ON-PROPERTY FRI DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is a 7-step systematic planning process recommended by the U.S. EPA when environmental data are used to select between potential alternatives or estimate extent of contamination (EPA 2006). DQOs were developed in the DQO report submitted to the U.S. EPA in October 2008 (Atlantic Richfield, 2008) and approved with comments by the EPA on April 23, 2009 (U.S. EPA, 2009). The intent of the PWP submitted to the EPA in July 2009 was to meet the requirements of the Administrative Order, elaborate on the data gap activities identified in the DQO Report, and present a prioritization and general scope and schedule for upcoming RI/FS investigation activities. The PWP also provided a Sampling and Analysis Plan (SAP) with a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP). The QAPP included identification of the primary analytical methods compared to typical human health and ecological risk assessment decision criteria, which are incorporated in to the more detailed DQOs provided here.

This FRI work plan is being prepared to expand upon the DQO Report and the PWP and provide specific details such as refined DQOs; the investigation locations; the number of soil borings and/or monitoring wells to be installed; the number of samples of soil, surface water, groundwater, biota and other applicable medium to be collected; the analytical program; and a schedule for implementation of the On-property FRI.

STEP 1 - STATE THE PROBLEM

Give a concise description of the problem that necessitates the study and develop a conceptual model of the environmental hazard to be investigated.

To assess on-property sources of acid drainage from the Leviathan Mine site that have the potential to degrade surface water quality. Assess whether concentrations of metals associated with past activities at the site exist at concentrations that exceed reference concentrations and/or present an unacceptable risk to human and/or ecological receptors.

The conceptual site models (CSMs) for the human health and ecological risk assessments are presented in the PWP and summarized where applicable to this On-property FRI.

Infiltrating precipitation and other waters contact mine waste and natural materials in some areas and create acid mine drainage that has the potential to discharge and impact surface water. The location and volume of the acid sources, the sources of water contributing to acid discharge and chemical processes during transport are not sufficiently understood to support necessary decisions.

Certain on-property areas may contain high concentrations of metals that represent a potential exposure to current and future human health and ecological receptors identified in the CSM.

STEP 2 - IDENTIFY THE GOALS OF THE STUDY

Identify the Decision (Principal Study Questions) - Identify principal study question, consider alternative outcomes, develop decision statements, organize multiple decisions.

Besides the discharges already captured, are there other sources of acid rock discharge to surface water on property that require remediation?

Alternative outcomes include:

If there are additional acid rock discharges that are degrading surface water quality in on-property streams then additional action may be necessary to mitigate or remediate these discharges.

If there are no additional discharges degrading surface water quality in on-property streams, then no additional action may be needed.

Does exposure to the COPC impacted soil, surface water or groundwater pose an unacceptable current or future risk to human or ecological receptors?

Alternatives outcomes include:

If the mean concentration of COPCs in surface water, sediment, soils, groundwater, and/or biota from potentially impacted areas are not substantially greater than COPC concentrations in surface water, sediment, soils, groundwater, and/or biota from reference locations (with greater than 90% confidence), then risks associated with the potentially impacted areas are similar to reference areas, or are within the acceptable risk range, and no action may be acceptable.

If mean COPC concentrations in surface water, sediment, soils, groundwater, and/or biota from potentially impacted areas are substantially greater than COPC concentrations in surface water, sediment, soils, ground water, and/or biota from reference areas (with greater than 90% confidence), then risks associated with the potentially impacted areas are higher than reference area risks, and risks should be assessed and corrective measures may need to be evaluated.

STEP 3 - IDENTIFY THE INPUTS TO THE DECISION

Identify types and sources of information needed to answer study questions, identify the basis of information, and select appropriate sampling and analysis methods for generating the information.

Several types and sources of information are needed to answer the study question. Field observations and physical, chemical and biological analytical results from a number of sitewide and source area specific studies will be collected.

Chemical concentrations at the site will be compared to relevant reference concentrations and human health and ecological benchmarks in comparable media. Issues related to selecting appropriately representative reference locations and defining reference data for each medium are addressed in the appropriate focused remedial investigation work plan based on U.S. EPA guidance for the evaluation of reference conditions (U.S. EPA, 2002). Human health risk-based screening levels and ecological site screening levels need to be developed and agreed upon.

The data to be used in the risk assessments will be consistent with EPA guidance (e.g., Risk Assessment Guidance for Superfund et al.).

