# FINAL
# Site Inspection Report
# Big Blue Mill Site

Kern County, California

*June 2021*

*Prepared By:*

ECM Consultants
Ignite Success.
25 YEARS 1996-2021

3525 Hyland Ave #200 • Costa Mesa, CA 92626 • Main: 714.662.2759

Prepared for:

United States Department of Agriculture
Forest Service
Southern California Service Area
1839 South Newcomb Street
Porterville, California

# FINAL
# Site Inspection Report
# Big Blue Mill Site

Kern County, California

*June 2021*

*Prepared By:*

ECM Consultants
Ignite Success.
25 YEARS 1996-2021

Contract No. 1291S818D0001
Order No. 129JGP20F0058

Deborah Wilson
Sr. Geologist/Risk Assessor

June 15, 2021

David Allison, PE
Project Manager

June 15, 2021

# TABLE OF CONTENTS

## FIGURES

## EXHIBITS



## TABLES



## APPENDICES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ABA | Acid-Base Accounting |
| AGP | Acid-Generation Potential |
| amsl | Above Mean Seal Level |
| ANP | Acid-Neutralization Potential |
| AOC | Area of Concern |
| BC | BC Laboratories |
| bgs | Below Ground Surface |
| BLM | Bureau of Land Management |
| CCR | Resource Conservation and Recovery Act |
| CDFG | California Department of Fish and Game |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| cfs | Cubic Feet per Second |
| COC | Chemical of Concern |
| C-O-C | Chain-of-Custody |
| COPC | Chemical of Potential Concern |
| COPEC | Chemical of Potential Ecological Concern |
| CNPS | California Native Plant Society |
| CTR | California Toxics Rule |
| DI | Deionized Water |
| DTSC | Department of Toxic Substances Control |
| DQO | Data Quality Objective |
| ECM | ECM Consultants |
| Eco-SSL | Ecological Screening Level (EPA) |
| EPA | United States Environmental Protection Agency |
| EPC | Exposure Point Concentration |
| ESV | Ecological Screening Value |
| °F | Degrees Fahrenheit |
| GPS | Global Positioning System |
| ID | Identification |
| IPaC | Information, Planning, and Conservation |
| IVBA | *In vitro* bioaccessibility |
| LANL | Los Alamos National Laboratories |
| MCL | Maximum Contaminant Level |
| MDL | Method Detection Limit |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MVA | Mercury Vapor Analyzer |
| mya | Millions of Years Ago |
| NCP | National Contingency Plan |

| | |
|---|---|
| NIOSH | National Institute for Occupational Safety and Health |
| NNP | Net Neutralization Potential |
| ORNL | Oak Ridge National Laboratories |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PEL | Permissible Exposure Limit |
| % | percent |
| PRP | Potential Responsible Party |
| ppm | Parts Per Million |
| PWP | Project Work Plan |
| PQL | Practical Quantitation Limit |
| QA | Quality Assurance |
| QC | Quality Control |
| RBA | Relative Bioavailability |
| RBSL | Risk-Based Screening Level |
| RCRA | Resource Conservation and Recovery Act |
| RSL | Regional Screening Level |
| RPD | Relative Percent Difference |
| SAP | Sampling and Analysis Plan |
| SCEM | Site Conceptual Exposure Model |
| SI | Site Inspection |
| SRA | Streamline Risk Assessment |
| SRM | Standard Reference Material |
| SSL | Soil Screening Level |
| STLC | Soluble Threshold Limit Concentration |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TTLC | Total Threshold Limit Concentration |
| UCL | Upper Confidence Level |
| USACE | United States Army Corps of Engineers |
| USFS | United States Department of Agriculture, Forest Service |
| UTL | Upper Tolerance Limit |
| VOA | Volatile Organic Analysis |
| VOC | Volatile Organic Compound |
| XRF | X-ray Fluorescence |
| WET | Waste Extraction Test |

*This page intentionally left blank.*

# 1 INTRODUCTION

On behalf of the United States Department of Agriculture, Forest Service (USFS), ECM Consultants (ECM) prepared this Site Inspection (SI) Report for the Big Blue Mill site on the Sequoia National Forest, Kern County, California (**Figure 1**). The site is under the jurisdiction of the USFS Kern River Ranger District. The SI was performed to determine the nature and extent of soil contamination, including an estimate of volumes and quantities, on behalf of the USFS under its delegated Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) lead agency authority as specified by work elements for Activity 1, Task 1 of the USFS Region 5 CERCLA Environmental Response ID/IQ contract (#1291S818D0001 and modifications).

All work was performed in accordance with CERCLA; the National Contingency Plan (NCP), including 40 Code of Federal Regulations (CFR) 300.400 through 300.440 (in particular, 300.410 and 300.415); USFS Order Number 129JGP20F0058 and associated modification requirements; and the following United States Environmental Protection Agency (EPA) guidance documents:

- *Improving Site Assessment: Integrating Removal and Remedial Site Evaluations*, EPA-540-F-99-006. April 2000a.
- *Improving Site Assessment: Combined PA/SI Assessments*, EPA-540-F-98-038. October 1999.
- G*uidance for Performing Site Inspections (SI) Under CERCLA*, EPA-540-R-92-021, Interim Final. September 1992a.

## 1.1 Project Objectives

Site-specific information and data were collected to satisfy USFS requirements presented in the Project Work Plan (PWP) (ECM, 2020a) and Sampling and Analysis Plan (SAP) (ECM, 2020b). The primary objectives were:

- Assess the general nature of any discolored or variant-textured site tailings or mill processing deposits, or indicators of environmental releases or erosion of waste materials into nearby soil or surface water.
- Document site accessibility, general topography, access restrictions, nearby structures, evidence of public visitation, remaining mill features, proximity to river features, sensitive environments, and drainage characteristics by collecting Trimble Global Positioning System (GPS) points and developing a photographic log of site features, as well as field notes.
- Collect X-ray fluorescence (XRF) and laboratory surface and near-surface samples of soil and waste material to establish background and evaluate the distribution of metals on USFS-administered land and determine whether contamination is present up to the private property boundary and likely extends onto private property.
- Assess surface water and sediment impacts in the North Fork Kern River.
- Provide USFS with sufficient information to characterize the nature and extent of contamination.
- Estimate the volumes of impacted soil/waste.
- Assess whether mercury vapor emissions are present given the proximity to residences.
- Analyze bioavailability of chemicals of concern (COCs).
- Analyze metals leachability to evaluate threat to surface water and support California mining waste classification.

- Determine whether industrial activities have impacted the Site with volatile organic compounds (VOCs) and semivolatile organic compounds (polycyclic aromatic hydrocarbons [PAHs]).
- Develop a site Conceptual Exposure Model (SCEM) that illustrates potential receptors and exposure pathways.
- Develop a Streamlined Risk Assessment (SRA) to characterize risk and hazards to Residents, Recreational Visitors, and ecological receptors.
- Evaluate the need for further study and recommend an approach that is consistent with CERCLA.

# 2 SITE BACKGROUND

## 2.1 Location

The Big Blue Mine site is approximately 2 miles south of the town of Kernville, California (**Figure 1**), and is about 4.1 acres in size. The former mills lie directly on the western bank of the North Fork Kern River in the northeast ¼ of Section 27, Township 25 South, Range 33 East. The North Fork Kern River is a tributary feeding into the head of Lake Isabella.

## 2.2 Current Conditions

**Figure 2** depicts the approximate site boundary (pink dashed line), residences, mill foundation area, floodplain, shoreline, and downriver sand bar along the North Fork Kern River. The only physical evidence at the site of the former mill structures are concrete foundations and retaining walls, which were recorded during field activities in October 2020. Approximate locations of additional buildings associated with the mill complex estimated from an undated survey drawing of Kernville and surrounding area from Kern County Engineering, Surveying, and Permits Services are shown on **Figure 2** for reference. Copies of the historical drawings and aerial photographs provided by USFS and referenced in the potential responsible party (PRP) search report for the site are presented in **Appendix A**.

Tailings and mineral processing wastes from former mill operations are prominent along a section of the river shoreline. These are evidenced by very fine brown materials, rust colored formations, and white powdery and large clast deposits. Metals contamination is associated with an area of cemented tailings deposited along the riverbank from the mill foundation downriver approximately 300 feet. There is evidence that recreational visitors use the site for dumping. Modern trash was found mixed with remnants of the historic mining structures.

The Kern River is a popular rafting and fishing corridor, and a worn fisherman's trail runs parallel to the river along the shoreline. The former mill site is also used as a rest area for those rafting on the river. The west bank of the North Fork Kern River near the former site is heavily eroded, although pockets of tailings remain. The North Fork Kern River is the dominant riverine system in the project area. The river has a defined bed and bank, with sediment-deposited sand bars and a developing riparian community. Near the confluence with Isabella Lake, the North Fork Kern River is braided, with intermittent freshwater emergent and forested/shrub wetlands. The area contains driftwood and other river debris that indicate the site is subject to periodic flooding. The floodplain on the north side of the Kern River extends north, northeast, and east of the former mill area.

## 2.3 Area Population

Based on the 2010 census (American Fact Finder, www.factfinder.census.gov), the total population of Kern County was 839,631. The populations of the nearest populated areas to the site are listed below:

- Kernville – population of 1,395 (2 miles north)
- Wofford Heights – population of 2,200 (2.2 miles southwest)
- Bakersfield – population of 347,483 (50 miles southwest)

The locations of the Big Blue Mine, the mill site, and Kernville and Wofford Heights population centers are shown on **Figure 1**. Kernville, the closest population center to the site, has a population density of 613 people per square mile (City Data, www.city-data.com). The nearest city with a population greater than Bakersfield is Los Angeles, California, located approximately 170 miles south.

## 2.4 Site History

The Big Blue Mill site, also referred to as the "Sumner Mill" in some historical reports, is a former gold ore processing facility dating to the mid-1860s. The former mill site is associated with the nearby historic Big Blue and Sumner group of mines, which were part of the Cove Mining District. The mines are located southwest of the site on the west side of the Kern River Valley. The September 15, 1896, *Thirteenth Report of the State Mineralogist* (for the California State Mining Bureau), indicates there were multiple mining claims associated with the mill site, including the Big Blue, Commonwealth, Content, Nelly Dent, Nelly Dent Extension, Sumner, and Sumner 5 Extensions. According to the January 1940, Volume 36, *California Journal of Mines and Geology*, the gold vein mined by these operations was first discovered in 1860. Historical records from the California State Division of Mines indicate at least four different mineral processing operations were conducted: a 16-stamp mill from approximately 1867 through the mid-1870s, an 80-stamp mill from 1875 through 1883, a 10-stamp mill from approximately 1901 through 1932, and a 150-ton flotation plant and ball mill from 1934 to 1943. Records stated that the 80-stamp mill was the largest of its kind at the time. Historical drawings and aerial photographs of the site provided by USFS were used to approximate the locations of historical buildings identified with the Big Blue Mill. Some of the drawings included cadastral information for reference; however, the historical records do not include scaled drawings or geo-referenced locations, resulting in uncertainty regarding the actual locations of the mill facilities and associated operations buildings (**Appendix A**).

According to several Annual Reports of the State Mineralogist, up until the 1930s, tailings and other materials from the mill operations were dumped into the North Fork Kern River and most washed down stream. After the flotation plant and ball mill was installed at the site (1934 *30th Annual Report of the State Mineralogist*), tailings from the processing operations were pumped across the North Fork Kern River and deposited into a tailings pond. Tailings deposits attributed to historical milling operations for the Big Blue Mine on the eastern floodplain are associated with the Kern Floodplain CERCLA site. The Big Blue Mill operated until 1943, when it was shut down during World War II per Order L208 of the War Production Board. The report *Mines and Mineral Resources of Kern County, California (*California Division of Mines and Geology, 1962) states that Order L208 caused the permanent shutdown of the mine.

In 1948, the U.S. Army Corps of Engineers (USACE) began construction of the Lake Isabella Dam and reservoir project. In 1954, to complete the reservoir project, the USACE acquired all land below elevation 2,617 feet. This included the Big Blue Mill site, which was at a lower elevation than the spillway of Lake Isabella dam. In 1957, the mill was sold at auction, and removed to New Mexico (California Division of Mines and Geology, 1962). In 1991, to ensure ongoing public access to recreational activities along the river, the land was exchanged from the USACE to USFS.

As indicated in the *Removal Preliminary Assessment* (USFS, 2020a), included in **Appendix A**, portable field XRF and confirmatory laboratory data collected by USFS staff during a site reconnaissance in January 2020 revealed arsenic, lead, mercury, and zinc concentrations exceeding background levels in previously unknown mine tailings between occupied single-family housing units and the shoreline of the North Fork Kern River on USFS land. Concentrations of arsenic, lead, and mercury exceeded EPA Regional Screening Levels (RSLs) for potential Residential and Industrial receptors and soil screening levels (SSLs) for Recreational Visitors developed by the Bureau of Land Management (BLM) for metals typically found in soils at Abandoned Mine Lands sites. In accordance with a Time-Critical Removal Action Memorandum (USFS, 2020b) (**Appendix A**), USFS staff implemented institutional controls to restrict public entry to the site and prevent human exposure to elevated concentrations of arsenic, lead, and mercury in soil, waste, and sediments while the USFS conducts additional site investigation activities and related actions needed to implement a response action.

## 2.5 Surrounding Land Use

The land surrounding the site is used for recreation such as hiking, camping, fishing, rafting, horseback riding, off-road driving, mountain biking, and water activities at Lake Isabella. Rock-climbing, snowmobiling, grazing, and hunting occur within Sequoia National Forest as permitted by the USFS. Site visitors include recreational users, USFS personnel/workers, and nearby residential users. Remnants of the mill foundation and tailings material are found within 100 feet of an occupied residence that was constructed up to the USFS property boundary in the early 2000s and within 500 and 1,000 feet of two additional occupied residences (**Figure 2).** Residents can walk their dogs or hike through this location and access fishing areas along the river. Potential future land uses for the surrounding area include wildlife and recreational uses as allowed by the USFS and Sequoia National Forest policies and procedures.

