Water Sampling and Radiation Instrumentation Calibration*

Specified calibration procedures must be followed for all field radiation instrumentation to ensure proper operation, as further defined in the RPP. The RSO/ARSO will review radiological instrument calibrations to ensure the procedures are being followed. If discrepancies are noted, corrective action will be initiated, which may include retraining, equipment replacement, or revised procedures.

Water sampling and measurement equipment will be maintained and calibrated in conformance with manufacturer recommendations and regulatory requirements. The Lead Operator will ensure that water sampling equipment procedures are being followed.

2.5.3. *Field Parameter Meter Calibration*

Manufacturer-specific calibrations procedures must be followed for each day of sample collection and counting. The RSO/ARSO will review meter calibrations to ensure the procedures are being followed.

2.5.4. *Laboratory*

Laboratory data will be reviewed to determine if internal quality control requirements are not met. Laboratory duplicates, spikes, and surrogates will be examined to determine if the results are of sufficient quality.

2.5.5. *Survey Data*

All water sampling and radiological surveys on site will be performed in accordance with the SAP and RPP.

2.5.6. *Documentation*

All documentation will be reviewed for discrepancies, missing information, missing signatures, etc. on a weekly basis (minimum frequency). Document deficiencies will be brought to the attention of the appropriate personnel as soon as possible for correction. Documentation may be modified if a more appropriate method is identified.

2.6. Special Training Requirements/Certification

Samples will be collected by personnel with current 40-hr HAZWOPER certification. Certification documentation will be maintained by Linkan.

Instrument specific training will be provided to the appropriate Site personnel.

Radiological Free Release surveys shall be conducted by trained individuals as specified in the RPP.

The Class A Operator is responsible for signing off on Operators working in the WTP to ensure that all operational activities are conducted in compliance with regulatory and certification requirements.

2.7. Documentation and Records

The project will generate the following documentation, which will be included in the sampling data report:

- Field meter calibration logs,
- Safety reports (Daily Job Safety Analysis),
- Sample/Survey data,
- Equipment survey reports,
- Laboratory analytical reports and supporting data (includes calibration and any corrective action data),
- Field meter calibration reports,
- Chain-of-custody forms,
- Applicable field notes (sample collection and field meter measurements), and
- Interpretation of laboratory data (statistical summaries, etc.).

The sampling data report will summarize the field activities. Any modifications to initial procedures caused by unforeseen problems will be discussed. All measurement and analytical data will be summarized, and the necessary calculations will be performed to show compliance with the appropriate guidance and waste acceptance criteria.

3.0 RADIOLOGICAL SAMPLING PROCESS DESIGN

3.1. Sample Methods Requirements

The sample types, number, documentation, and sample collection methods for the project are detailed in the SAP and RPP.

3.2. Sample Handling and Custody Requirements

Linkan personnel will maintain a documented COC record for all analytical samples submitted for on and off-site analysis. The COC documents that the sample was in the possession of a specified individual until it has been transferred to another responsible individual, stored in a secure location, or shipped to a laboratory (COC must accompany the samples).

3.2.1. *Field Procedures*

The following steps must be taken by field personnel to ensure maintenance of unbroken custody over field samples:

- Use only approved containers for acquiring samples;
- Properly label all sample containers at the time of sample acquisition;
- Record all required sampling information in field notebooks and/or sampling forms as applicable (e.g., soil type, color, etc.);
- Ensure that labels are legible and intact after sampling or write information directly on sample container;
- Immediately place samples in a designated container (cooler, etc.) that accompanies the sampling personnel until custody can be surrendered;
- Place the sample in a secure location if not transferring to another individual;
- Document all changes of sample custody such as transfer to on site contractors or to the laboratory; and
- Use an appropriate custody seal on the sample container during shipment to ensure no tampering en route to the laboratory.

3.2.2. *Approved Sample Containers*

Samples will be placed and transported in containers appropriate to the sample matrix and analytical parameters.

3.2.3. *Sample Label Requirements*

Samples will be labeled with the following minimum information:

- Date and time of sample;
- Unique sample number;
- Project identification or company name;
- Name of sampler;
- Requested analysis;

- Preservative (if applicable); and
- Matrix identification.

Other information may be included on the sample label if appropriate.

3.2.4. *Sample Documentation*

Sampling activity is documented in field notebooks or on field sampling forms. If a standard form is available for the documentation of sampling activities, it should be used. Otherwise, the relevant information should be recorded in field logbooks. The following information will be recorded:

- Sample point designation (as approved by the Department(s));
- Type of material sampled (e.g., clay, sand, silt, etc.);
- Appearance of sample material (e.g., soil type and color);
- Site conditions that might affect sample characteristics or integrity;
- Results of any field measurements;
- Calibration information or references for field instruments used;
- Quantities of sample obtained, or quantity of material sampled, and;
- Any other information necessary to locate the sample in time and space and apply the results of the analysis to project objectives.

