

WASTE CHARACTERIZATION PLAN

KENNECOTT UTAH COPPER LLC BLUEWATER 1 MAIN REPOSITORY

1.0 Scope

This waste characterization plan will be used to characterize the nature of any waste materials planned to be disposed in the Bluewater 1 Main Repository. Wastes already placed in the repository are representative of the Bingham Creek Tailings, previously provided.

As specified in Groundwater Discharge Permit #UGW350010, issued July 14th, 2010, the Bluewater 1 Main Repository may only accept tailings, sludge, soil and waste rock generated from mining activities. No organic chemicals will be permitted in the repository, although minor amounts of organic matter (grasses, leaves, sticks, etc...) may unavoidably be mixed with the large volume, low toxicity waste materials. This primary information will be supported by visual inspection and by a level of sampling and analysis appropriate to the extent and type of waste deposit.

2.0 Objectives

The objectives of the Waste Characterization Plan are as follows:

- Ensure, through knowledge and understanding of the waste genesis and visual inspection, that the waste materials do not contain synthetic organic chemicals;
- Characterize the nature of total metals and inorganic metals in the waste;
- Characterize the variability in composition of the waste with respect to total metals and inorganics; and
- Characterize the leachability of metals from the waste.

3.0 Criteria

As noted above, the primary method used to characterize the waste material will be the identification and knowledge of the process and processes that generated the waste material. Specifically, information regarding waste deposition patterns and potential migration pathways, as well as information supporting the hypothesis that only inorganic (i.e. no synthetic organic chemical) wastes are present will be evaluated. The waste must also fit within a broad definition of tailings, waste rock, soil and sludge from mining activities.

The second criteria that will be used to determine character of the waste will be the area and vertical extent of the waste deposit and its heterogeneity. The criteria will be based on visual inspection and sampling as necessary. The number of samples collected will be based on the size of the deposit, taking into account possibly variability with depth. In addition, the homogeneity or heterogeneity of the waste will also be judged to adjust the

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number of sample to be collected and analyzed. The precise design of sampling grids and types and numbers of samples will be developed and submitted to the Utah Division of Water Quality (DWQ) on a case by case basis; however, the following sampling plan provides a representative approach for tailings and waste rock.

Approximately, the following number of grab or composite samples will be prepared and analyzed:

<u>Estimated Waste Volume (cu yd)</u>	<u>Number of Samples</u>
<100	1-3
100-1,000	5
1,000-10,000	15
>10,000	20

The number of samples will be adjusted accordingly depending on the degree of heterogeneity of the waste. Composite samples will consist of a minimum of three sub samples.

4.0 Sampling Methods

Two types of samples may be collected, grab samples and composite samples. The choice of sample type will be decided based on knowledge of the waste and visual inspection for heterogeneity. Grab samples will generally only be used for waste materials which are quite homogeneous, whereas composite samples will be used for more heterogeneous wastes. Based on the envisioned analytical suit, each grab or composite sample will contain approximately five pounds of waste material. All sampling will be performed in accordance with the Standard Operating Procedures in Kennecott Utah Copper LLC (KUC) Quality Assurance Standards. This includes the use of plastic sampling tools and appropriate decontamination methods. KUC's Health and Safety Standards will also be used for personnel protection.

Composite samples will be prepared by dividing the waste into approximately 100ft x 100ft grid. The grid size will be adjusted based on the extent of the waste deposit. A proportional volume of waste material will be collected from the center of each grid to the full depth of the waste deposit. The individual grab samples will be accumulated in a large container until the appropriate number of sub samples has been collected. Then material will be manually, but thoroughly mixed until homogenized. A sub sample will be collected from the homogenized mass for analysis.

5.0 Analytical Methods

Samples will be analyzed for total metals, total inorganics, and leaching characteristics. Since the waste will be placed in the Bluewater 1 Main Repository, and no organic waste will be placed in this disposal facility, there is not a likelihood of generating organic acids which could solubilize metals. Therefore, the Toxicity Characteristics Leaching procedure (TCLP, EPA Method 1311) is not appropriate for waste materials to be placed

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in the Bluewater 1 Main repository. The Synthetic Precipitation Leaching Procedure (SPLP, EPA Method 1312) is more appropriate, and will be used as the principal method for assessing leachability. Nevertheless, both SPLP and TCLP methods will be performed on representative samples of the waste materials so that a worst-case assessment can be made.

Tables B1 and B2 list the specific analytical methods which will be used as reference. All methods for metals and leaching characteristics are based on EPA Method SW-846. The methods for conventional inorganics are also based on standard reference documents. The limits of detection are provided along with specific method references. All metals, except mercury, will be analyzed through acid digestion and Inductively Coupled Argon Plasma (ICP). Mercury analysis will be analyzed by cold vapor atomic adsorption to ensure the attainment of low detection limits.

Table B1. Standardized Preparation/Analytical Methods & Detection Limits for Analytes in Soils.

Total Metals	Method Index	Method Reference	Limit of Detection (µg/g)
Total Metals	Method Index	Method	Practical
Arsenic	3050B	6010C	4
Barium	3050B	6010C	2
Cadmium	3050B	6010C	1
Chromium	3050B	6010C	2
Cobalt	3050B	6010C	1
Copper	3050B	6010C	5
Iron	3050B	6010C	1
Lead	3050B	6010C	3
Manganese	3050B	6010C	1
Mercury	3050B	7471A	0.10
Molybdenum	3050B	6010C	1
Nickel	3050B	6010C	1
Silver	3050B	6010C	5
Selenium	3050B	6010C	5
Zinc	3050B	6010C	5

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Table B2. Standardized Preparation/Analytical Methods & Detection Limits for Leachable Metals in Soils.

EPA Method	Method Index	Method Reference	Limit of Detection (mg/L)
TCLP-1311			
Arsenic	1311/3010A	6010C	0.1
Barium	1311/3010A	6010C	0.1
Cadmium	1311/3010A	6010C	0.01
Chromium	1311/3010A	6010C	0.1
Lead	1311/3010A	6010C	0.05
Mercury	1311/3010A	7471A	0.0010
Selenium	1311/3010A	6010C	0.1
Silver	1311/3010A	6010C	0.1
SPLP-1312			
Arsenic	1312/3010A	6010C	0.1
Barium	1312/3010A	6010C	0.1
Cadmium	1312/3010A	6010C	0.01
Chromium	1312/3010A	6010C	0.1
Lead	1312/3010A	6010C	0.05
Mercury	1312/3010A	7471A	0.0010
Selenium	1312/3010A	6010C	0.1
Silver	1312/3010A	6010C	0.1

NOTE: Method Index/Method reference

(1) SW 846 “test Methods for Evaluating Solid Waste,” 3rd Edition, November 1986.