### 2.5.1 Wilderness Areas

There are six wilderness areas within Sequoia National Forest that are part of the National Wilderness Preservation System. Some of these extend into neighboring national forests. The Monarch Wilderness is shared with the Sierra National Forest, and the Golden Trout Wilderness and the South Sierra Wilderness are shared with Inyo National Forest. Domeland Wilderness and Kiavah Wilderness extend onto land that is managed by the BLM. Within the Giant Sequoia National Monument are the western third of the Golden Trout Wilderness and the Monarch Wilderness located adjacent to Sequoia and Kings Canyon National Park. The site is not located within wilderness area.

### 2.5.2 Wild and Scenic Rivers

Over 151 miles of the North and South Forks of the Kern River above Lake Isabella were designated part of the National Wild and Scenic River system in 1987. The Upper Kern River flows between Lake Isabella and the Johnsondale Bridge and is part of the North Fork of the Kern Wild and Scenic River. The upper reaches of the North Fork are remote and accessed only by hiking and horseback. The North Fork upstream of Johnsondale Bridge, which is about 20 miles north of Kernville, was designated a Heritage Trout Stream in 1999. This 4-mile section is a catch-and-release wild trout fishery managed under special angling regulations. Deep pools and fast runs characterize this part of the river, which has good trail access. This stream is within the Golden Trout Wilderness in the Sequoia National Forest and Sequoia National Park.

## 2.6 Beneficial Uses of the Kern River

The Water Quality Control Plan for the Tulare Lake Basin (Tulare Lake Basin Plan) (Central Valley Regional Water Quality Control Board, 2018) has identified the following Designated Uses for the Kern River above Lake Isabella: MUN (municipal and domestic supply, including drinking water supply), POW (hydropower generation), REC-1 (water contact recreation such as swimming and fishing where ingestion of water is reasonably possible, especially for children), REC-2 (non-contact water recreation such as hiking and boating), WARM (warm freshwater habitat), COLD (cold freshwater habitat), WILD (wildlife habitat), RARE (rare, threatened, or endangered species), SPWN (spawning, reproduction, and/or early development), and FRSH (freshwater replenishment).

## 2.7 Geologic Setting

The site is in the southern part of the Sierra Nevada geomorphic province, which lies between the Basin and Range geomorphic province to the east, the Great Valley to the west, and the Mojave Desert to the south (**Exhibit 1**). The Sierra Nevada forms a mountain chain more than 400 miles long and 60 miles wide. The Sierra Nevada batholith is one of the world's largest and was assembled by multiple intrusive plutonic events, largely during Cretaceous time. Tectonically, the Sierra Nevada has been tilted westward by rapid uplift along the Sierra Nevada Fault Zone, which forms the eastern escarpment and gentle west-sloping foothills.

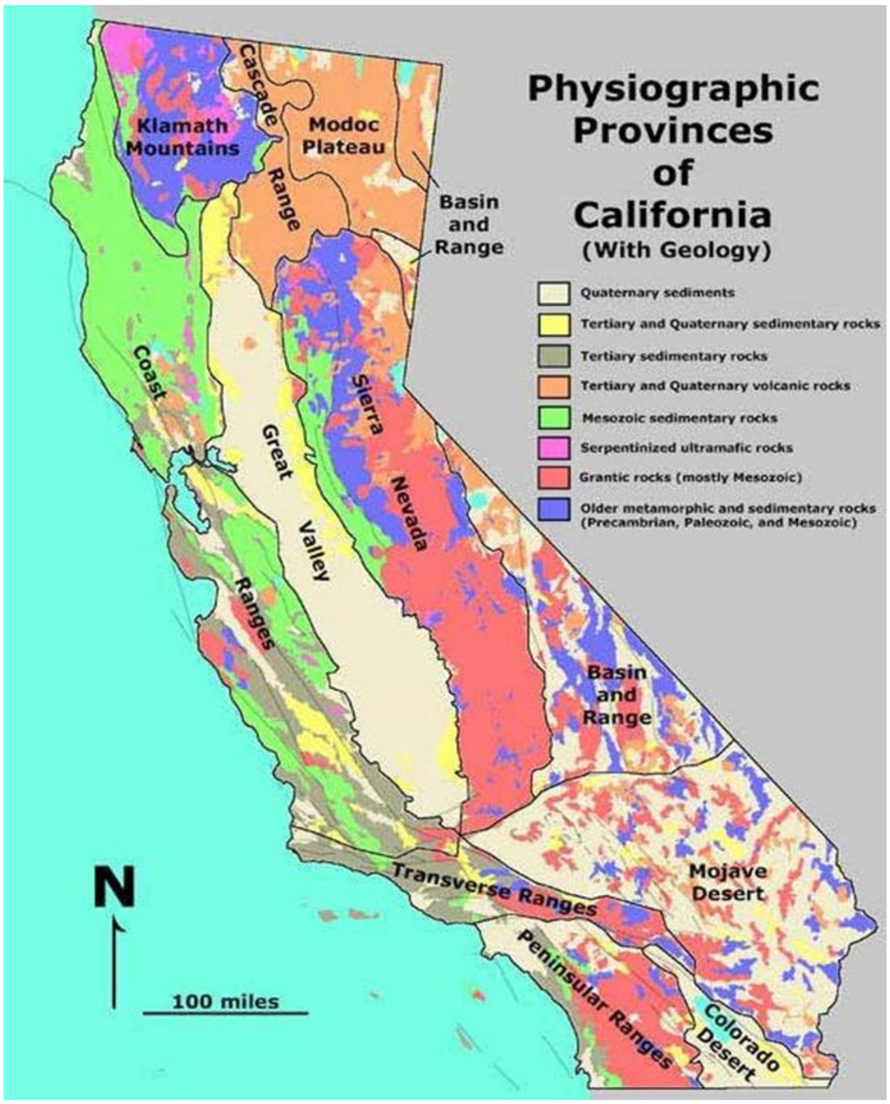
### 2.7.1 Regional Geology

The site is in the Kern River Valley within the Sierra Nevada range. The following description of the historical geology of the Sierra Nevada has been excerpted from the Draft Kern River Valley Specific Plan Environmental Impact Report (County of Kern, 2011a). At the outset of its formation, the ancestral Sierra Nevada was a folded range uplifted out of a deep sedimentary marine basin to form mountains only a few thousand feet high. During the 75 million years that followed, they were reduced by erosion to flat land. In Early Triassic time, a series of five deep-seated intrusive periodic pulses started the building of the new Sierra. During each pulse, igneous melts penetrated the thick original sedimentary cover creating zones of metamorphic rocks. At most other places, the melts solidified and crystallized as granitic rocks. In the intervals between pulses, the elevated land was reduced by erosion until some portions were lowered below sea level and sediments were again deposited. The fifth and last pulse of deep-seated igneous activity terminated in Late Cretaceous about 80 million years ago (mya).

Beginning with the Tertiary period, the development of the Sierra Nevada was essentially caused by fault movements. Sediments were deposited along the shoreline of the westerly lying ocean near the present western base of the mountains. At the end of the Miocene Epoch, uplift on the eastern Sierra Nevada fault produced the first tilt toward the west and Mount Whitney was a small hill about 500 feet above a land surface of low relief. Toward the end of the Pliocene, volcanic activity started with the extrusion of lava flows, then through several discontinuous pulses, ultimately ending about the middle of the Pleistocene (1.0 to 1.5 mya), the Sierra Nevada had reached approximately its present elevation.

The Sierra Nevada has an asymmetric form with the crest of the range near the abrupt slope of the eastern face terminated by the Sierra Nevada Fault, which on its downthrown side, shows a vertical displacement of several thousand feet. In contrast, the western flank has a relatively gentle slope. The western slope consists of a series of north-northwest to south-southeast trending crustal blocks limited by faults. One of the most notable of these faults within the Southern Sierra Nevada is the Breckenridge-Kern Canyon Fault. At the western edge of the mountain range, near the point where the granitic mass becomes overlapped by sediments of the San Joaquin Valley, the upthrown eastern escarpment of the Kern Gorge Fault is exposed intermittently for several miles along its northwesterly trace. No evidence of movement during Holocene time (last 11,000 years) has been noted along this fault. The known active faults in the region are discussed below.

**Exhibit 1: Physiographic Provinces of California**




The ancestral Sierra Nevada at the time of the Pliocene uplift existed as a low range in the north but a higher range in the south, shown to be about 6,000 to 8,000 feet high in the Tuolumne and San Joaquin River areas and presumably similar or perhaps higher south of there. Remnants of the oldest landscape in the Sierra Nevada are preserved as the plateau in the headwaters of the upper Kern River north of Isabella Reservoir. When the ancestral Kern River and its tributaries had eroded into this old landscape and by the start of the current phase of uplift in the Pliocene, the relief was considerable. In response to the uplift, the Kern River and its tributaries have incised deeper into the range, creating the dramatic inner gorges along the larger water courses.

Superimposed on the uplifted block are relatively minor fault movements that generally occur on ancient major bedrock fault zones, similar to the low activity faults along the Foothills fault system that have been documented in many places in the northern Sierra Nevada. In particular, the overall geomorphology of the area around the Kern Canyon fault indicates active tectonics, but of moderate to low activity. Specifically, the two intermountain basins, South Fork Valley and Walker Basin, and the smaller Havilah Valley, are sediment traps that appear similar to "drowned valleys," filled with sediment accumulations during the Quaternary. Sediments are 1,000 feet or more deep in the South Fork Valley, hundreds of feet deep in the Walker Basin, and less than 100 feet in the Havilah Valley, all fed with sandy gravelly materials by tributaries that were also choked with alluvium. None of the basins have terraces, except the upper part of the South Fork Valley. These basins are bounded on their western outlet sides by mountain fronts and the outlet rivers are incised into narrow canyons on the west side of the Kern Canyon Fault and Breckenridge Fault. These features indicate reactivation of the fault with up-on-the-west displacement in response to the regional uplift of the Sierra Nevada that started about 5 mya. Similarly, but at a much smaller scale, the Kern Canyon Fault between Kernville and the Little Kern River is marked by small alluvial basins along a prominent alignment of hillside saddles on the east side of the Kern Canyon.

The Sierra Nevada is composed primarily of crystalline rocks composed largely of dark hornblende-biotite quartz diorite (a coarse-grained rock closely related to granite), granite, and quartz monzonite of Jurassic or early Cretaceous age, which have been thoroughly metamorphosed to schist, quartzite, and marble.

### 2.7.2 Local Geology

The rocks in the Isabella Lake area belong to the Sierra Nevada Basement complex and consist of sedimentary rocks that have been metamorphosed during emplacement of the igneous rocks of the Sierra Nevada batholiths (USACE, 2012). The age of the igneous rocks is late Jurassic. In the Kernville area, the igneous rocks are divided into Isabella granodiorite, Sacater quartz diorite, and Summit gabbro. Kern River Granite bounds the Kern Canyon Fault to the east and granodorite of Alta Sierra to the west. Numerous dikes and veins of quartz pegmatite, apatite, and calcite intrude the igneous formations.

The metamorphic rocks have been referred to as the Kernville Series and are interpreted to be undivided pre-Cenozoic metasedimentary and metavolcanic rocks of great variety, mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble (California Geological Survey, 2010). Hydrothermal alteration is prominent along the Kern Canyon Fault Zone with the development of secondary silica and calcite deposits. Nearly vertical and steeply dipping fracture and shear planes developed during deformation, accelerating weathering to great depths. The metamorphic rocks have weathered to a clayey soil with schist fragments. Where schistose structure is present, weathering has further softened and decomposed the underlying schist to considerable depths. Below the zone of weathering, the metamorphic rocks are unweathered and the joint fractures remain close.

Areas in the vicinity of the site contain ultramafic rocks and soils derived from ultramafic rocks, such as serpentine and amphibole. Ultramafic rocks are known to bear naturally occurring asbestos. Naturally occurring asbestos occurs in many forms in a variety of minerals and rocks. Asbestos is a mineral known to cause certain forms of cancer. These minerals are generally ubiquitous in rock in low concentrations. However, these minerals can be concentrated in certain rock types. Asbestos in California is principally associated with the serpentine located in the Coast Ranges and soils derived from the serpentine.

## ***Soil***

Site soils are classified as Aquents-Aquolls-Riverwash complex, 0 to 5 percent slopes and Stineway-Kiscove association, 30 to 60 percent slopes (United States Department of Agriculture, Natural Resources Conservation Service, 2021; **Exhibit 2** and **Appendix B**). The area surrounding the site is composed of approximately 40% Aquents and similar soils, 35% Aquolls and similar soils, 15% Riverwash, and 10% minor unspecified components. The Vock and similar soils are alluvial material derived from granite parent rock formed on flood plains, mountain valleys, channels, or depressions. These soils are characterized by a surficial cover of loamy fine sand (0 to 7 inches) that overlies fine sandy loam (7 to 18 inches) and loamy fine sand subsoils to a depth of 18 to 60 inches. These soils are very poorly drained with moderately high to high capacity to transmit water. Runoff is high; however, ponding is frequent. Soils are nonsaline to slightly saline.

