# DRAFT

## SAMPLING AND ANALYSIS PLAN
## ARCHER MINE

Prepared for:
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California State Office
U.S. Department of Interior
Bureau of Land Management

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## TABLE OF CONTENTS



LIST OF FIGURES



LIST OF TABLES

## 1.0 INTRODUCTION

The U.S. Department of Interior, Bureau of Land Management (BLM) prepared this Sampling and Analysis Plan (SAP) for a Abandoned Mine Land (AML) investigation to be performed at the Clear Creek Management Area, Hollister Field Office. The purpose of this SAP is to identify the activities that will be conducted to: (1) map the geology, mining and site features, (2) characterize the location and nature of any mercury sources, including naturally occurring sources, adjacent to the Archer AML site.

In 2004 the BLM was formally under a Regional Water Quality Control Board Resolution to meet water quality objectives for mercury into Clear Creek. These numeric objectives are difficult to meet, and may require additional best management practices (BMPs) to address non-point source sediment from the naturally occurring mercury enriched outcrops. Although this Archer AML site is in a different watershed than the Clear Creek TMDL, it still warrants remediation due to the release and transport of mercury into the White Creek watershed.

Using geological mapping and ground survey, BLM needs to field map the suspected mercury enriched outcrops, mined sites and alluvial terrace deposits to determine the pathways that allow contaminated sediment to reach the White Creek tributaries, main stem drainage and increase the mercury loading into the surface water.

Using the BLM technical staff located in Hollister, Sacramento, and Denver and USGS staff in Menlo Park, soil samples will be analyzed to determine the potential of geochemical/geophysical properties of the native serpentine and the mercury enriched intruded veins that would allow detailed field mapping of the location and distribution of these rock types and associated sediment transport.

## 2.0 SITE HISTORY AND SITE DESCRIPTION

### 2.1 Environmental Setting and Background

The White Creek watershed site is located in Western Fresno County approximately 65 miles south of Hollister, California in a remote area of the Diablo mountains at approximately $36^{o}$ 17' 29"N, $120^{o}$ 33' 14"W, (Figure 1). For the purposes of the preliminary investigation, the site will be defined to include the area shown in Figure 1.

The White Creek watershed is the southern upland drainage area of the Arroyo Pasajero and drains steep upland areas of the Diablo mountain range. White Creek runs into the Arroyo Pasajero just downstream of Coalinga. The climate in the watershed is semi-desert temperate, with wet winters and hot, dry summers. There is typically little or no precipitation during the period May-November.

White Creek runs roughly northwest-southeast and is bounded to the north and east by the Diablo Mountains and to the south and east into the Central Valley. White Creek drains an area that is predominantly public land managed by the BLM. Most of the land is used for recreational purposes including off-road vehicle usage. Past land use has included a number of mining activities due to deposits of asbestos, chromium, mercury, and other metals.

Past soil sampling by BLM showed mercury between 2.5 to over 10 ppm (BLM, 1993). Sampling by USGS indicated calcine concentrations from 4.4->100 mg/kg near the millsite. Areas of highest soil results were near the Archer Millsite (also referred to as Archer Camp), however the Archer Mine water discharge was sampled and a result of 5.2 ppm(b?) was obtained. between the Archer millsite and the Archer Mine's surface workings (underground shafts now mostly unsafe and partially to totally collapsed) there are some fluvial terrace deposits containing mercury waste.

### 2.2 Topography

The area of interest is the upper White Creek watershed. White Creek runs through a narrow canyon bordered by steep hillsides of asbestos-bearing lithologies. Little vegetation grows on these slopes. The average elevation of White Creek in the site area ranges from 2,600 to 3,600 feet above mean sea level. White Creek forms a northeast-southwest valley in the serpentine rocks of the Diablo Mountains that is dissected by north and south flowing ephemeral tributaries.

The major structures associated with the White Creek watershed are roads, off-road vehicle trails, and abandoned asbestos mines including the Atlas Superfund and the Coalinga Mine Superfund site, and other smaller asbestos exploration pits.