3.2.5. *Preservatives*

Except for ice, only preservatives provided by the receiving laboratory will be used for samples.

3.3. Analytical Requirements

3.3.1. *Laboratory Analytical Procedures*

Samples will be analyzed at a certified environmental/radionuclides laboratory. Samples designated for laboratory analysis will be analyzed in accordance with laboratory-specific internal procedures for the specified analytical method. The laboratory methods used for this project will include:

- Natural Uranium and its decay chain
- Heavy metals
- Other parameters required by Site Licenses and Permits

Radiological and Water Quality sample detection limits for the required analytes will be the standard laboratory detection limits.

Additional analytical procedures may be identified during the project in response to previously unidentified material or additional analytical requirements. If this scenario occurs the PM or senior technical staff will review appropriate methods and contact the laboratory to determine the appropriate sample methods and detection limits.

3.3.2. *Radiological Field Equipment Analytical Procedures*

Radiological field equipment analytical procedures can be found in the RPP.

3.4. Quality Control Requirements

The following sections discuss the QC requirements for the types of samples required by this project. The samples may include environmental radioactivity survey samples, personal and work area air, and water quality samples.

3.4.1. *Occupation Health Samples Quality Control Requirements*

Occupational health samples addressed consist of personal breathing zone and work area air monitoring samples that may be obtained during Site activities, and wipe samples for the measurement of removable radioactivity. Further details about the occupation health samples quality control requirements can be found in the RPP.

3.4.2. *Personal Air Samples Quality Control Requirements*

Personal air monitoring is not currently anticipated; however, it may be conducted at the discretion of the RSO based on site-specific conditions or as required by the RPP. If implemented, air samples obtained from individual workers' breathing zones will follow the level of quality control effort specified in the applicable analytical methods described in the RPP. Monitoring may include radio nuclides, if relevant. Where such methods exist, the analytical methods established by the National Institute of Occupational Safety and Health (NIOSH) will be used for the analysis of these constituents. If there is no published NIOSH method, other technically sound determinative methods will be utilized. Samples of other airborne contaminants or potential airborne contaminants may be collected and analyzed as site conditions or materials encountered may dictate.

3.4.3. *Sample Quality Control Requirements*

Samples will be properly collected and stored to prevent cross contamination in accordance with the SAP and RPP.

3.4.4. *Laboratory Quality Control Requirements*

Laboratory QC shall be in accordance with established internal laboratory procedures that were reviewed as part of their certification. Standard QA/QC procedures include initial calibration, continuing calibration, reagent blanks (where applicable), laboratory control samples (for radionuclide samples), laboratory duplicates, serial dilutions (as needed), tracer samples (both chemical and radionuclide), and matrix spike/matrix spike duplicates (i.e., addition of known quantities of chemicals or radionuclides).

All laboratory quality control samples shall be reported along with the standard sample analyses. Problems with laboratory QC shall be reported in the laboratory data package. Analysis that are out of accepted laboratory QC ranges shall be reported to the Offsite Environmental Support personnel to determine if the samples need to be rerun. Problems with QC shall be corrected as soon as possible and affected samples may require re-analysis.

3.5. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All instrumentation used for this project shall require testing, inspection, and maintenance. Equipment problems will be identified in a timely manner and the instrument will be repaired or replaced as soon as possible. Instrumentation that will or may be used on this project includes:

- Hand-held radiation survey instruments;
- Various air sampling pumps;
- Laboratory analytical instruments, and
- Water sampling measurement and sampling equipment.

3.5.1. *Field Instrument Preventive Testing, Inspection, and Maintenance*

Manufacturer or vendor specified preventive maintenance procedures and/or consumable item replacement schedules shall be strictly followed for all field instrumentation/equipment.

Field instrumentation/equipment will be function checked and/or calibrated before being assigned to the field activity. Function testing and/or calibration in the field will be performed daily or in conformance with the manufacturer's recommendations. A sufficient inventory of repair items and consumable components will be maintained on the site to keep the field instruments and equipment in service. Arrangements will be made with off-site vendors and service companies for repair and maintenance of instruments that require specialized equipment or skills.

3.5.2. *Laboratory Instrument Preventive Maintenance*

Laboratory instrumentation shall be maintained in accordance with certified internal laboratory procedures. Maintenance problems shall be brought to the attention of the PM or Offsite Environmental Support personnel if data quality is affected.

3.5.3. *Instrument Calibration and Frequency*

All field instrumentation shall be calibrated in accordance with the SAP, RPP, and manufacturers' recommendations. Laboratory instrumentation shall be calibrated in accordance with internal procedures.