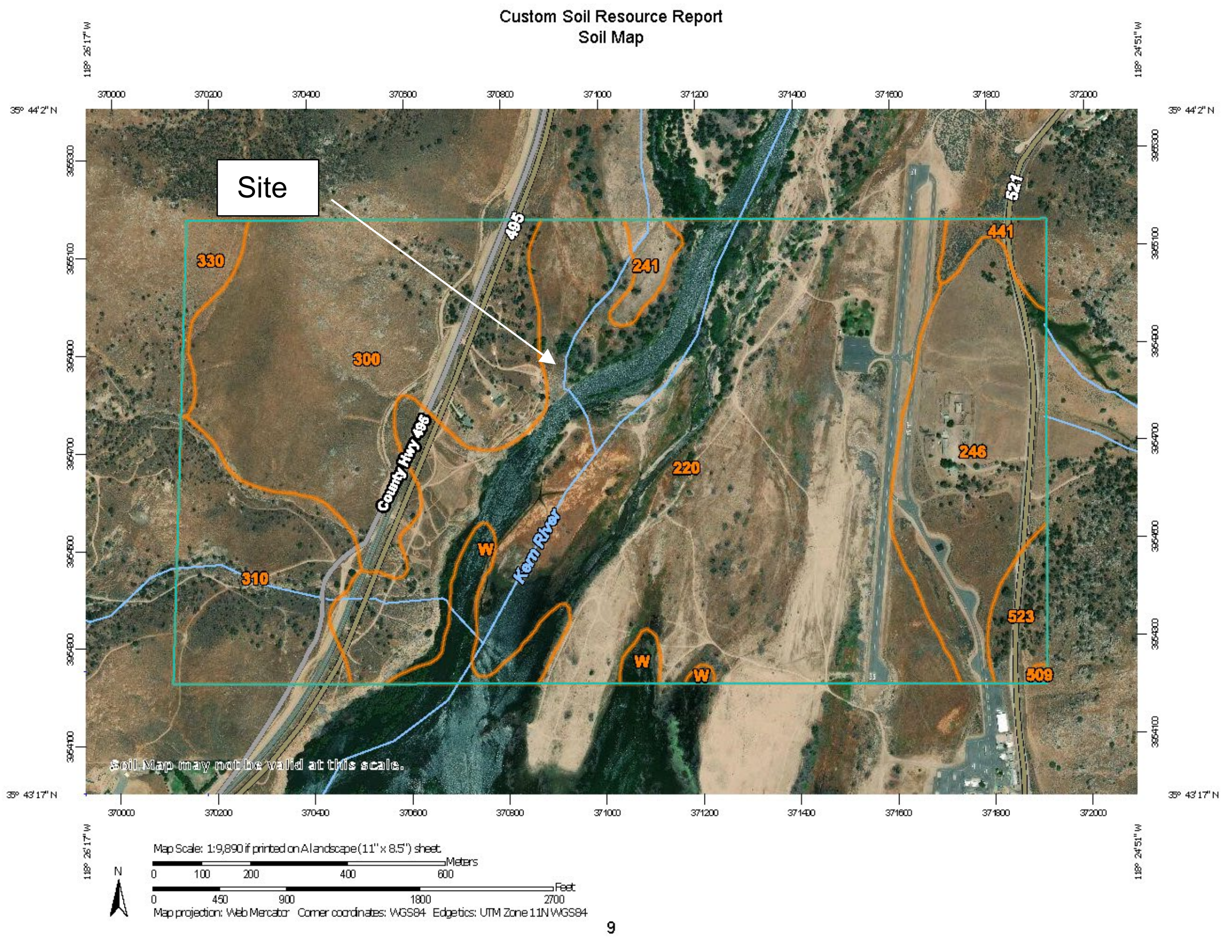
The Aquolls and similar soils are alluvial material derived from granitoid parent rock-types. Soils are formed on 0 to 5 percent slopes in flood plains, mountain valleys, and channels. Aquolls soils are very poorly drained, with moderately high to high capacity to transmit water. These soils typically have a 0 to 3-inch surficial cover of silt loam that overlies subsoils consisting of very fine sandy loam to a depth of 12 inches and loamy fine sand from 12 to 60 inches. Runoff is high but ponding is frequent. Soils are nonsaline to slightly saline.

The Riverwash and similar soils are alluvial material derived from granitoid parent rock-types. Soils are formed on 0 to 2 percent slopes in mountain valleys, channels, drainageways. Depth to the water table is 0 to 12 inches. Runoff is high and ponding is occasional.

The northern area of the site includes slopes between 30 to 60 percent. This area is composed of approximately 50% Stineway and similar soils, 30% Kiscove and similar soils, and 20% minor unspecified components. The Stineway and similar soils are residuum weathered from schist and/or residuum weathered from metamorphic rock formed on mountain slopes. These soils are characterized by a 0 to 4-inch surficial cover of very gravelly sandy loam that overlies two horizons (4 to 10 inches and 10 to 13 inches) of very gravelly loam that sits on bedrock that occurs at depths between 13 and 23 inches. These soils are well drained with very low to low capacity to transmit water. Runoff is very high. Ponding does not occur. Soils are nonsaline to very slightly saline.

The Kiscove and similar soils are residuum weathered from metamorphic rock. Soils are formed on 30 to 60 percent slopes mountain slopes. Kiscove soils typically have a 0 to 3-inch surficial cover of gravelly loam that overlies gravelly clay loam to a depth of 9 inches. Weathered bedrock occurs at depths between 9 and 12 inches and bedrock is present between 12 and 22 inches. These soils are well drained, with very low to low capacity to transmit water. Runoff is very high and ponding occurs. Soils are nonsaline to slightly saline.

**Exhibit 2: Soil Units in the Vicinity of Big Blue Mill**

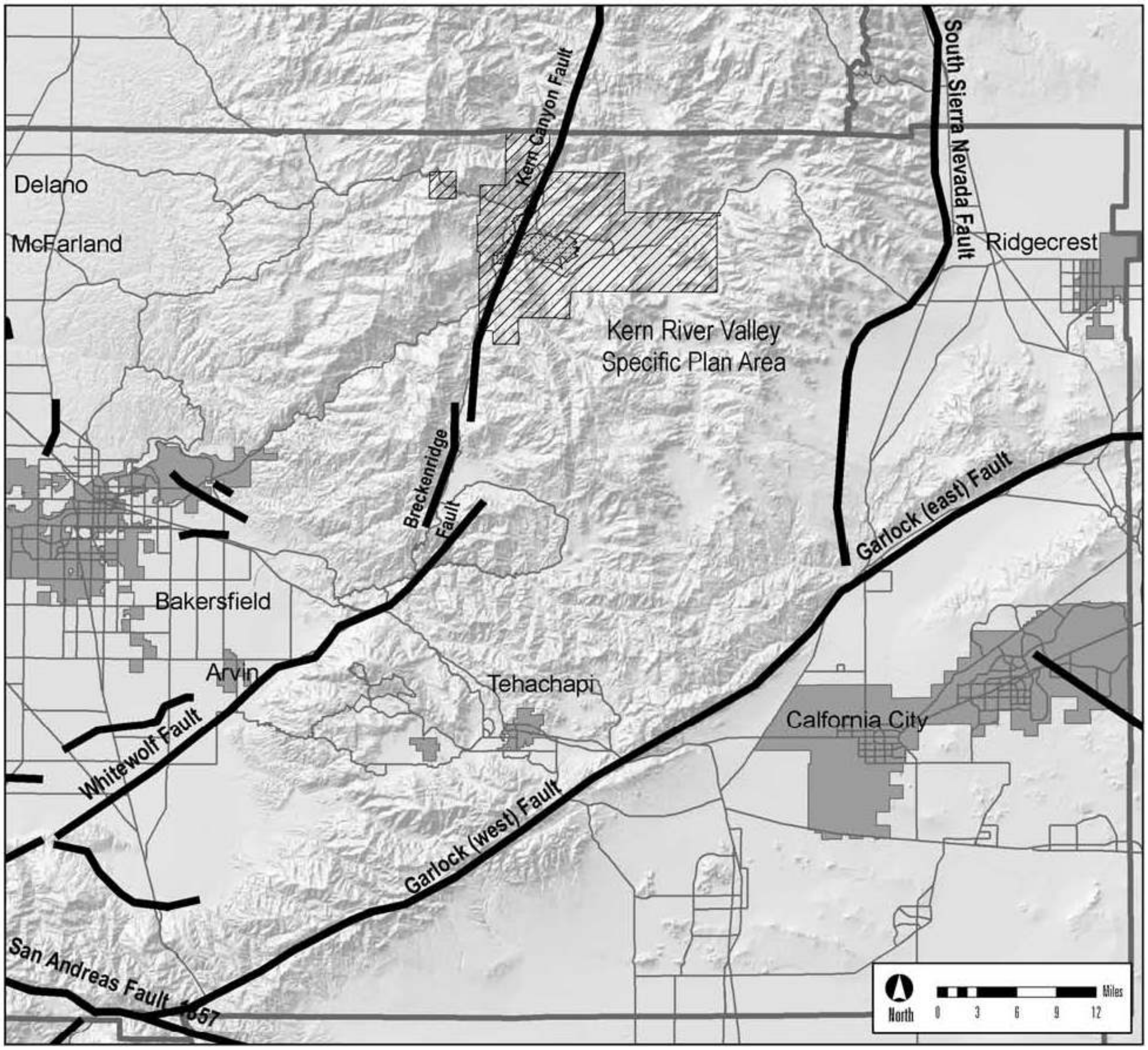



## 2.7.3 Seismicity

The project area is influenced by active seismic zones (USACE, 2012). The fault classification criteria adopted by the California Geological Survey (formerly the California Division of Mines and Geology) defines Earthquake Fault Zones along active or potentially active faults. An active fault is one that has ruptured during Holocene time (roughly within the last 11,000 years). A fault that has ruptured during the last 1.8 million years (Quaternary time) but has not been proven by direct evidence to have not moved within Holocene time, is considered to be potentially active. A fault that has not moved during both Pleistocene and Holocene time (no movement within the last 1.8 million years) is considered inactive.

The southern Sierra Nevada is bisected by a system of faults that form a zone nearly 100 miles long—the White Wolf Fault Zone, including the Breckenridge fault, to the south of the lake, and the Kern Canyon Fault Zone, which extends through the Isabella Lake Dam site to the north (**Exhibit 3**). Other major active faults in the project's vicinity are the Garlock Fault (50 miles south), the San Andreas Fault (70 miles west), and the Sierra Nevada Fault (60 miles east). **Exhibit 4** indicates the known active and potentially active faults in the general area of the site.

**Exhibit 3: Active Faults in the Vicinity of the Site**




After Kern River Valley Specific Plan, 2011a.

Liquefaction of saturated non-cohesive soil due to the build-up of excess pore pressure has been a major cause of damage during past earthquakes. Liquefaction occurs due to a cyclic loading or vibration when an increase of pore fluid pressure in the soil leads to a lower effective confining pressure. The occurrence and severity of this phenomenon depend on many variables, such as the level and the duration of vibration, the relative density or looseness of the soil, previous strain history, grain characteristic, aging under sustained load, lateral earth pressure or stress state of soil elements, over consolidation of soil, and boundary conditions of soil layers. Liquefaction more often occurs in earthquake-prone areas underlain by young alluvium where the groundwater table is less than 50 feet below the ground surface. The site and low-lying areas adjacent to the South Fork of the Kern River and within the Hot Springs Valley have conditions of younger alluvial soils and shallow groundwater, which together have the potential to result in liquefaction during a seismic event.

**Exhibit 4: Summary of Faults within 70 Miles of the Site**

| Fault | Age | Approximate Distance from Site (miles) | Maximum Earthquake Magnitude | Maximum Credible Bedrock Acceleration (g)* |
|---|---|---|---|---|
| **Active Faults** | | | | |
| Kern Canyon Fault | Holocene | 0 | 7.0 | 1.11 |
| Breckenridge Fault | Quaternary | 5 | 7.3 | 0.63 |
| White Wolf Fault | Historic | 30 | 7.5 | 0.22 |
| Pleito Fault | Holocene | 40 | 7.3 | 0.22 |
| Garlock Fault | Holocene | 50 | 7.6 | 0.28 |
| Sierra Nevada Fault | Quaternary | 60 | 6.5 | 0.23 |
| San Andreas Fault (Mojave Segment) | Historic | 70 | 8.0 | 0.25 |
| **Potentially Active Faults** | | | | |
| Goat Ranch Fault | N/A | 0 | N/A | N/A |
| Pinyon Peak Fault | N/A | 10 | N/A | N/A |

***Notes:***

* The maximum credible earthquake magnitude and bedrock acceleration are calculated at the Isabella Dam (USACE, 2012).
N/A – Not known
Historic: displacement has occurred within the last 200 years
Holocene: displacement has occurred during the past 11,700 years
Quaternary: displacement has occurred within the Quaternary (1.8 my)

## 2.8 Hydrogeology

The site is in the Kern River Valley Groundwater Basin (**Exhibit 5**) in the southern Sierra Nevada Mountains at elevations ranging from 2,500 to 7,100 feet above mean sea level (amsl). It is irregularly shaped, reflecting the drainage pattern of the North and South Forks of the Kern River, Kelso Creek, Tillie Creek, Erskine Creek, and other smaller tributary creeks. The basin is bounded by the Dome Lands Wilderness Area to the north, Piute and Kiavah Mountains to the south and east, and the Greenhorn Mountains and Kern Canyon Fault to the west. The southern portion of the basin is dominated by the Isabella Reservoir, from which the lower Kern River flows towards the San Joaquin Valley.

Groundwater in the Kern River Valley occurs in alluvium, a sedimentary material deposited by rivers and streams that derives from the granite and metamorphic bedrock surrounding the basin (County of Kern, 2011b). Alluvium consists of coarse deposits, such as sand and gravel, and finer-grained deposits such as clay and silt. The coarse sand and gravel deposits usually have the best water storage capability and are termed aquifers. The finer-grained clay and silt deposits that have relatively poor water storage capability are called aquitards. Most of the basin is characterized by alluvial aquifers except for aquitards found in the northern and southwestern portions of the Kern River Valley groundwater basin.

Groundwater pumped from the basin is the primary water supply source for the Kern River Valley. However, groundwater rights in the Kern River Valley groundwater basin are not adjudicated and there is no established groundwater management plan for the basin. Groundwater producers generally pump as much water needed to meet demands until water levels drop to a point of declining production. Consequently, the Kern River Valley has been subject to various moratoria due to groundwater quality and quantity issues.

Groundwater recharge is defined as the natural or intentional infiltration of water from the surface into groundwater reservoirs. Groundwater recharge in the Kern River Valley occurs through direct precipitation and infiltration along the Valley's margins. Recharge also occurs along the North and South Forks of the Kern River, and along tributaries such as Kelso, Tillie, and Erskine Creeks. A study of the sources of the shallow groundwater in the Hot Springs Valley conducted by the firm KOMEX in 2003 used a chloride mass balance approach to estimate that 7 percent of the average annual precipitation of 13.6 inches per year infiltrates into the groundwater basin. This equates to a groundwater recharge from precipitation on the order of 8,766 acre-feet per year in the vicinity of Lake Isabella (County of Kern, 2011b). Inflows to the groundwater basin may be on the order of 8,000 to 10,000 acre-feet per year on average but may vary significantly with local hydrologic conditions. Existing production could potentially consume most of this inflow, exclusive of other losses from the basin such as evapotranspiration and subsurface outflow.