### 2.3 Geology

The watershed occurs in the Diablo mountains geologic province, which includes Franciscan Formation sedimentary rocks, and various igneous and metamorphic rocks, including serpentine, and silicate-carbonate rocks. Geological mapping of the area has been compiled by Dibblee, 1971, Moore, 2006 and Moring, 2006 and is shown on Figure 2. There is little Franciscan rock in the watershed except at high elevations in the west side of the study area.

A key geologic feature of the White Creek area is a large dome-shaped deposit of serpentine. This geologic feature is commonly described as "barrens" at the land surface because the material is generally fairly crusty and does not support much vegetation. The serpentine also contains asbestos and is managed as a hazardous area by BLM.

The largest mineral deposits in the region occur as fillings in fractures around the edges of this serpentine dome (for example the New Idria Mine). These deposits around the dome are generally outside the Clear Creek area, but smaller deposits have been found filling fractures in the serpentine dome area including the Alpine Mine. Metals rich sediment is common throughout the watershed, originating from natural rocks and soils, mining and human activities, including use of ORV.

### 2.4 Previous Investigations and Remediation

Over the last five years, BLM has remediated five abandoned mercury mines, including the Alpine and Xanadu mines in the Clear Creek watershed and the Aurora Mine in the San Carlos Creek watershed. Remediation has consisted of constructed repositories, capping and drainage controls. Photomonitoring of the condition of these sites is required by the TMDL.