3.6. Inspection/Acceptance Requirements for Supplies and Consumables

Certified clean containers shall be used for all samples. The documentation of the sample containers shall be maintained with the project files.

Supplies and consumables used by the laboratory shall be evaluated in accordance with their internal standard procedures to ensure QC is maintained. A record of this process shall be maintained with the project files and/or presented in the data package.

3.7. Data Management

Data generated during this project must be technically sound, capable of supporting engineering decisions, and legally defensible in a court of law. Data must be managed to ensure that all data is of adequate quantity, quality, and usability for their intended purpose, and further ensures that such data are authentic, appropriately documented, and technically defensible.

Site data will be reported to project management in the form of summary tables and procedural documentation (e.g., water sampling, health and safety exposure monitoring, other sampling activities, air quality, radiation surveys). Other information will be compiled and submitted as requested by the PM. Numerical data summaries and reports of information subject to this QAPP will be reviewed and endorsed by the Offsite Engineering Support personnel before submittal in final form. Specific deficiencies or

reservations regarding the reported data, data reduction, or conclusions will be discussed in the sampling data report.

3.7.1. *Data Recording*

Data for this project will be in written and electronic form. Some reporting will be made through the Department website portal (discharge reporting). The portal reporting will be documented in the form of email to the project management team. All Site data will be recorded in field notebooks, COC forms, instrumentation visual output, instrumentation digital output, and software generated digital output. All of this data must be accurately recorded and cross-checked to verify quality data is produced for decision making and the sampling data report. Each employee shall be responsible for accurately filling out water quality reports, surveys, measurement data, sample labels, COC forms, and field notebook entries. Instruments must be accurately read and entered into field notebooks. Equipment problems and corrective actions shall be noted, as necessary.

Laboratory analyses will be provided in standard laboratory data packages with appropriate QC documentation.

3.7.2. *Data Validation*

Data validation will be required for both water quality and radio nuclides and should follow guidelines such as the National Functional Guidelines for Data Validation. Validation review should include confirmation that initial and continuing calibrations were performed, analytes are absent in the reagent blank (if appropriate), and recoveries from the Laboratory Control Sample are within acceptable limits. Review also should address split and/or duplicate analysis (if applicable). Tracer and spike recovery rates should be checked for compliance with specific control limits. Documented internal laboratory limits shall be used for the validation.

3.7.3. *Data transformation*

Data transformation will primarily be limited to determination of instrument detection limits and statistical interpretation of the data. The required equation for instrument detection limits shall be entered into a Microsoft Excel spreadsheet with data cells available for the input parameters. The equation cells shall be protected to prevent unauthorized tampering. The input parameters should be checked during each use to ensure accurate data generation.

Statistical interpretation of the data will be primarily performed in Microsoft Excel using accepted statistical methods. Data input to Excel will rely on electronic submittals from the laboratory and manual input of field data. The data input section will be reviewed as needed if the input parameters must be entered by hand.

3.7.4. *Data Transmittal*

All data from the laboratory shall be in electronic format. The laboratory will provide an electronic data deliverable (EDD) of the data prior to sending the final data report in pdf format. The EDD shall be in space or comma separated ASCII format or in Excel spreadsheet format to allow easy downloading.

3.7.5. *Data Reduction and Analysis*

Data reduction techniques will include general data review, statistical analysis including looking for outliers, and relational and statistical plotting of data. If outliers or other data values appear incorrect, the data reduction method used will be reviewed. If the method appears valid the raw data will be examined for inconsistency or input errors. To ensure that problems are promptly identified, data reduction operations will be performed throughout the project.

Data reduction for laboratory data will be performed in accordance with the laboratory internal procedures. If alternative methods are required because of previously unidentified sample requirements, the PM, Offsite Environmental Support personnel, and the laboratory will determine the appropriate method and data reduction needs.

Each laboratory utilized as a vendor of analytical services in support of this project will supply information relating to their internal management procedures for data reduction. Offsite Environmental Support personnel will review the laboratory procedures.

3.7.6. *Data Tracking*

The Lead Operator, the Offsite Environmental Support personnel and the Offsite Engineering Support personnel will be responsible for the project data tracking. This will include checking of the field notebook for completeness and consistency, review of COC forms, and review of laboratory submittals. The Offsite Environmental Support personnel shall maintain close communication with laboratory personnel to ensure timely delivery of the data. Data delivery delays must be quickly addressed because of the effects on project schedules. If delivery problems are not quickly resolved, the Offsite Environmental Support personnel or PM will initiate corrective action measures.

3.7.7. *Data Storage and Retrieval*

All project data will be maintained in hard or electronic copies. Backup copies of all laboratory submittals will be digitally maintained or equivalent. All of the appropriate data will be provided in the sampling data report. The majority of the sampling data report will be in electronic format, but some submittals may be in hard copy form.