The groundwater system beneath the area surrounding Lake Isabella has been subdivided into four alluvial groundwater basins as well as a fractured granitic groundwater aquifer that underlies the entire area (County of Kern, 2011b). The alluvial groundwater basins are generally similar in geologic setting and composition. Estimated total volume of groundwater in storage in the vicinity of Lake Isabella is approximately 1,224,300 acre-feet. This estimate does not include the saturated alluvial aquifer of the North and South Forks of the Kern River that is currently submerged beneath the Isabella Reservoir which contains an additional 247,600 acre-feet of storage.

The Big Blue Mill site is in the North Fork of the Kern River Groundwater Basin (5-25; **Exhibit 5**), which follows the trend of the Kern Canyon Fault to the north of Isabella Reservoir (County of Kern, 2011b). The alluvial aquifer material within the North Fork of the Kern River Groundwater Basin is composed of alluvial fan and flood plain deposits from the North Fork of the Kern River and other intermittent streams. The grain size distribution across the basin appears typical for alluvial basins. In general large cobbles and boulders are confined to the edges of the basin with sediments fining toward the middle of the basin. The majority of the sediments in the basin consist of sands and gravels. The estimated average porosity of the alluvium is 30%.

The basin is approximately one-half mile wide to the north of the Kern River Bridge in Kernville and expands to over one mile wide south of the Kern River Bridge downstream until the North Fork of the Kern River drains into Isabella Reservoir. The alluvium is underlain by granitic bedrock and varies in thickness from only a few feet to a maximum thickness of approximately 50 feet in the southern portion of the basin. The depth to groundwater is very shallow throughout the alluvial basin; the thickness of saturated soils north of the Kern River Bridge is estimated to average 10 feet and south of the Kern River Bridge is estimated to average 30 feet. Underflow potentially enters the alluvium beneath the surface water drainages, principally the North and South Forks of the Kern River, as well as from fractured bedrock in the higher elevations of the Sierra Nevada Mountains. Similarly, underflow leaves the area in alluvium, principally the lower Kern River, as well as fractured bedrock at lower elevations of the Sierra Nevada.

**Exhibit 5: Alluvial Groundwater Basins in the Vicinity of the Site**


After California Department of Water Resources, *Groundwater Bulletin 118.*

## 2.9 Hydrology

The site lies in the Kern River Basin, which contains the North and South Forks of the Kern River (County of Kern, 2011b). **Figure 1** indicates the location of the site at the entrance of the North Fork Kern River into Lake Isabella. Water, sediment, and other materials in the Kern River Valley drain into the Kern River. The drainage area of the Kern River from its headwaters (originating near Mt. Whitney, the tallest peak in California) to Isabella Dam is approximately 2,300 square miles. USACE completed construction of Isabella Dam in 1953 and the Isabella Dam holds Kern River water in what is known as Isabella Reservoir (also referred to as Lake Isabella), a reservoir with a maximum water storage capacity of 568,000 acre-feet (County of Kern, 2011b). The primary purpose of the dam and reservoir is flood control and water supply regulation. The total water storage capacity of Isabella Reservoir is reserved for downstream water rights holders, except for a 30,000 acre-feet pool. The minimum pool volume cannot be utilized by the downstream water users and must remain in Isabella Reservoir.

The North Fork Kern River begins at over 10,000 feet in elevation along the Kings-Kern Divide, Junction Peak, and Triple Divide Peak, which separate the south-flowing North Fork Kern River from the headwaters of the Kings River and the west-flowing Kaweah River. The North Fork Kern River tributary system flows over 400 miles from its headwaters to Lake Isabella (USFS, 2012).

Water chemistry has pH values from 6.0 to 9.0 in this watershed basin. Temperature ranges from data that was taken at a point during summer months from 6 to 19 ºC. Alkalinity values range from 16 to 140 parts per million (ppm). The Upper Kern Basin was rated as a category II in the Unified Watershed Assessment. A category II rating describes watersheds with good water quality that through regular program activities can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems.

## 2.10 Climate, Vegetation and Wildlife

### 2.10.1 Climate

The climate in the Upper Kern Watershed of the Tulare Lake Basin is typical Mediterranean with distinct wet and dry seasons. The intensity, duration, and timing of precipitation have the most substantial effect on the area (USACE, 2012). Annual precipitation ranges from 25 to 50 inches with most accumulation as snow in December through March. Snow accumulation averages 100 to 300 inches depending in part on elevation. Snow accumulates from approximately 4,000 feet amsl in elevation and above; then it will fall and stick at lower elevations for one to several days. Substantial rain-on-snow events occur approximately at 10- to 20-year intervals in the south to 20- to 30-year intervals in the north. Late summer thunderstorms with intense rainfall for short durations often cause heavy erosion on potentially hydrophobic soils, due, in part, to dry conditions. In addition, summer thunderstorms associated with lightning are a major source of wildfire ignition. Rainfall at lower elevations is less than at higher elevations due to adiabatic effects. Lower elevations are subject to thick fog layers from November through January affecting air quality at lower elevations more so than at higher elevations due to inversion.

Annual precipitation in the Upper Kern River watershed over the last five years ranged from 15 to 45 inches. Most occurs in the form of rain from January-March, and results in an annual average snowpack of approximately three feet at higher elevations of the watershed. Peak flows for the North Fork Kern River occur in April, May, and June with historic flows being highest in May. Monthly stream flow ranges from 17 to 600 cubic feet per second (cfs) with a mean annual flow of 329 cfs. Recorded peak flows ranged from 22,000 cfs in 1963 to 60,000 cfs in 1969, substantial rain-on-snow events occur roughly on a 10- to 20-year cycle. Major floods occurred in 1951, 1956, 1963, 1967, 1969, 1980, 1982, and 1996. Ambient summer temperatures recorded at District weather stations range from 60-90 degrees Fahrenheit (°F) and winter temperatures from 35-70 °F.

Climate conditions in the vicinity of the site are typified by warm summers and moderately cold winters. Temperatures range from 100 °F or greater during the summer months to as low as sub-zero temperatures in the winter. Precipitation varies widely, with an annual average of approximately 13.6 inches. Annual precipitation is greatest in the Greenhorn Mountains with an annual average of almost 2 feet. The least amount of precipitation occurs near the eastern side of Lake Isabella with an annual average of 6 inches. Snow is common to the highland areas, but most precipitation falls as rain. The prevailing wind is from the west to southwest. Kernville, California, receives approximately 13 inches of precipitation a year with the summer (May through October) months being very dry. Temperatures range from an annual high of 77.3°F to an annual low of 45°F (US Climate Data, http://www.usclimatedata.com/climate/kernville/california/united-states/usca1430). Much precipitation (approximately 10.9 inches) at the site occurs from November to March; rain in summer is rare.

### 2.10.2 Vegetation

Lake Isabella and much of the Kern River are in the foothills of Sequoia National Forest. Hydrologic features, such as natural springs, hot springs, tributaries of the Kern River, and the Kern River itself, dominate the surrounding landscape and support extensive areas of riparian and limnetic habitat, as well as some fringing wetland habitat, flanked by upland that is dominated by oak and pine woodlands or patches of sagebrush-scrub uplands. Vegetation present at the site is generally representative of riparian woodland and disturbed herbaceous woody shrub cover with local freshwater emergent wetlands.

***Riparian woodlands (Salix gooddingii, Populus fremontii, and S. laevigata Woodland Alliances)***

Riparian woodlands are common in the proposed project area upstream of the limnetic zone of Lake Isabella along the North Fork Kern River (**Exhibit 6**). The riparian woodland cover type is dominated by Goodding's willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), and red willow (*S. laevigata*). Also common in some areas are Pacific willow (*S. lasiandra)*, yellow willow (*S. lutea*), narrowleaf willow (*S. exigua*), shining willow (*S. lucida ssp.*), boxelder (*Acer negundo*), California buckeye (*Aesculus californica*), and white alder (*Alnus rhombifolia*) (USACE, 2012). Black elderberry (*Sambucus nigra*) is also found in this vegetation type. Tree canopy height can be up to 80 feet and is open to continuous. Common shrubs in the riparian woodlands include mule-fat (*Baccharis salicifolia*), coyote brush (*B. pilularis*), and redosier dogwood (*Cornus sericea*), which also form an open to continuous cover. The herbaceous layer is variable and is often dominated by primary colonizers such as rough cocklebur (*Xanthium strumarium*), stinging nettle (*Urtica dioica*), goosegrass (*Elusine indica*), common rush (Juncus effusus), common knotweed (*Polygonum lapathifolium*), common plantain (Plantago major), and cress (*Cardamine sp.*) (USACE, 2012).

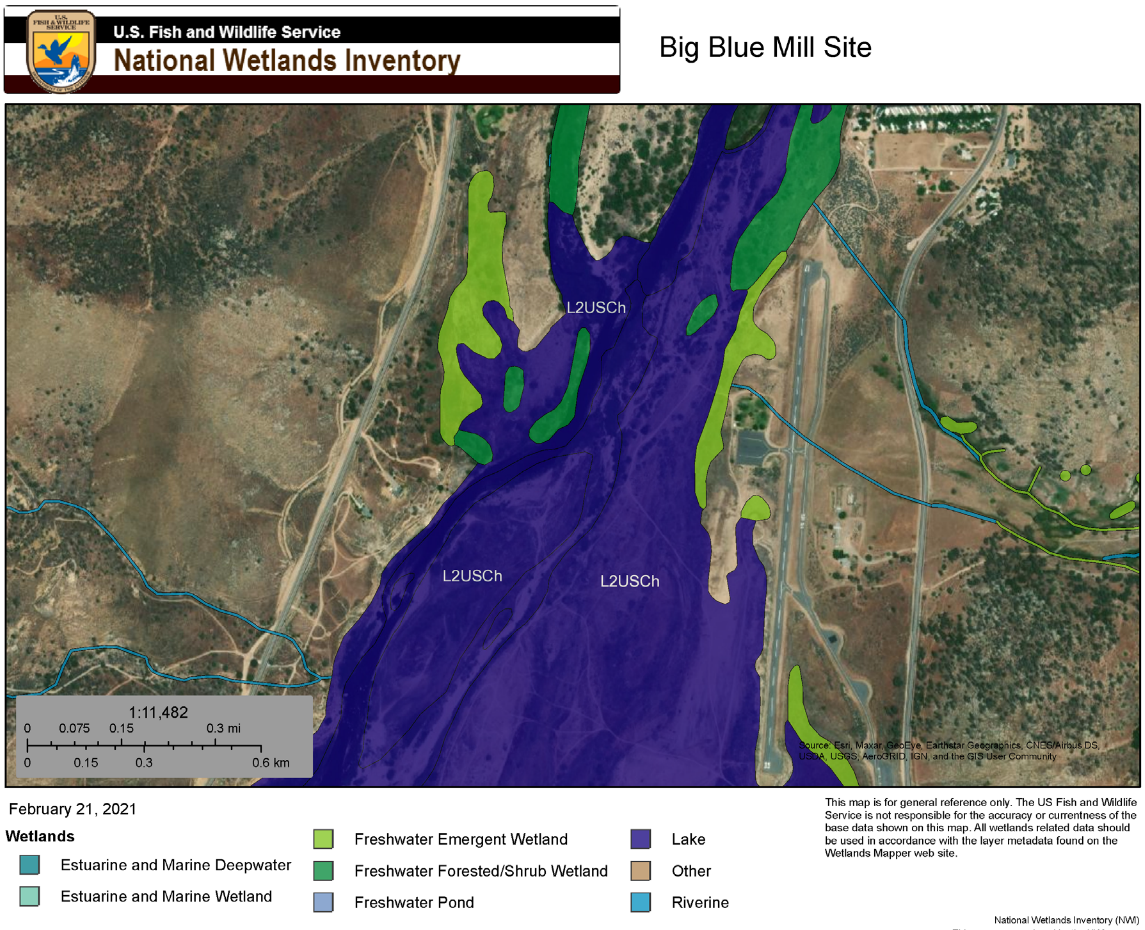
***Sagebrush-scrub upland (Ericameria nauseosa Shrubland Alliance) (Disturbed herbaceous Woody Shrub)***

The shrub and herbaceous layers are open to intermittent and host a diversity of species common to grasslands or other upland plant communities, disturbed areas, or riparian buffers. This cover type occurs on upland slopes, valley bottoms, or on terraces with soils that are shallow and moderately to excessively drained (USACE, 2012). The sagebrush-scrub upland cover type is dominated by rubber rabbitbrush with other species including big sagebrush (*Artemisia tridentata*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), Mormon tea, California buckwheat (*Eriogonum fasciculatum*), western juniper, and antelope bitterbrush (*Purshia tridentata*); immature junipers or pine may also be present at low cover (USACE, 2012). The shrub canopy is typically less than 10 feet high and is open to continuous (USACE, 2012). The herbaceous layer is sparse or grassy and primarily includes annual grasses and herbs, such as Bromus spp., California poppy (*Eschscholzia californica*), longbeak stork's bill (*Erodium boytrys*), red-stemmed filaree (*E. cicutarium*), perennial goldfields (*Lasthenia californica*), miniature lupine (*Lupinus bicolor*), slender oat (*Avena barbata*), wild oat (*A. fatua*), mustards (*Brassica* spp.), owl's-clover (*Castilleja exserta*), Italian rye grass, and yellow star-thistle (*Centaurea solstitialis*) (USACE, 2012). Sagebrush-scrub upland is found in all topographic settings, especially in disturbed settings.

### *2.10.2.1 Wetlands*

Within the site area, riverine, freshwater emergent wetlands and freshwater forested/shrub wetlands are present. Dominant forested/shrub and emergent wetlands species may include: *J. balticus, Distichlis spicata* (FACW), *Salix laevigata* (FACW), *Scirpus americanus* (OBL), and *Polygonum lapathifolium* (OBL). *Salix gooddingii* (OBL), *Urtica dioica* (FACW), *Eleocharis macrostachya* (OBL) may also be present. **Exhibit 6** shows the locations of wetlands in the vicinity of the site based on the National Wetlands Inventory (U.S. Fish & Wildlife Service, 2021).

**Exhibit 6: Wetlands in the Vicinity of the Site**




## 2.10.3 Wildlife

The diversity of habitats around Lake Isabella attracts a variety of wildlife species, including many residents and abundant migrants. The extensive riparian areas found in the deltas of the North Fork Kern River are the most substantial habitat for wildlife found in the vicinity of the lake. These areas host expanses of mature riparian woodland growing in braided stream channels, pools, and wetlands.