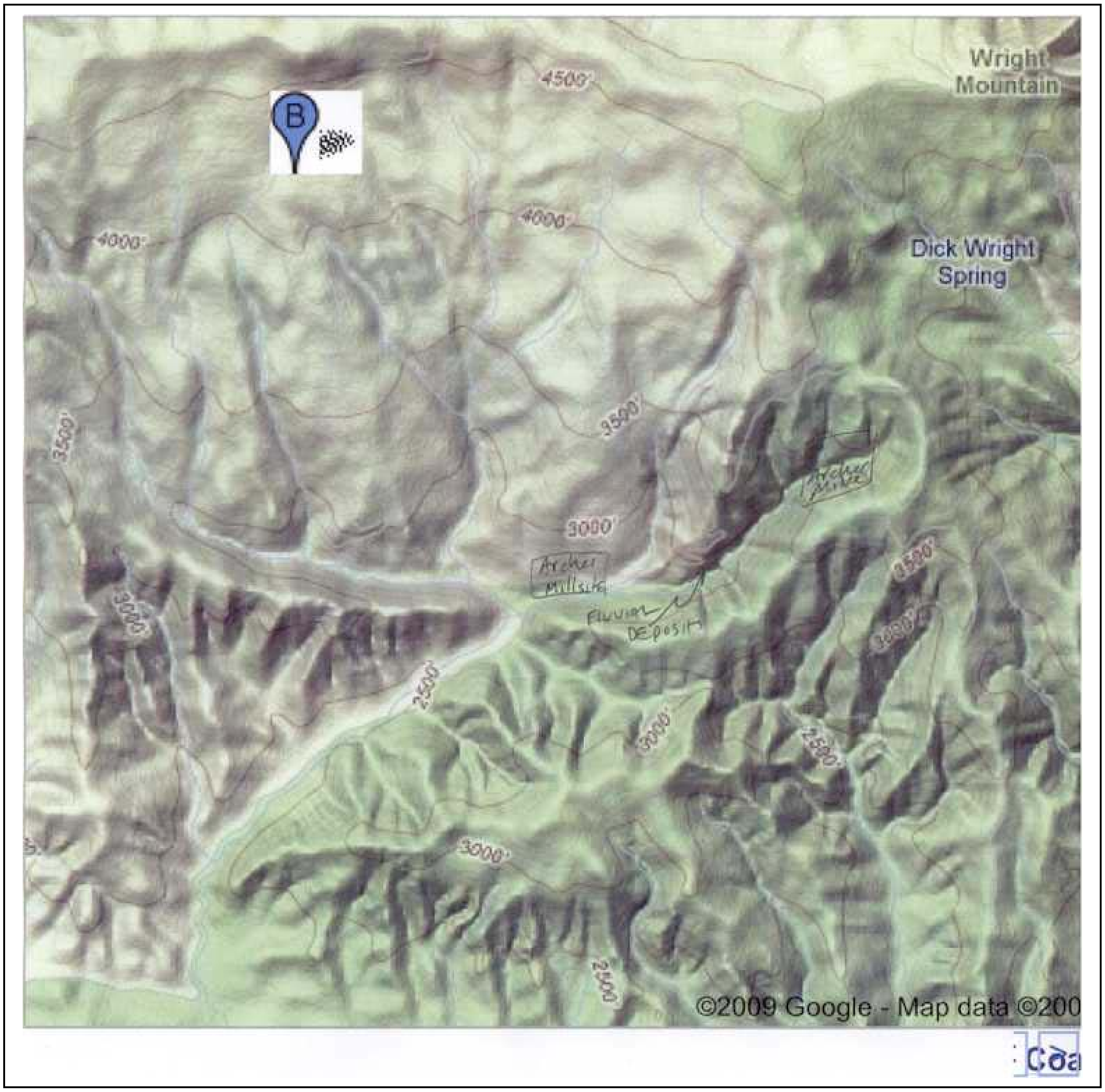


Figure 1. Site Location Map.

## 3.0 SITE SAMPLING STRATEGY

The purpose of the site characterization is to obtain the data necessary to determine if a removal action is necessary and to provide information necessary to conduct the removal action. Surface water and sediment sampling is planned by James Rytuba of USGS and is not included in this SAP.

The activities planned to obtain these data are as follows: collection and analyses soil, sediment and geological samples from the site. The sampling activities are described in detail in the sections to follow. The proposed sample areas are provided in Figure 2.


Figure 2. Calcine Sample Location Map. Note White Creek flows through the site from left to right; waste rock dumps are upstream out of the picture.

All environmental samples will be collected in accordance with the criteria specified in the following documents: *Compendium of ERT Soil Sampling Procedures (EPA/540/P-91/006)*; *Compendium of ERT Surface Water and Sediment Sampling Procedures (EPA/540/P-91/005)*; *Compendium of ERT Waste Sampling Procedures (EPA/540/P-91/008)*. In general, samples will be collected using stainless steel trowels or disposable/single-use sampling equipment.

### 3.1 Data Quality Objectives

The data quality objective (DQO) process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity, and quality of environmental data used in the decision making are appropriate for the intended purpose. DQOs specify the quality of the data necessary to support evaluation of risk in the human health and ecological risk assessments (RAs) and the decision making process (EPA, 1987). The six steps in the DQO process are:

- State the problem: (Section 1.0)
- Identify the decision: What mine waste or soil should be removed (if any)?
- Identify the inputs: e.g. sample types, number, and locations, Tables 2, and 3, and Figure 2.
- Define boundaries: (Section 3.0, and Figure 2 for potential impact areas).
- Develop a preliminary decision rule: If mine waste arsenic exceeds an applicable, relevant and appropriate requirement (ARAR), then depending on funding, a removal action may be taken. California has hazardous waste criteria (total threshold limit concentration (TTLC and soluble threshold limit concentration STLC) and several soil guidance levels, EPA Region 9 Preliminary Remedial Goals (PRGs), none of which are regulatory nor applicable for recreational use. BLM uses risk management criteria (RMC) (Ford, 2004) for the camper (Ford 2004). The potential soil mercury ARARs are:

| | |
|---|---|
| 1. California Total Threshold Limit Concentration | 20 mg/kg |
| 2. BLM ATV rider Risk Management Criteria (camper) | 40 |
| 3. Site background | ? |
| 4. EPA Region IX Preliminary Remedial Goal-Industrial | 310 |