4.0 ASSESSMENT/OVERSIGHT

4.1. Assessments and Response Actions

Performance and system audits of field activities may be conducted to verify that activities are performed in accordance with the procedures established by or provided in the SAP, RPP and QAPP. The lead operator will conduct audits of all field activities. The audit will include a review of applicable records, record-keeping practices, and field operations to ascertain that field activities are conducted in accordance with established procedures.

A general project review will be provided to all personnel prior to the commencement of the project to review project details and assign tasks. Follow-up training may be provided on an as needed basis. Audits may be performed to check on the implementation of specified corrective actions.

The Lead Operator will prepare a written record of any field audits performed. The findings of any such audits, including any corrective actions recommended or required, will be included in the sampling data report.

Corrective actions may be required for either field or laboratory actions. The procedures for initiating corrective action are similar in both cases.

4.1.1. *Field Corrective Actions*

Corrective actions may be required in the field to correct situations or conditions with a negative impact on data or sample quality. These conditions may arise from an instrument or device malfunction or from a failure to follow established procedures.

4.1.1.1. Instrument Malfunction Corrective Actions

A formal corrective action will be implemented as soon as the existence of an equipment or instrument malfunction is brought to the attention of the Lead Operator or the PM. The following actions will be undertaken:

- Identify the item that is not functioning properly;
- If possible, determine how long the item has been malfunctioning;
- Remove the item from service and order its repair or replacement; and
- Evaluate the effect of the malfunction on current and past operations.

The Lead Operator will make a written record of the circumstances of the corrective action. If the condition results in the impairment of the quality of data already collected, the senior technical personnel will identify the affected data, evaluate the effect of the equipment malfunction, and take appropriate action to correct the affected data, if this is possible. Corrected data will be noted as such, together with a statement of how the correction was performed. Data that cannot be corrected will be identified. Limitations on the future usability of the data will be noted.

The Lead Operator will conduct such follow-up investigations as may be required in the event of an equipment malfunction. The effectiveness of any repairs, replacement, or recalibration will be examined and evaluated.

4.1.1.2. Procedural Corrective Actions

Failure to follow approved procedures for field operations also will result in a formal corrective action when necessary. When the Lead Operator becomes aware of a breakdown in procedural discipline, several actions must be undertaken. These include the following:

- Consultation with the Project Manager to identify the situation and define its scope and significance;
- Evaluate the effect on data quality of the failure to follow approved procedures;
- Determine the extent and duration of the procedural breakdown;
- Instruct affected personnel in the proper procedure;
- Conduct follow-up inspections, observations, or audits to ensure that the procedure is being properly utilized; and
- Prepare a written record of the corrective action.

4.1.1.3. Laboratory Corrective Actions

Implementation of corrective actions will be the responsibility of the laboratory's QA personnel. In the event that Contractor personnel discover errors or inconsistencies with laboratory data, the Offsite Environmental Support personnel will initiate an investigation to determine if a corrective action is required. Offsite, Environmental Support personnel may order corrective action in the event that any condition or circumstance results in the impairment of laboratory data.

The laboratory will be required to inform the Offsite Environmental Support personnel of any laboratory corrective actions undertaken and identify any data whose usefulness may be affected by the condition or circumstance causing the corrective action. This requirement applies for corrective actions initiated by the laboratory as well any corrective actions ordered by the Contractor.

4.2. Reports to Management

The PM will be updated verbally and electronically (if necessary) of problems as the project progresses. Key information includes summaries of routine QA operations, result of any audits, status of continuing corrective actions, and any other matters relevant to QA issues affecting the project.

A summary of QA activities, including any conditions or situations affecting data completeness or quality, corrective actions, and outcomes of corrective actions will be prepared as part of the sampling data report. The report will address completeness and reliability of data generated during project activities, quality, and completeness of documentation, and identify data and documentation that is incomplete or not in conformance with the requirements of the project requirements. The QA reporting will be incorporated into the required reports to the Department (as applicable).

5.0 PROJECT SPECIFIC DATA VALIDATION

The Offsite Engineering Support personnel will review project data throughout the process to ensure the data quality objectives are being met and the reported data is accurate and complete.

Environmental sampling that indicates potentially excessive exposures, will be brought to the attention of the PM by the RSO / ARSO as soon as the information is available. Again, data review and validation for environmental samples will be a continuing effort throughout the project.

6.0 QAPP REVISIONS

During the course of environmental data collection, it is possible that changes will occur and revisions to the QAPP will have to be made. Any changes to the technical procedures will be evaluated senior technical personnel and PM to determine if they significantly affect the technical and quality objectives of the project. If so, the QAPP will be revised and re-approved, and a revised copy will be sent to the Colorado Department of Public Health and Environment (CDPHE).