Common birds include passerines such as flycatchers, warblers, kinglets, chickadees, thrushes, jays, blackbirds, sparrows, finches, towhees, wrens, nuthatches, and swallows. Other common birds are hummingbirds, woodpeckers, water birds, waders, and various raptors such as owls, buteos, and smaller accipiters (USACE, 2012). Wildlife species common in this area include mammals such as foxes, coyote, bobcat, striped skunk, spotted skunk, raccoon, Virginia opossum, bats, and woodrats. Reptiles and amphibians that are relatively common include the Pacific chorus frog, western toad, bullfrog, and valley garter snake (USACE, 2012). Many invertebrates live on and in the soils of this area and provide the dietary basis for the high densities seen in some wildlife species.

Much of the upland habitat around Isabella Lake hosts species adapted to arid environments. Common reptiles include side-blotched lizard, southern alligator lizard, western fence lizard, California kingsnake, Pacific gopher snake, and Northern Pacific rattlesnake (USACE, 2012). Common upland bird species include California quail, scrub jay, goldfinches, wrentit, and acorn woodpecker. Mammals that are expected to be in the area include pocket gophers, mice, tree and ground squirrels, mule deer, mountain lion, and a diversity of bats. Isabella Lake and the Kern River host a variety of waterfowl, including migratory and resident waterfowl such as American coot, grebes, cormorants, gulls, and waders (USACE, 2012).

The open water of Lake Isabella and the Kern River hosts a variety of aquatic species, including native fishes (*e.g.*, Sacramento pikeminnow, hardhead, Sacramento sucker, Kern River rainbow trout), and introduced fishes (*e.g.* smallmouth bass, rainbow trout, redear sunfish, spotted bass, crappie, bluegill, brown bullhead, brown trout) (**Appendix C**). Lake Isabella has been managed as both a coldwater and warmwater fishery since the 1950s (USACE, 2012).

#### *2.10.3.1 Special Status Species*

General information regarding threatened, endangered, or sensitive species potentially present within the Sequoia National Forest and Kern County, California, was obtained via a search of the United States Fish and Wildlife Service's (USFWS) Information, Planning, and Conservation (IPaC) database. The USFWS IPaC database identifies one mammal (fisher), four birds (California condor, least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo), one amphibian (California red-legged frog), and one fish (delta smelt) as federally endangered or threatened species that potentially occur within the project area. Bald eagles and 11 migratory birds of conservation concern could be present. No critical habitat is present on site.

During the preparation of the Isabella Lake Dam Safety Modification Project Environmental Impact Statement (USACE, 2012), 45 special status species (USFWS, USFS, California Department of Fish and Game [CDFG], and California Native Plant Society [CNPS]) with the potential (low, medium, or high) to occur in or near the Isabella Dam Safety Modification Project area were identified. Following the removal of species with low potential for occurrence, the USFS Sequoia National Forest lists five plant species and nine animal species as sensitive within the forest. CNPS lists level 1, 2, and 3 Threat Rank plants near Isabella Lake. CDFG lists two rare and five endangered plant species and six threatened, four endangered, and one fully protected animal species (**Appendix C**). Excerpted information providing more detail regarding special status species that may be found in the vicinity of Lake Isabella is presented in **Appendix C**.

# 3 SI FIELD INVESTIGATION

Based on the history of the site and the results of screening and sampling conducted during the Removal Preliminary Assessment (USFS, 2020a), USFS determined that potential adverse impacts to human health and the environment would likely result from exposure to elevated metals concentrations in impacted soil/tailings, with potential impacts to river sediment and surface water. USFS identified additional data needs to provide conclusive evidence on which to base further action. ECM completed an SI field investigation to characterize contamination at the site. The following activities were performed:

- Characterize the lateral extent of chemicals of potential concern/chemicals of potential ecological concern (COPCs/COPECs) in mill waste using XRF and laboratory data.

- Characterize the vertical extent of COPCs/COPECs in test pits installed in two areas of elevated surface concentrations using XRF and laboratory data.
- Characterize metals in river sediment and surface water at locations upriver, adjacent to the site, and downriver to evaluate impacts from off-site and site sources and assess potential for contaminant migration downriver.
- Refine background concentrations for soil.
- Characterize the fraction of respirable metals in dust.
- Characterize leachability, potential to generate acid mine drainage, and bio-accessibility.
- Conduct air sampling using mercury vapor analyzer (MVA).
- Quantify the amount of material exceeding regulatory criteria.
- Assess risks to human health and the environment.

## 3.1 Sampling and Analysis Approach

ECM conducted sampling activities from October 19 to 23, 2020, to document current conditions at the Big Blue Mill site and potential impacts related to former operations. Field personnel collected XRF and laboratory samples to characterize contaminants in surface and subsurface soil/mill wastes; dry sediment, including the downriver sand bar; dust/air particulates; surface water; and river sediment. ECM also photographed site features and documented the remains of the former mill foundation and associated structures using the Trimble GPS. Field notes and forms completed during the site visit are presented in **Appendix D.** Photographs documenting site features and showing sampling locations are presented in **Appendix E**. ECM removed and disposed of equipment, personal protective equipment, and unused materials off site. No investigation-derived wastes were generated during the site visit. All sampling activities were performed in accordance with the PWP (ECM, 2020a) and SAP (ECM, 2020b).

**Table 1** summarizes the sampling program for the SI. ECM collected metals data from 200 surface samples within the investigation boundary on a 27-foot, on-center grid layout using a Vanta VMR-CXX portable XRF unit. While in the field, the ECM crew relocated select surface sample locations to areas of higher interest identified by USFS to more accurately delineate suspected impacted media. Twenty-eight subsurface soil samples were analyzed at seven locations to characterize the vertical distribution of metals to depths up to 5 feet below ground surface (bgs) and 10 surface samples were collected from downriver locations on a sand bar to evaluate off-site migration of metals. XRF readings of 20 subsamples and one composite sample were collected at a background location upgradient of the site. Laboratory data were collected for correlation with co-located XRF soil/waste samples (21 surface, 5 subsurface, and 1 composite background sample). Laboratory analyses were also performed for four sediment samples and three co-located surface water samples collected from the Kern River. One duplicate sample each was collected for soil/mill waste and surface water. Twelve samples were submitted to evaluate the respirable fraction of metals in dust and the area was screened using a Jerome 431X MVA. Acid-Base Accounting (ABA) (four samples) and Waste Extraction Test (WET) performed with deionized water (DI WET) (three samples) were analyzed to evaluate the potential to generate acid-mine drainage.

Samples were submitted to BC Laboratories (BC) in Bakersfield, California. Soil, sediment, and surface water samples were analyzed for CAM-17 metals using EPA Methods 6010/6020/7471, including total and dissolved fractions of surface water. Four samples were also analyzed for volatile organic compounds (VOCs) using EPA Method 8260B and PAHs using EPA Method

8270C SIM, and two samples (four metals) were evaluated for bio-accessibility using EPA Method 1340. Air samples were analyzed for Total Dust (National Institute for Occupational Safety and Health [NIOSH] 0500), Respirable Dust (NIOSH 0600), and metals (NIOSH 7303). One sample was analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) (EPA Method 1311) for four metals to evaluate off-site disposal alternatives. The laboratory analytical reports and chain-of-custody records (C-O-C) are presented in **Appendix F.**

**Tables 2** through **6** summarize the analytical results for metals, PAHs, VOCs, and particulates in environmental media at the site, including background. Concentrations are color-coded to show exceedances of ecological screening levels (green shading), Residential screening criteria (orange shading), and BLM Recreational Visitor SSLs (rose shading). Bolded values identify results that exceed the three-times background screening criteria. **Exhibits 9** through **11** summarize the results for TCLP, ABA/WET, and bio-accessibility analyses.

All sample locations were documented using a Trimble GPS unit with sub-meter accuracy. **Figure 2** shows soil/mill waste, sediment, surface water, and MVA sample locations and corresponding sample identification numbers (IDs). XRF and laboratory data were plotted onto site maps to show the distribution of arsenic, lead, and mercury in surface soil/waste (**Figures 4A** through **4C**) and delineate exposure units for risk assessment.

## 3.2 Mercury Vapor Analyzer Sampling

Areas with documented XRF mercury readings, such as AOC 3 (process area) and AOC 5 (cemented layered tailings), were field screened within the breathing zone using a Jerome J431-X MVA at the 12 locations shown on **Figure 2**. The MVA did not detect mercury in any sample except BB-MV-11, collected near BB-54. MVA sample results are provided in **Appendix D**.

## 3.3 Site Survey

Identification and marking the site boundary and visible historical features was performed in two phases of work. The first task involved a boundary survey of the existing property to identify the lateral extent of investigation.  The ECM Field Manager directed a survey crew of two licensed surveyors from August 10 to August 13, 2020.  The work included locating monuments and placing boundary posts and signs. The data were used to plot the pink hatched investigation boundary shown on the site figures.

During the second mobilization between October 19 and 23, 2020, ECM field personnel documented site accessibility, general topography, access restrictions, nearby structures, evidence of public visitation, remaining mill features, proximity to river features, sensitive environments and drainage characteristics by collecting GPS points and developing a photographic log of site features, as well as field notes. ECM searched the site for remaining mill features and recorded all observed mill foundations and associated retaining walls using GPS with submeter accuracy. Field personnel surveyed the perimeter of each mill foundation and retaining wall by slowly walking the outer boundary while recording the path with GPS. ECM collected georeferenced photographs at each location to document the condition and approximate relative age of the structures. Points of interest such as the fishing platform noted in the PA (USFS, 2020a) were also photographed and located using GPS to show evidence of public access.  The mill foundation and wall segments are plotted in **Figure 2**.

## 3.4 Quality Control XRF Results

XRF samples were analyzed for detector accuracy and reliability. Blanks were collected to ensure that detector drift was minimized. A quality control (QC) sample with known concentrations provided with the XRF instrument was analyzed to determine relative repeatability of detections. The results are provided below in **Exhibit 7**.

QC results for XRF data collection are summarized in **Exhibit 7** in accordance with the following QC procedure. Prior to the start of XRF monitoring each day, field personnel analyzed a blank standard to identify whether the XRF instrument has any problems with false positives or if there might be contamination on the analysis window or on the detector. Additional readings in the middle of the day after lunch and at the end of the day were also collected as indicated. The resulting data from a blank standard contain only trace amounts of the elements of interest. In addition to blank standard, field personnel analyzed a known standard that includes targeted elements close to the range of the action level and note the accuracy and precision of the result. Results for the analysis of standards throughout the field effort were logged and compared against the certified values of the standard for arsenic, lead and mercury, identified as relevant COPC/COPEC for the project. The XRF was professionally calibrated by Olympus America in accordance with the manufacturer's recommendations. Field personnel collected QC readings against the blank and National Institute of Standards and Technology Standard Reference Material (SRM) 2711A standard.

**Exhibit 7. Quality Control XRF Results**

| Sample ID | Date | As | Pb | Hg |
|---|---|---|---|---|
| ***Units*** | | *ppm* | *ppm* | *ppm* |
| BLANK | 10/19/2020 | 0 | 0 | 0 |
| BLANK | 10/19/2020 | 0 | 0 | 0 |
| BLANK | 10/19/2020 | 0 | 0 | 0 |
| BLANK | 10/20/2020 | 0 | 0 | 0 |
| BLANK | 10/21/2020 | 2 | 0 | 0 |
| BLANK | 10/22/2020 | 0 | 0 | 0 |
| BLANK | 10/22/2020 | 3 | 0 | 0 |
| BLANK | 10/22/2020 | 3 | 0 | 0 |
| BLANK | 10/23/2020 | 2 | 0 | 0 |
| SRM2711A | 10/19/2020 | 46 | 1572 | 10 |
| SRM2711A | 10/19/2020 | 38 | 1564 | 11 |
| SRM2711A | 10/19/2020 | 51 | 1592 | 3 |
| SRM2711A | 10/19/2020 | 47 | 1588 | 3 |
| SRM2711A | 10/19/2020 | 53 | 1580 | 12 |
| SRM2711A | 10/20/2020 | 47 | 1586 | 12 |
| SRM2711A | 10/21/2020 | 38 | 1565 | 10 |
| SRM2711A | 10/21/2020 | 47 | 1600 | 11 |
| SRM2711A | 10/22/2020 | 38 | 1561 | 9 |
| SRM2711A | 10/22/2020 | 38 | 1578 | 12 |
| SRM2711A | 10/22/2020 | 49 | 1580 | 10 |
| SRM2711A | 10/23/2020 | 45 | 1585 | 12 |

## 3.5 Correlation Between XRF Data and Laboratory Results

A total of 27 confirmation soil samples were collected and submitted to the fixed laboratory for

CAM 17 metals analysis to verify the quality of the XRF data. Per EPA Method 6200 (EPA, 2007) the confirmatory samples were selected from the lower, middle, and upper range of the XRF data. The confirmatory soil samples and XRF results (approximately 12%) were evaluated using a least squares linear regression analysis. **Table G1** summarizes the statistical correlation data between the XRF and laboratory confirmatory samples and correlation graphs are included in **Appendix G**.

Non-detect values were not used in the correlation analysis and individual metals with an incomplete data set were not evaluated. Antimony, arsenic, chromium, copper, lead, mercury, nickel, vanadium, and zinc had a full data set of XRF values and lab values to graph and perform the correlation analysis. The linear correlation coefficient (r) and the coefficient of determination ($R^2$) were used to quantify the accuracy of XRF data compared with laboratory analytical results.

The linear correlation coefficient measures the strength and direction between two variables. The r value is such that $-1 \leq r \leq +1$, with the plus or minus signs representing positive or negative correlations.