- Potential ARARs listed above are not regulatory except item 1 and hence are not ARARs, but "to be considered."
- Specify limits on decision errors: The analytical methods are described below and the DQOs are listed in Table 1. Sampling methodology to minimize bias is described in Sections 3.2-3.5.
- Optimize the design: The sampling design is described in Sections 3.2 through 3.4

The data quality objective (DQO) process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity, and quality of environmental data used in the decision making are appropriate for the intended purpose. DQOs specify the quality of the data necessary to support evaluation of risk and the decision making process (EPA, 1987). DQOs in general reflect the uncertainty in the data that is acceptable for each specific activity during the investigation. This uncertainty includes both sampling error and analytical instrument error. The ideal level of uncertainty is zero; however, the variables associated with the sampling and analytical processes inherently contribute to some overall uncertainty in the data. The objective of quality assurance and quality control (QA/QC) is to assure that the uncertainty of the generated data is within an acceptable range that will allow proper evaluation of the Site through the collected data.

**Table 1. Data Quality Objectives for Samples**

| Analysis | Analytical Method | Targeted Detection Limit | Accuracy Percent | Laboratory Precision RPD | Field Duplicate Precision (RPD)* | Completeness Percent | Data Type |
|---|---|---|---|---|---|---|---|
| Total Arsenic | EPA 3050B or 3051 followed by 6010B | As = 30.0 mg/kg | 75 - 125 | +/- 35% | +/- 50% | 90 | D |
| Total arsenic | EPA 200 | As = 0.002 ug/L | 75–125 | +/- 20% | 90 | D | D |

**Notes:**

D = Definitive data
EPA = United States Environmental Protection Agency
mg/kg = Milligrams per kilogram
RPD = Relative percent difference

BLM has a Quality Assurance Project Plan (QAPP) for preliminary assessments and site inspections (BLM, 2005). Different intended uses of data require different levels of analytical and sampling certainty. In order to achieve the objectives of the project, specific data quality requirements are specified, where appropriate, throughout the QAPP. Section 3 of the QAPP provides the specific quality assurance objectives for the field and laboratory measurement data (BLM, 2004).

Appropriate quality levels have been specified for the PA/SI analytical data to be collected. The following definitions of analytical levels will be used for this project:

- Level I - This analytical level applies to field screening or analysis using portable instruments. Results often are not compound-specific; however, they can be quantitative or qualitative. The results are available in real time. This level is the least costly of the analytical options. Field measured pH, specific conductance (EC), and dissolved oxygen all represent analytical Level I for the R1/FS activities.

- Level II – This analytical level is characterized by the use of portable analytical instruments (e.g. portable x-ray fluorescence or Lumex spectrometers) that can be used on-site or in mobile laboratories stationed near the Site (close-support laboratories). Depending upon the types of contaminants, sample matrix, and personnel skills, qualitative and quantitative data (Level III) can be obtained.

- Level III - Under this analytical level, all analyses are performed in an off-Site analytical laboratory using standard EPA methods (e.g., SW-846 Test Methods for Evaluating Solid Waste (Third Edition), referred to hereinafter as SW-846, or ALS Chemex methods.
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To meet the goals of the investigation and to obtain sufficient quality data to evaluate the Site and its present condition, soils and mill residue samples will be collected. Each media will be analyzed to obtain Level II or III data. Level I field screening of various media and physical data will also be used to help define the nature and extent of wastes and potential migration pathways. Data types, analytical levels, and data uses for the work are summarized on Table 1-1 of the QAPP. Analyses will be to determine concentrations of the chemical of potential concern (COPC) – mercury.