The appropriate data quality standards and sampling procedures are described in the draft Sampling and Analysis Plan (SAP) with the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) (AMEC 2009). Chemical and biological analytical methods identified in the SAP and this FRI will be adequate to assess concentrations of COPCs in order to compare these results to the appropriate reference condition and human health and ecological screening criteria and in order to make the appropriate site decisions. Physical testing methods identified in the SAP and in this FRI will be adequate to generate data to make the appropriate interpretation of these data with respect to the physical constraints that control fate and transport and/or the integrity of existing facilities and materials. Additional detail on data collection methods are described in the FRI.

Inputs to mitigate impacts and assess risk are listed below. Each type of data will have the appropriate tolerance limits so that the data generated can be used to compare to the appropriate performance or acceptance criteria (e.g., chemical analysis methods with the appropriate sensitivity to generate data to compare to the appropriate risk based screening levels). Table 3 through 7 of the QAPP defines the appropriate limits for chemistry analytical data. Existing data will be used to limit the need for additional data collection where possible.

1. **Physical Data** - Physical data confirming the location of mine features including area and volume of mine material and structures (sources) that might be contributing to ARD discharge and transport pathways that may represent a potential risk to human

and ecological receptors. Data collection methods will include geophysics, excavation, observation, drilling, field measurement and surveying.

Meteorological data, surface water, pond level data, storm water and groundwater level and flow data will be collected. A new meteorological station will allow measuring these data to the most accurate units. Surface water, pond levels, storm water flows and groundwater elevation data will be collected both by direct measurement and by automated methods.

Selected samples will be collected for physical testing to assess hydrogeological fate and transport characteristics. Mineralogical analysis may also be conducted to better characterize source materials.

2. **Chemical Data** - Assessment of the chemical characteristics of source material creating or contributing to ARD and that may represent a human health or ecological exposure. Soil, surface water, sediment and groundwater water data will be collected and analyzed. Chemical analytical methods compared to human and ecological reference values are identified in the QAPP.

3. **Bioassessment Data** - Biological data to assess the exposure to ecological and human health receptors and to measure baseline conditions from discharges for the risk assessment. Biological data will be compiled from public resources, and confirmed through field surveys and selected sampling activities. Analytical methods and initial reference values for biological data are provided in the QAPP.

4. **Geotechnical Data** - Specifically collected to assess the condition of the existing facilities (structure and piles) and consisting of observation, field measurement and physical testing. Data will also consist of field measurements and laboratory testing of materials for use in the assess of the integrity of existing structures, the repair of existing structures and slopes, the expansion of existing facilities and the construction of new facilities.

Reference data will be developed under a separate FRI work plan.

STEP 4 - DEFINE THE BOUNDARIES OF THE STUDY

Specify the target population, determine spatial and temporal limits, identify practical constraints, and define the scale of inference.

The data of primary interest include meteorlogical data, surface water, storm water, sediment, groundwater and biota collected from the on-property study areas.

The on-property study areas (ACSA, PSA, and LCSA) include the area disturbed by mining at Leviathan Mine. These areas include the current locations of mine waste and mining related disturbances at the surface, and the volume and extent of in-situ rock that contributes water and acid drainage.

Human receptors include the current on-property trespasser, future on-property recreational visitor and future on-property Washoe tribe member. Ecological receptors include mammals, fish, birds, reptiles, amphibians, invertebrates, and plants. The appropriate exposure area will be defined in order to assess each of these receptors. The exposure period is current and future risk.

The study duration will extend from the fall of 2009 through at least two complete hydrologic cycles and may extend to later time periods if additional information is determined to be necessary based on evaluation of initial information.

Where possible, data collected will provide information on seasonal variability. However, access to the on-property area is limited due to weather conditions and the majority of the data collection will likely occur between June 1 and September 30 of each year.

STEP 5 - DEVELOP THE ANALYTIC APPROACH

Specify appropriate population parameters for making estimates and specify the statistical function and the estimation procedure.

Population parameters include the study areas (ACSA, PSA and LCSA), the appropriate number of samples necessary to physically or chemically characterize each media and a distribution appropriate for that media. Additional detail on the population parameters is provided in the rationale and procedures presented in each sample collection description in this FRI Work Plan.

The statistical parameter often selected to characterize a site is the “mean” because it is frequently used to model random exposure to environmental contamination (Byrnes, 2008).