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\ \sqrt{n(\sum y^2) - (\sum y)^2}}$$

Where:

$n$ = number of values or elements

$x$ = XRF value

$y$ = lab value

$\sum xy$ = Sum of the product of XRF and lab values

$\sum x$ = Sum of the XRF values

$\sum y$ = Sum of the lab values

$\sum x^2$ = Sum of square XRF values

$\sum y^2$ = Sum of square lab values

Based on 27 XRF and laboratory sample pairs, the calculated r values for antimony, arsenic, chromium, copper, lead, mercury, and zinc were 0.7540, 0.9808, 0.6761, 0.7987, 0.9410, 0.8398, and 0.9411, respectively. Correlation coefficients (r) exceeding approximately 0.7 indicate XRF results for the metal may be used for quantitative evaluation (EPA, 2007). The r values for nickel (0.3416) and vanadium (0.3365) were below 0.7, so these data are considered screening level. Screening level data are useful to delineate areas containing metals at concentrations exceeding screening criteria. Characterization of barium, beryllium, cadmium, cobalt, selenium, and thallium was largely based on laboratory results. The XRF analyzer may not provide reliable concentrations for these metals due to limitations of the instrument, or the sample-specific LODs for a majority of locations may be elevated above screening criteria. Where available, XRF data were used to characterize nature and extent of contamination, since these data were collected from a site-wide grid. Samples from 12% of the XRF locations were submitted for laboratory analysis to provide data used to confirm XRF results and fill data gaps. The laboratory data are limited in extent and may not provide representative concentrations for an investigation area. Uncertainty resulting from use of XRF and laboratory data for nature and extent characterization is discussed in **Section 4.6.4**.

The $R^2$ is a measure of how well the regression line predicts the data.

$$R^2 = 1 - \frac{SS_{err}}{SS_{tot}}$$

Where:

$SS_{err} = \sum(y_i - f_i)^2$ – the sum of squared errors

$SS_{tot} = \sum(y_i - y)^2$ – the total sum of squares

Regression data were used as a factor to identify COPCs/COPECs for risk assessment (**Section 3.11**). XRF metal $R^2$ values exceeding approximately 0.8 (EPA, 1995), as reported for arsenic (0.9621), lead (0.8855), and zinc (0.8858), are considered suitable to support quantitative risk assessment. XRF metals with $R^2$ values greater than 0.5 (antimony, chromium, copper, and mercury) may be used for screening level assessment on a case-by-case basis. $R^2$ values for cadmium and silver were not calculated due to the high number of sample pairs containing non-detect concentrations. However, detected cadmium and silver values were determined to be suitable as potential screening level COPCs/COPECs. $R^2$ values for XRF data sets less than 0.2 (nickel and vanadium) and were not considered for risk assessment. XRF metals identified as quantitative and screening level COPCs/COPECs were evaluated using the same risk assessment procedures. Limitations related to the use of screening level metals for assessment are discussed in **Section 4.6.4**.

All laboratory data were considered valid for quantitative risk assessment purposes. However, these data may not be representative of conditions site wide or over an investigation area since they were only collected from AOCs 4 through 7 and represent a small number of samples (approximately 12% of XRF data). For example, in some AOCs where laboratory data were analyzed, the maximum detected concentrations of metals were used as EPCs due to sample size compared to 95% UCL values calculated for corresponding XRF data collected from a sample grid. Because of the site-wide coverage, nature and extent evaluations and risk characterization were performed using quantitative and screening level XRF data, as available. To fill data gaps and evaluate potential bias in XRF results, the XRF characterization results were also compared to results using laboratory data as confirmation. The text identifies how the XRF and laboratory data supported project objectives.

Potential uncertainties affecting the risk assessment from use of XRF and laboratory data sets are discussed in **Section 4.6.4**.

## 3.6 Deviations from PWP and SAP

The following deviations to the SAP were noted:

1. A single sample was analyzed for TCLP. The laboratory reported insufficient sample volume to perform the TCLP analysis on the second sample submitted due to required volume needed for the other requested analyses.
2. No sample for hardness for surface water was requested from the laboratory. A hardness of 100 milligrams per liter (mg/L) was assumed for hardness-dependent metals screening criteria.

## 3.7 Environmental Media Screening Levels

Soil screening levels (SSLs) are concentrations of chemicals intended to be protective of human health and/or the environment under a defined exposure setting. Screening levels are not cleanup goals and exceedances do not automatically indicate that a response action is warranted. The SI used risk-based screening levels (RBSLs) and other criteria to identify preliminary

COPCs/COPECs for risk assessment and determine whether a release of contaminants to the environment has occurred or is occurring. These criteria were established in the SAP (ECM, 2020b) and are referenced in **Tables 2** through **6**. Site analytical data were compared with the RBSLs to evaluate Residential, Recreational Visitor, and ecological receptor exposures to contaminants identified in site media.

The following human health screening criteria and ecological screening values (ESVs) were identified for soil, sediment, and surface water:

- **Soil/Waste/Upland Sediment**. Residential exposures to impacted soil/waste and dry sediment deposits for metals, PAHs, and VOCs were evaluated using EPA (2020b) Residential RSLs. For some chemicals, such as arsenic, lead, and mercury (**Table 3A**), risk assessment guidance provided in Department of Toxic Substances Control (DTSC) Note 3 (2020) provides more conservative SSLs that should be used instead of the EPA RSLs. Recreational Visitor SSLs developed by the BLM (2017) for metals commonly found at abandoned mine land sites were used to evaluate potential exposures to child and adult visitors to the site. ESVs for plants, invertebrates, mammals, and birds were selected from EPA Ecological Soil Screening Levels (Eco-SSLs) (EPA ECOTOX website, 2020a). If an Eco-SSL was not available, peer-reviewed benchmarks from Los Alamos National Laboratory (LANL) ECORISK Database Release 3.2 (2017) or Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks (2018) were selected to evaluate soil impacts. The selected criteria for soil and tailings/waste are shown on **Tables 3A** and **3B** for metals, **Table 3C** for PAHs, and **Table 3D** for VOCs.
- **River Sediment.** Investigation results were compared to EPA RSLs or DTSC Note 3 SSLs (EPA, 2020b; DTSC, 2020) and BLM screening criteria for child/adult Recreational Visitors (BLM, 2017) to evaluate potential impacts to human receptor groups from exposure to metals in river sediment. California has not established numerical benchmarks to evaluate exposure of aquatic organisms to metals in river or stream sediment. Ecological no-effect benchmarks for river sediment were selected from peer-reviewed studies (MacDonald *et al*. [2000], Long *et al*. [1995], and Thompson *et al*. [2005]) to evaluate potential impacts to ecological receptors from exposure to metal contaminants in the Kern River. The selected sediment screening criteria are shown on **Table 4**.
- **Surface Water**. SI analytical results for metals in samples collected from the Kern River were compared to water quality standards protective of the Kern River above Lake Isabella. Beneficial uses for human and ecological receptors and water quality standards are described in the Tulare Lake Basin Plan (Central Valley Regional Water Quality Control Board, 2018). Designated uses include MUN (municipal and domestic water supply), REC-1 (water contact recreation), REC-2 (noncontact water recreation), and ecological habitat protection. According to USFS, the North Fork Kern River immediately adjacent to the site is only used for recreational purposes. No drinking water intakes are present and water is not used for drinking water along the reach of the river adjacent to the site. Potential water quality standards include California Toxics Rule (CTR) criteria for inland surface waters (human consumption of water and organism and acute/chronic ecological criteria) (EPA, 2000b), and National Recommended Water Quality Criteria (formerly National Ambient Water Quality Criteria) for human consumption of water and organism and acute/chronic ecological exposure (EPA, 2020c). The selected screening criteria are shown on **Table 5**.
- **Air.** Exposures to metals in dust/particulates within the breathing zone were evaluated using EPA (2020b) Residential and Industrial RSLs. For some chemicals, screening levels provided in DTSC Note 3 (2020) that were more stringent than the RSLs were used. For

metals, criteria from Table AC-1 Permissible Exposure Limits (PELs) for Chemical Contaminants, including Particulates not otherwise regulated for zinc and respirable and total dust (California Department of Industrial Relations, current version) were considered. The PEL is the 8-hour time-weighted average concentration limit for exposure during a 40-hour work week. Screening criteria for particulates are shown in **Table 6**.

### 3.7.1 Soil Background Screening Levels

Under CERCLA, concentrations of contaminants below naturally occurring background levels are not generally subject to removal or remedial actions. Historical aerial photographs were reviewed to verify no activity had occurred in the area selected as background. The area was topographically higher than the site, so it appeared to be above the floodplain. Surface soil samples were collected from an area upgradient of the site that appeared visually undisturbed as determined by the appearance and presence of the soil and vegetation. These samples were analyzed to establish background concentrations of metals in soil for comparison to site analytical data (such as impacted soil/tailings) to determine whether a release has occurred and delineate areas of impact.

Three-times background screening criteria were developed using the site-specific background concentrations in surface soil. In accordance with EPA guidance (EPA, 1995), a release at the site is documented when a hazardous substance (*e.g.*, a metal such as mercury potentially associated with processing gold ore) was detected at a concentration equal to, or greater than, three times the background concentration, and the release was at least partially attributable to the site under investigation. If an analyte was not detected in background samples, then a release was established when the reported concentration was equal to or exceeded the detection limit (40 Code of Federal Regulations [CFR] Part 300, Appendix A, Table 2-3). The results of the background characterization and release evaluation are presented in **Section 3.8** and **Section 3.9,** respectively. Exceedances of background screening criteria do not automatically indicate that a response action is warranted because the concentration may not exceed a RBSL for that chemical.

## 3.8 Background Characterization

Site-specific background concentrations for metals in soil were established by analyzing a composite sample collected northwest of the site, about 100 feet below Highway 495 (**Figure 2**). Twenty-four subsamples were screened in the field using the XRF instrument before compositing. Four of the subsamples, BB-B-01, BB-B-02, BB-B-03, and BB-B-04, were not included in the composite sample. Subsamples BB-B-01 and BB-B-02 contained elevated arsenic concentrations indicating potential impacts due to former operations, and subsamples BB-B-03 and BB-B-04 were located topographically higher and in disturbed soil not similar to the site conditions. The resulting 20-point composite sample was screened using XRF and submitted to BC in Bakersfield, California, for analysis of CAM-17 metals using EPA Methods 6010/6020/7471. **Table 2** summarizes the background concentrations established for the SI using XRF and laboratory analytical data.

## 3.9 Release Determination

Surface and subsurface site soil data were compared to the three-times background screening criteria identified in Tables **3A** and **3B** using background concentrations summarized in **Table 2**. Bolded values in **Table 3A** for surface soil/waste and **Table 3B** for subsurface samples indicate that the concentrations of several metals exceeded background screening criteria. For the XRF dataset, antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc concentrations exceeded the XRF three-times background criteria in one or more surface samples, indicating a potential release to the environment. Laboratory concentrations of antimony, arsenic, cadmium, copper, lead, mercury, molybdenum, selenium, silver, and zinc also exceeded the laboratory background screening criterion. In subsurface soil/mill waste (**Table 3B**), XRF concentrations of antimony, arsenic, cadmium, lead, mercury, selenium, silver, and zinc exceeded the background screening criteria, indicating a potential release. Laboratory concentrations of antimony, arsenic, cadmium, copper, lead, mercury, molybdenum, selenium, silver, and zinc concentrations in subsurface soil also exceeded the applicable background screening criteria.

## 3.10 Investigation Areas of Concern

The SI dataset collected by ECM was used to identify source and potential migration areas and characterize the distribution of contaminants. For this objective, the site was divided into seven Areas of Concern (AOCs) (**Figure 3**) for calculation of exposure point concentrations (EPCs). AOC delineation was based on a weight-of evidence evaluation of factors that include the SCEM; distribution of elevated concentrations of metals in surface and subsurface soil; historical uses of the site; observations of tailings, debris, foundations, and historical walls during site visit; and proximity to site features, source areas, and/or occupied residences. Evaluating the site by AOC provides USFS flexibility in developing a plan to respond to impacted areas. For example, AOCs containing metals at background concentrations may not require cleanup under CERCLA, while those AOCs reporting the highest concentrations of metals may be prioritized for further action. The boundaries of the AOCs are shown on **Figure 3**.

The following AOCs are identified for the SI:

- **AOC 1 – Northeastern Floodplain Area**. This AOC is located upriver of the former mill foundation and incorporates the floodplain on the west bank of the Kern River, northeast of the mill process AOC (AOC 3). This area is characterized by metals at concentrations generally consistent with background levels.
- **AOC 2 – North Area**. This exposure area is located west of AOC 1 and north and northwest of the mill process AOC. This floodplain area rises in elevation to the west and contains a ditch that traverses the site; the western boundary of this AOC coincides with the sloped area west of the ditch. The AOC was delineated based on the distribution of metals concentrations in floodplain deposit material above background levels. Elevated mercury concentrations and slag remnants along a north-oriented trail extending from the mill process area (AOC 3) may indicate impacts from an unknown gold processing area.
- **AOC 3 – Mill Process Area**. This exposure area contains debris, mill foundations, and old retaining wall remnants associated with former operations of the mill facilities. Elevated concentrations of arsenic, lead, and mercury likely associated with mill process activities are present within this AOC.
- **AOC 4 – Area Adjacent to Residence**. This exposure area is located between the private property boundary and USFS land near the former mill foundation. The AOC contains elevated metals concentrations in surface and subsurface soil near a private residence.
- **AOC 5 – Cemented Tailings Area**. This exposure area is characterized by deposits of exposed and buried cemented tailings and extends downriver approximately 300 feet along the shoreline from the area downgradient of the former mill foundation to the location of sample BB-123. Arsenic, lead, and mercury concentrations in the tailings materials are among the highest observed at the site.

- **<u>AOC 6 – Downriver Distributed Mill Material</u>**. This AOC extends downriver from the former mill site but lies north of the cemented tailings deposits that characterize AOC 5. Elevated metals concentrations in impacted soil observed in the AOC may derive from dispersed mill tailings that have been relocated from the former mill site by operational procedures or river processes.
- **<u>AOC 7 – Downriver Sand Bar</u>**. This AOC includes the sediment samples collected from the sand bar downriver of the site. The sand bar is accessible from the north bank of the Kern River but, at times, may be surrounded by river flow. Metals concentrations are generally below background levels in this AOC.

The color that outlines each AOC on **Figures 3**, **4A**, **4B**, and **4C** corresponds to the shading for each AOC used in **Tables 3A** and **3B**.