Levels II and III reflect the need for high quality data that can be documented as being representative of Site conditions. This level is necessary to evaluate the Site for the quantitative analysis for the TMDL and to be able to evaluate Site conditions in terms of certain potential Applicable and Relevant or Appropriate Requirements (ARARs). For laboratory soils, the DQO shall be to attain 0.01 ppm mercury detection limit in soil. If XRF is used for screening in hotspots, and samples are sieved, the DQO detection limit will be 10 ppm and >0.75 $R^2$ with laboratory confirmation splits. If samples are not sieved, Level II screening data will be the DQO with no quantitative laboratory split comparison. The DQO process is further discussed in the QAPP (BLM, 2004). Based on the objectives of this investigation, data collected during the course of this project will satisfy Level III requirements. The specific USEPA analytical methods for chemical analyses that have been selected are as follows:

Soil, mine/mill waste:

- ALS Chemex ICP/MS – ME-ICP41m ultra-trace package total metals in soil or Hg only at Field Office choice
- EPA Method 6200 - Field Portable X-ray Fluorescence Spectrometry
- California WET Test

Upon collection, samples will immediately be placed in an appropriate container. The sample containers will then be labeled and prepared for analysis (dried and sieved through #10 mesh) and analyzed on-site via XRF with shipment of sample splits to the appropriate analytical laboratory. The information provided on the sample labels will include: time and date the sample was collected; sampling location; initials of person who collected the sample; and a unique sample number. Finally, all sampling activities and locations will be recorded in the field notebook. Samples for metals analysis will be shipped to ALS Chemex and to another analytical laboratory for California WET.

## 3.2 Soil and Mine Waste Sampling

Samples will be collected from the calcine tailings and waste rock dumps for metal analysis. Table 2 describes the units, and projected number of samples. Figure 2 shows the planned sampling locations. At each sample location, using a plastic trowel, 8 ounce samples will be collected at 0-6" into labeled ziplock bags. Trowels may be deconned and re-used. For waste rock dumps, 1 kilogram (1 quart bag) will be collected. At least three background samples will be collected in undisturbed areas.

### 3.2.1 Calcines

A calcine pile is located near the Archer millsite. It is approximately 1 acre in size. A grid will be established over the pile and samples collected on 50'x50' grid nodes. At selected nodes, subsurface samples will be collected using a backhoe or post-hole digger to determine the depth of contamination. Samples will be collected at 2' intervals unless the depth is <2', in which case, samples will be collected at 1' and at the end of visual contamination or deeper as necessary if XRF results indicate.

### 3.2.2 Waste Rock

Waste rock dump composite samples will be sampled via the USGS method of Smith, 2004. This involves collecting 30 representative surface grab samples within the waste rock dump, compositing and sieving them through a #10 sieve to attain 1 kg. The sample is analyzed for mercury and other metals. Each waste rock dump will have a perimeter measurement in GPS. If XRF analysis of mine waste locates hotspots, additional samples will be collected to focus on the source and size of the mercury hotspot.

**Table 2: Planned Sample Number by Type**

| Unit | Description | Samples Chemex | Niton XRF | California WET |
|---|---|---|---|---|
| 1 | Surface Calcines | 4 | 36 | 1 |
| 2 | Subsurface Calcines | 2 | 20 | 1 |
| 3 | Waste Rock | 1 | 5 | 1 |
| 4 | Soil Background | 3 | 3 | 0 |
| Total | | 7 | 64 | 3 |

## 3.3 Supplemental Activities

In addition to the proposed sampling activities, measurements will be recorded for the following:

- size and volume of each waste area.
- contamination. Samples will be collected at the interface with native soil and be analyzed for mercury.
- all grid perimeter sampling locations will be recorded with a global positioning unit and logged in the field notebook.
- Possible lead paint of buildings will be screened via XRF. If lead is present, samples will be collected.
- Potential asbestos will be inspected in the buildings.

### 3.4 Quality Assurance/Quality Control

Quality assurance and quality control samples will be collected to ensure the integrity of the sampling data. The QA/QC samples will consist of confirmation replicate samples collected at mine waste. Confirmation or replicate samples will be collected to provide a check on the accuracy of the XRF analyses using linear regression per Method 6200. Blanks, certified standards and precision samples will be analyzed to check for sampling and analytical