Historical data and any new data collected will primarily support evaluation of the potential risks to human and ecological receptors, evaluate long-term treatment options for surface water discharges, and evaluate potential geotechnical stability issues that could affect implementation of long-term remedies.

STEP 6 - SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

Specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors.

Sensitivity for each of the data types are described below.

1. **Physical Data** - Physical data collection methods will include geophysics, excavation, observation, field measurement and surveying. Modern remote detection techniques are accurate to a few meters, field sampling will be used to confirm remote detection and will be accurate to within less than one meter (vertically and horizontally). Meteorological data, surface water, pond level data, storm water and groundwater level and flow data will be collected to the most accurate measurements needed for the intended use.
2. **Chemical Data** - Chemical analytical methods are specified in the QAPP.
3. **Bioassessment Data** - Analytical methods are provided in the QAPP.
4. **Geotechnical Data** - Field measurements and laboratory testing of materials for use in the assessment of the integrity of existing structures will be recorded according to ASTM standards.

Sampling of surface water, sediment, soils, groundwater, and/or biota will be performed opportunistically and professional judgment will be used to assess the suitability of initial sampling results. Both statistical and judgmental sampling designs will be employed as warranted by the media of interest. As additional data are available, statistical analysis will be applied to assess concentration data such that a confidence level of at least 90% is achieved.

Appropriate quality assurance/quality control (QA/QC) measures will be in place (e.g. collection of field duplicates, laboratory splits, trip blanks, calibration data) as specified in QAPP to reduce the risk of sampling and analytical error. Implementation of these measures will result in a reliable analytical data set suitable for use in risk assessment and engineering design. As described in the draft QAPP, analytical data will be evaluated in accordance with PARCC parameters through use of laboratory control samples, calibration data, and results of MS/MSD samples.

STEP 7 - DEVELOP THE PLAN FOR OBTAINING DATA

Select the resource-effective sampling and analysis plan that meets the performance or acceptance criteria.

The sampling plan for the on-property investigation is developed in the next section of this FRI. Sampling of soil, sediment, surface water, biota and groundwater will proceed initially using professional judgment to provide location information suitable for supporting engineering design. Evaluation of initial information has been used to design a sampling and analytical strategy to quantify physical and chemical parameters sufficiently to support risk assessment and to make site decisions.

Surface Water

Sampling of surface water and sediment will occur during specific time ranges determined by the seasonal hydrological flow patterns of the watersheds. Sampling locations will be verified through field reconnaissance. Additional sites may be included and additional sampling will be performed as needed to support requirements for risk assessment and the development of reference conditions.

Sediment

Stream sediments will be collected from the reach that includes the surface water sampling stations. The use multi-incremental sampling (MIS) methodology (see description) is anticipated to allow representative soil/sediment samples to be collected and reduce the analytical costs. Sediment samples will be collected along a systematic grid pattern and composited using MIS processing procedures to form a single sample for analysis. To allow statistical comparisons, composite samples be collected from each reach.

Groundwater

Sampling of groundwater will occur during specific time ranges determined by the seasonal hydrological flow patterns of the watersheds. Historic well location and rehabilitation activities will be conducted under a separate FRI (AMEC, 2009x) to determine if these historic locations are currently viable monitoring locations. Additional groundwater monitoring wells will be installed on property as part of the site-wide hydrogeologic investigation and to assess source contribution and assess migration pathways.

Groundwater samples will be collected seasonally, where safe access allows, coinciding with the hydrologic cycle at the site, and as necessary based on review of new information as it is acquired.

Soils

Soil samples will be collected in each of the study areas/potential sources areas to evaluate potential source contribution and human health and ecological risk. Soil samples will be analyzed with COPCs. Where possible representative soil samples will be collected and then compiled to reduce the analytical costs.

Biota

Plant

Plant sampling will be conducted in each of the study areas as necessary to assess the exposure pathways identified in the CSM.

Fish

Fish population estimates will be accomplished using the three pass electrofishing method (Li and Li, 1996) described in greater detail in the FRI Work Plan. Chemical analysis of selected fish species would be completed by creating three composite samples following protocols in EPA (2000).

The Herbst index will be used to assess the health of benthic invertebrates and EPA soil screening levels will be used to assess impacts to soil invertebrates. The risk for other receptors will be estimated by calculating the dose from soil/sediment, plant and fish receptors.