## 3.11 Selection of COPCs/COPECs

XRF and laboratory analytical data for soil/waste were evaluated to determine COPCs and COPECs for risk assessment. Due to limitations detecting barium, beryllium, and thallium using the XRF method and potential for sample-specific XRF detection limits to exceed RBSLs for metals such as antimony, cadmium, cobalt, mercury, and silver, both XRF and laboratory data were evaluated for COPC/COPEC selection. XRF data included antimony, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc. The CAM-17 metals list was analyzed for a small subset of site locations (12% of XRF samples) to confirm the useability of the XRF data. Thallium was not detected in the laboratory samples and was not evaluated. PAHs and VOCs were analyzed at four locations. Additionally, XRF data are not available for the co-located sediment and surface water samples; therefore, laboratory data were used to determine COPCs/COPECs for these media.

The selection criteria for identification of metal, PAH, and VOC COPCs and COPECs for soil/waste in order of application are:

1. The number of detections for a metal is greater than 5%;
2. The maximum metal concentration exceeds the background screening criterion (3 times background), or method detection limit (MDL), if the analyte was not detected in the background sample; and
3. The maximum metal, PAH, or VOC analyte concentration exceeds a human health or ecological screening value.

**Tables H1-1** through **H1-5** summarize the COPCs and COPECs for each medium based on the results of the application of the selection criteria to laboratory and XRF data sets, as applicable.

### 3.11.1 Soil

The maximum analyte concentrations reported for surface soil/waste material were compared to background screening criteria developed for XRF and laboratory metals datasets and the most stringent human health and ecological screening levels for the SI. Screening criteria were the lowest values for Residential exposure selected for metals, PAHs, and VOCs between the EPA RSLs (November 2020) and DTSC Note 3 Residential SSLs (2020) for human health. For ecological exposure, the most stringent ESV for each metal was selected among the four receptor groups (plants, invertebrates, mammals, and birds). Only analytes with a reported detection frequency exceeding 5% were considered.

Five metals were identified as COPCs for the laboratory dataset (antimony, arsenic, cadmium, lead, and mercury) and four metals were identified as COPCs for the XRF dataset (antimony, arsenic, lead, and mercury). Eleven metals were selected as COPECs for laboratory data (antimony, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, silver, selenium, and zinc) and seven metals were selected as COPECs for the XRF dataset (antimony, arsenic, copper, lead, mercury, silver, and zinc). These metals were retained for further evaluation in the SI and risk assessment (**Section 4.0**).

VOC and PAH concentrations in soil were less than the screening levels for all receptors and these analytes were not retained as either a human health COPC or an ecological COPEC. These constituents were not further evaluated in the risk assessment.

### 3.11.2 River Sediment

Metals reported in river sediment were compared to screening levels identified for the SI. The human health screening levels were the same as those developed for soil. No-effect screening criteria for aquatic organisms were applied. To evaluate the potential effects of milling activity on sediment quality at the site, samples were collected upriver, immediately adjacent to the site, and downriver (two locations). . The upriver sample was used as the background comparison sample to identify COPCs or COPECs in sediment for risk assessment.

Arsenic was identified as a COPC, and arsenic, mercury, and selenium were selected as COPECs. These metals were retained for further evaluation in the SI and risk assessment (**Section 4.0**).

### 3.11.3 Surface Water

Metals reported in surface water collected from the Kern River were compared to screening levels identified for the SI. The human health and ecological screening levels were developed to protect the beneficial uses and water quality of the Kern River. The most stringent numeric values (human health and aquatic organism) among the potentially applicable water quality standards for each metal were used to identify COPCs and COPECs. To evaluate the potential effects of milling activity on surface water quality at the site, samples were collected at locations upriver, immediately adjacent to the site, and downriver. These samples were co-located with river sediment. The upriver sample was used as the background comparison sample to identify COPCs or COPECs in surface water for risk assessment.

Two COPCs, arsenic and mercury, were retained for further evaluation in the SI and risk assessment. No COPECs were identified.

## 3.12 Field XRF and Laboratory Metals Sample Results

Data collected during the SI were used to characterize contaminant distribution (**Section 3.13**) and risk (**Section 4**) for site media including (1) surface and subsurface soil, (2) cemented tailings, (3) dispersed tailings, and (4) particulates. The potential for off-site migration was evaluated for river sediment and surface water through comparison of upriver and downriver results. COPCs and COPECs were identified for metals constituents based on comparing site data (maximum concentration for each metal) with background screening criteria and screening levels. The following sections describe the data trends for metal COPCs and COPECs, PAHs, and VOCs in environmental media for the seven soil/tailings AOCs, river sediment, and surface water. Evaluating the site by AOC and medium helps delineate higher and lower areas of risk and determine migration pathways.

The metals background results are summarized in **Table 2;** surface and subsurface metals results are in **Table 3A** and **3B, and Tables 3C** and **3D** summarize PAH and VOC data. **Tables 4** and **5** present sediment and surface water results for metals**,** and **Table 6** summarizes results for particulates**. Exhibits 9**, **10**, and **11** summarize analytical results for ABA/WET, TCLP, and bioaccessibility. All laboratory analyses were conducted by BC in Bakersfield, California. The laboratory analytical report and C-O-C records are presented in **Appendix F**. The laboratory data quality review is presented in **Section 3.26**.

## 3.13 Source, Nature, and Extent of Contamination

This section describes the source, nature, and extent of contamination based on SI data. Data summary tables use color and bolding to delineate AOCs and highlight samples with exceedances of background screening criteria, ESVs, and Residential RSLs or Recreational Visitor SSLs. Review of the surface and subsurface soil summary tables (**Tables 3A** and **3B**) identified antimony, arsenic, lead, and mercury as the drivers for site characterization. Antimony, arsenic, and lead concentrations are related to the ore and mining operations, while mercury occurrence is associated with gold processing. These four metals are also COPCs. Other metals are discussed but their distributions are not plotted.

**Figures 4A**, **4B**, and **4C** illustrate the distribution of arsenic, mercury, and lead using bubble plots. The bubble dot color shown at each sample location corresponds to a concentration range for the respective metal. Green or blue dots show areas where concentrations are below the metal's background concentration, yellow or orange dots mark areas where Residential screening levels are exceeded, and red dots demonstrate areas where concentrations exceed the Recreational Visitor SSLs. The seven AOCs are outlined using colored borders that match the hue used in the summary table to shade the different regions. The use of color facilitates interpretation of site characteristics and trend analysis within and between the AOCs. The following subsections describe the distribution of those CAM-17 metals that were identified as COPCs and/or COPECs.

### 3.13.1 Arsenic

Arsenic is a human health COPC and a COPEC. Arsenic was reported in all surface samples analyzed during the SI. Arsenic detection trends show the most elevated concentrations occur in the mill process area (AOC 3), on USFS land adjacent to the residence that is located closest to the mill foundation (AOC 4), and area containing cemented tailings (AOC 5). The arsenic Residential RSL is 0.11 and the Recreational Visitor SSL is 30.6 mg/kg. The arsenic ESV is 18 mg/kg. Background concentrations determined based on XRF and laboratory analysis were similar (19 and 20 mg/kg). Arsenic concentrations for XRF surface samples are shown on **Figure 4A**.

**<u>AOC 3</u>**. Arsenic concentrations in the vicinity of the former mill exceeded the Residential RSL in all 25 XRF samples and the Recreational Visitor SSL and ESV in 24 samples. At the former mill foundation, arsenic concentrations were as high as 483 ppm at BB-022. Arsenic concentrations increased to the northwest of the former mill foundation, ranging from 941 ppm at BB-026 and 699 ppm at BB-033, to 1,105 ppm at BB-032 and 1,314 ppm at BB-095, to 2,183 ppm at BB-093. This area of elevated arsenic extends along a pathway into AOC 2 and may indicate the presence of a process area, since mercury concentrations are also elevated. Concentrations decrease to the north and northwest toward the floodplains (toward AOC 2), and northeast (toward AOC 1), but increase to the west near the residence (AOC 4) and within the cemented tailings (AOC 5).

**<u>AOC 4</u>**. Arsenic concentrations are elevated on USFS land up to the private property boundary west of the former mill foundation. The AOC borders an occupied residence and a former mill building may have been located within 100 feet of the USFS property boundary on what is currently private land. The distribution of elevated arsenic along the western boundary of AOC 4 indicates that the extent of arsenic to the west of AOC 4 is not defined by the private property boundary. Arsenic concentrations exceeded the Recreational Visitor SSL, Residential RSL, and ESV in all 15 XRF samples and both laboratory samples. Arsenic concentrations show an increasing trend on USFS land between the former mill area and the private property boundary to the west. The highest XRF concentrations are 10,929 ppm at BB-025, 8,226 ppm at BB-106, 4,678 ppm at BB-025-SO-01, and 2,997 ppm at BB-020. Laboratory concentrations ranged from 7,100 to 7,400 mg/kg.

**AOC 5**. Arsenic concentrations in this AOC are associated with the occurrence of buried and exposed cemented tailings. Concentrations exceeded the Recreational Visitor SSL, Residential RSL, and ESV in all 15 XRF samples and all 8 laboratory samples. The highest concentrations reported at the site are observed in this AOC. The northeast surface extent of the tailings deposit is on the beach immediately downgradient of the mill foundation at BB-023 (31,092 ppm), BB-116 (1,833 ppm), and BB-116-SO-01 (9,270 ppm). The tailings are present downriver along the shoreline as far southwest as BB-123 (27,168 ppm). The highest XRF arsenic concentration in the very fine-grained brown to rust colored cemented tailings deposit described in **Section 2.2** (**Appendix E**, Photo 16) was observed at BB-127 (90,189 ppm). Laboratory concentrations ranged from 1,100 to 88,000 mg/kg. No observable trend in the concentration distribution along the shoreline was evident. This may be due to incomplete exposure or mixing with other material along the bank of the Kern River during high flow events.

**AOC 6**. Although arsenic concentrations are lower in AOC 6 compared to concentrations reported at bordering AOCs, the distribution of elevated arsenic along the northwestern boundary of AOC 6 indicates that the extent of arsenic is not confined to USFS land. This area contains distributed tailings and mill waste on USFS land downriver of the mill process area and upgradient of the cemented tailings along the shore of the Kern River. The highest concentrations in AOC 6 are within the southwestern portion of the AOC at BB-002 (265 ppm) and BB-005 (369 ppm). Generally, arsenic concentrations decrease downriver with distance from the mill source area. Arsenic concentrations exceed the Residential RSL and Recreational Visitor SSL in the laboratory sample and in 13 of 16 XRF samples. Arsenic exceeded the ESV in three additional samples.

**AOC 7**. XRF arsenic concentrations in the downriver sand bar within AOC 7 are at or below the XRF background level (19 ppm), ranging from 4 ppm at BB-M1-03 to 26 ppm at BB-M1-09. Laboratory sample results were less than the laboratory background value (20 mg/kg) in the 10 samples within the AOC, ranging from <1.7 mg/kg to 17 mg/kg.

**AOC 2**. Arsenic concentrations are relatively consistent over most of the floodplain contained within AOC 2. Some isolated areas of higher concentration are observed, such as 249 ppm at BB-124, 297 ppm at BB-107, and 368 ppm at BB-088. A localized area of elevated arsenic is present along the trail that extends north from AOC 3. This area may represent a process area since mercury concentrations are also elevated and the footprint of an historical building may be located here (**Figure 4A**). Arsenic concentrations decrease to the north and northwest of the process area. The remaining arsenic concentrations in this area range from 12 ppm to 200 ppm.

**AOC 1**. This floodplain area adjacent to the North Fork Kern River contains arsenic concentrations that are consistently below background levels at most surface locations. Concentrations range from 6 to 25 ppm except for location BB-038 (37 ppm) along the North Fork Kern River.

### 3.13.2 Mercury

Mercury is a human health COPC and a COPEC. The distribution of mercury is shown on **Figure 4B**. Mercury concentrations in surface samples are most elevated in the cemented tailings (AOC 5) and are also elevated in a localized area northwest of the former mill foundation in AOC 3. Isolated occurrences of elevated mercury concentrations are also observed in other AOCs, but no distribution trends were noted. The XRF background concentration of mercury is 3 ppm (at the limit of detection) and the laboratory background is 0.62 mg/kg. The Recreational Visitor SSL is 271 mg/kg, the Residential RSL is 1 ppm, and the ESV is 0.013 mg/kg.

**<u>AOC 5</u>**. Elevated XRF mercury concentrations are present in cemented tailings located downgradient of the former mill foundation on the beach (108 ppm at BB-023 and 19 ppm at BB-116) and at isolated downriver locations (BB-127 [1,458 ppm], BB-007 [275 ppm], and BB-123 [693 ppm]). Concentrations at 13 locations exceeded the Residential RSL and the detections at BB-007, BB-123, and BB-127 exceeded the Recreational Visitor SSLs. Concentrations in laboratory samples exceeded the Residential RSL in eight samples and the Recreational Visitor SSL in one sample (BB-123). All detected XRF and laboratory values exceeded the ESV. The cemented tailings contain the highest mercury concentrations on site.

**<u>AOCs 2 and 3</u>**. All detected XRF mercury concentrations exceeded the Residential RSL. Concentrations show decreasing trends in AOC 2 toward the north and northeast (approaching AOC 1). Elevated mercury concentrations were observed in the northwest corner of AOC 3 at BB-053 (76 ppm) and BB-054 (47 ppm) with lower concentrations at or near background present to the south.

**<u>AOCs 1, 4, 6, and 7</u>**. XRF mercury concentrations (3 to 4 ppm) range from non-detect to concentrations in the range of background in AOCs 1 and 7. Mercury concentrations in AOCs 4 and 6 were slightly higher. The highest concentrations were reported at BB-016 in AOC 4 (16 ppm) and at BB-112 (17 ppm) in AOC 6 (**Figure 4B**). Laboratory results exceeded the Residential RSL at sample BB-M1-03 (4.3 mg/kg) in AOC 7 and samples BB-020 (2 mg/kg) and BB-025 (3 mg/kg) in AOC 4. Laboratory concentrations exceeded the ESV in 17 samples in AOCs 4, 6, and 7.

### 3.13.3 Lead

Lead is a human health COPC and a COPEC. The distribution of lead concentrations is shown on **Figure 4C**. Lead detection trends in surface soil show concentrations are highest in the cemented tailings (AOC 5), in the area north and northwest of the former mill foundation (AOCs 3 and 2), and on USFS land between the mill foundation and private property boundary (AOC 4). The distribution and trends of elevated lead are similar to those of arsenic. The DTSC Modified Screening Level is 80 mg/kg, the Recreational Visitor SSL is 800 mg/kg, and the ESV is 11 mg/kg, which is below the site background value of 43 mg/kg.

**<u>AOC 5</u>**. – The highest lead levels were reported at this AOC. XRF concentrations exceeded the Recreational Visitor SSL in 11 samples, the Residential RSL in 3 samples, and the ESV in 14 samples. Lead concentrations in the cemented tailings range from 3,162 ppm (BB-023), 1,002 ppm (BB-116), and 1,229 ppm (BB-116-SO-1) at the northeastern extent of the deposit on the beach downgradient of the mill foundation, to 6,956 ppm downriver of the foundation at BB-018, 1,685 ppm at BB-007, and 1,801 ppm at the southwestern extent of the tailings at BB-123. Laboratory lead concentrations ranged from 66 mg/kg to 13,000 mg/kg and exceeded the Recreational Visitor SSL at seven locations. This AOC contains the highest concentrations of lead reported at the site.

**<u>AOC 4</u>**. – Lead concentrations increase on USFS land from the mill foundation toward the residence near the private property boundary. Concentrations exceeded the Residential RSL in 8 samples, and the Recreational Visitor SSL at BB-025. The area adjacent to the private property boundary contained elevated XRF lead readings exceeding the Residential RSL at concentrations ranging from 87 ppm at BB-060 to 891 ppm at BB-025. Laboratory lead concentrations were reported at 520 mg/kg and 610 mg/kg at BB-020 and BB-025, above the Residential RSL.

**<u>AOCs 3 and 2</u>**. – Lead concentrations exceeded the Residential RSL in 18 samples within AOC 2 and 12 samples in AOC 3. Concentrations in all samples exceeded the ESV. Elevated lead concentrations are present at the mill foundation (264 ppm [BB-022]), northeast of the mill foundation (480 ppm at BB-073), and in an area of elevated concentrations northwest of the former mill foundation including BB-026 (272 ppm) and BB-095 (172 ppm), BB-054 (435 pm), and BB-053 (282 ppm), and extending into AOC 2 at BB-069 (234 ppm) and BB-070 (280 ppm), which are located on either side of the legacy road in the vicinity of the gate posts. Lead concentrations slowly decrease toward AOC 1; however, isolated areas of elevated lead concentrations persist farther north into AOC 2.

**<u>AOCs 1, 6, and 7</u>**. – Lead concentrations in these areas are generally consistent at concentrations less than background levels and the Residential RSL. XRF lead concentrations at sand bar locations within AOC 7 ranged from 6 to 10 ppm and laboratory concentrations were non-detect, below the ESV of 11 mg/kg. In AOC 6, concentrations ranged from 6 ppm at BB-006 to 56 ppm at BB-112. Lead concentrations in AOC 1 were consistently less than background across the area, ranging from 3 to 21 ppm, and exceeded the ESV in 12 samples.

### 3.13.4 Antimony

Antimony is a human health COPC and a COPEC. XRF surface sample concentrations exceeded the BLM Recreational Visitor SSL in AOC 4 and the Residential RSL in AOCs 4 and 5 and at isolated locations in AOC 2 and AOC 3. Antimony in laboratory samples exceeded the Residential RSL in AOC 4 and AOC 5. ESV exceedances in XRF surface samples were reported in AOCs 2, 3, 4, and 5. The Residential RSL is 31 ppm and the Recreational Visitor SSL is 782 mg/kg. The ESV is 0.27 mg/kg.

**<u>AOC 4</u>**. The highest antimony concentrations were observed on USFS land between the private property boundary and the mill foundation area. XRF antimony levels exceeded the Recreational Visitor SSL at BB-020 (8,764 ppm) and BB-106 (1,172 ppm), and the Residential RSL at BB-025 (414 ppm)/step-out sample BB-025-SO-01 (224 ppm), and at BB-055 (142) along the property boundary. ESV exceedances were also reported at BB-079 and BB-058. The laboratory concentrations of antimony confirmed the XRF data in samples BB-020 and BB-025, exceeding the Residential RSL.

**<u>AOC 5</u>**. Antimony XRF concentrations exceeded the Residential RSL in the cemented tailings located downgradient of the mill foundation on the beach (BB-023 [79 ppm] and BB-116-SO-01 [95 ppm]) and farther downriver at BB-135 (32 ppm) and BB-127 (91 ppm). Antimony also exceeded the ESV in two samples (BB-116 and BB-007). Concentrations of antimony in laboratory confirmation samples exceeded the ESV in all eight samples and the Residential RSL in one sample. Concentrations ranged from 0.83 mg/kg at BB-012 to 74 mg/kg at BB-127.

**<u>AOCs 1, 2, 3, 6, and 7</u>**. Elevated antimony concentrations exceeding the Residential RSL were reported in AOC 3 at BB-095 (69 ppm) and in AOC 2 at BB-073 (33 ppm). Concentrations in BB-139 (22 ppm), BB-032 (22 ppm), and BB-053 (23 mg/kg) exceeded the ESV. Antimony was not detected in XRF samples in AOC 1, and was reported below the limit of detection in most XRF samples within AOC 2, AOC 3, AOC 6, and AOC 7. Laboratory concentrations in AOC 6 and AOC 7 were at non-detect levels.

### 3.13.5 Cadmium

Cadmium is a human health COPC and a COPEC. The distribution of this metal was evaluated based on laboratory analytical results reported in AOC 4, AOC 5, and AOC 6. XRF results were largely reported below the sample-specific LOD. Cadmium concentrations exceeded the Residential RSL (71 mg/kg) in AOC 5. All detected concentrations within the three AOCs exceeded the ESV (0.36 mg/kg). Cadmium was not detected in samples collected from the downriver sand bar (AOC 7).

**<u>AOC 4</u>**. Cadmium concentrations exceeded the Residential RSL in samples BB-020 (60 ppm) and BB-025 (51 ppm). Both concentrations exceeded the ESV.

**AOC 5**. Cadmium exceeded the Residential RSL in five cemented tailings samples along the beach at concentrations ranging from 91 to 630 mg/kg. The highest concentrations were reported in sample BB-127 (630 ppm) along the trail and in BB-023 (210 ppm) downgradient of the former mill foundation. Cadmium exceeded the ESV in all laboratory samples analyzed in AOC 5.

**AOC 6**. In AOC 6, cadmium exceeded the ESV in the laboratory sample collected at BB-011.

### 3.13.6 Chromium

Chromium is a COPEC. XRF concentrations exceeded the ESV of 0.4 mg/kg in all seven AOCs. XRF and laboratory chromium concentrations were generally consistent across the site, ranging from not detected to 51 ppm for XRF data. Laboratory concentrations ranged from not detected to 12 mg/kg. Most laboratory concentrations were less than 10 mg/kg for laboratory background. The chromium ESV is likely overly conservative, as it is based on toxicity data for chromium VI, the more toxic form of chromium.

### 3.13.7 Copper

Copper is a COPEC at the site. Concentrations exceed the ESV of 28 mg/kg in a limited number of samples in AOCs 1 through 6. All but one XRF sample result and two laboratory results are within the range of background concentrations. Concentrations range from non-detect to 88 ppm for XRF data (BB-053 in AOC 3) and from non-detect to 87 ppm in laboratory samples (BB-018 in AOC 5). The lowest concentrations in both XRF and laboratory data were reported in the downriver sand bar deposits (AOC 7). These concentrations ranged from 11 to 23 ppm for XRF results and from 6.1 to 13 mg/kg for laboratory samples.

### 3.13.8 Molybdenum

Molybdenum is a COPEC. Molybdenum concentrations were generally consistent across the site, ranging from non-detect to 18 ppm. All detected XRF and laboratory concentrations exceeded the ESV of 0.52 mg/kg, and XRF concentrations were within the range of background (18 mg/kg for XRF data). The highest concentrations were reported in cemented tailings in AOC 5. Molybdenum was not detected in the laboratory samples collected from the downriver sand bar.

### 3.13.9 Selenium

Selenium was identified as a COPEC in laboratory data. Concentrations exceeded the ESV of 0.52 mg/kg in six XRF samples and five laboratory samples collected from AOC 5, AOC 6, and AOC 7. Detected XRF concentrations ranged from 2 to 4 ppm and from 1.6 to 3.9 mg/kg in laboratory samples, with the highest concentration (3.9 mg/kg) reported in AOC 6 at BB-011. No detection trends were observed.

### 3.13.10 Silver

Silver is a COPEC at the site. Detections exceeded the ESV of 4.2 mg/kg at two locations each in AOC 1 and AOC 2 and three locations each in AOC 3 and AOC 4. Concentrations ranged from 9 to 26 ppm. The highest XRF concentrations were reported in AOC 5, where eight sample concentrations (10 to 190 ppm) exceeded the ESV. The highest concentration was reported in the cemented tailings at BB-127. Laboratory results in AOC 4 exceeded the ESV in two samples (8.5 and 11 mg/kg) and AOC 5 exceeded the ESV in six of eight samples at concentrations ranging from 4.6 to 45 mg/kg.

### 3.13.11 Vanadium

Vanadium was detected in all but three XRF samples at concentrations exceeding the ESV of 2 mg/kg. Detected concentrations across all AOCs ranged from 98 ppm at BB-123 (AOC 5) to 365 ppm at BB-M1-06 (AOC 7). All reported concentrations were below the background screening criterion for vanadium based on XRF data (627 mg/kg). Vanadium concentrations in laboratory samples exceeded the ESV in all samples collected from AOC 4, AOC 5, and AOC 6. Concentrations ranged from 3.3 to 65 mg/kg, below the background screening criterion of 90 mg/kg and were highest in AOC 7.

### 3.13.12 Zinc

Zinc was identified as a COPEC. Zinc was detected in all XRF samples and exceeded the ESV of 46 in all but nine samples. Detected concentrations were similar across all AOCs and exceeded the background screening criterion in only two samples (BB-016 in AOC 4 and BB-015 in AOC 5). Zinc concentrations in laboratory samples exceeded the ESV in eight of ten samples collected from AOC 4 and AOC 5, and one sample in AOC 7. The concentration reported at BB-025 in AOC 4 (360 mg/kg) exceeded the background screening criterion.

## 3.14 PAH Results

Soil samples collected at BB-022, BB-043, BB-097, and BB-116-SO-01 were submitted for PAH analyses. Low-level concentrations were reported in all samples (**Table 3C**). The total low molecular weight concentrations ranged from 0.00061 mg/kg (BB-097) to 0.01297 mg/kg (BB-022) and the total high molecular weight concentrations ranged from 0.0111 mg/kg (BB-097) to 0.0734 mg/kg (BB-043). All concentrations were below human health and ecological screening criteria.

## 3.15 VOC Results

Soil samples collected at BB-022, BB-043, BB-097, and BB-116-SO-01 were submitted for VOC analysis (**Table 3D**). Toluene (0.0014J mg/kg) was reported in sample BB-043. Benzene (0.0011 mg/kg) and toluene (0.0012) were present in sample BB-022. All concentrations were below human health and ecological screening criteria.

## 3.16 River Sediment Results

Sediment samples were collected upriver (BB-SW-01-SED), adjacent to the site (BB-SW-02-SED), at the sand bar (BB-SW-03-SED), and downriver of the site (BB-M1-SED-01) (**Figure 2**). All samples were taken from dry areas immediately adjacent to the river. Sediment samples were analyzed for CAM-17 metals at BC, located in Bakersfield, California. Arsenic concentrations exceeded the Recreational Visitor SSL in on-site sample BB-SW-02-SED (32 mg/kg), and exceeded the EPA Residential RSL (EPA, 2020b) in upriver sample BB-SW-01-SED (2.7 mg/kg), in downriver sand bar sample BB-SW-03-SED (13 mg/kg), and in downriver sample BB-M1-SED-01 (22 mg/kg) **(Table 4**). Arsenic, mercury, and selenium concentrations exceeded ESVs in on-site sample BB-SW-02-SED, and arsenic and selenium concentrations exceeded ESVs in downriver sand bar sample BB-SW-03-SED. Only arsenic exceeded the ESV in sample BB-M1-SED-01.

With the understanding that the site boundaries are approximate, the upriver sample location appears to be outside the site boundary. Sediment at this location appears related to deposition of material derived from non-site sources during natural river processes. Therefore, the data indicate that metals may have an upriver source. Arsenic is present above screening criteria in the upriver sample, and although concentrations of barium, chromium, cobalt, copper, nickel, vanadium, and zinc are below screening levels in upriver sample BB-SW-01-SED, concentrations of these metals in this sample are higher than concentrations in on-site sample BB-SW-02-SED and downriver sample BB-SW-03-SED. Mercury and arsenic concentrations decreased downriver compared to the on-site concentrations, indicating off-site migration in sediment is not occurring.

## 3.17 Surface Water Results

Co-located surface water samples were collected with sediment samples at locations upriver (BB-SW-01), adjacent to (BB-SW-02), and downriver (BB-SW-03) of the site (**Figure 2**). Samples were analyzed for CAM-17 metals at BC, located in Bakersfield, California. **Table 5** summarizes the sampling results for metals and the surface water screening levels for human and ecological receptors. Arsenic, cadmium, lead, and mercury concentrations showed slightly increasing trends downriver compared to upriver levels. Total and dissolved arsenic and mercury concentrations in all samples exceeded the most-stringent human health screening criteria developed for surface water based on current use of the North Fork Kern River, including those collected upriver of the site. No metal concentration exceeded ESVs.

## 3.18 Particulate Results

Vapor and dust were analyzed to determine the risk posed to humans by milling-related contamination at the site. Metals in respirable dust are typically associated with Industrial Hygiene and worker monitoring samples. To collect data for metals in the respirable dust fraction, ECM personnel wore personal sampling pumps equipped with filter cartridges, while performing sampling activities for at least 2 hours for each sample set. Four samples were submitted for Total Dust (National Institute for Occupational Safety and Health [NIOSH] 0500), Respirable Dust (NIOSH 0600), and metals (NIOSH 7303).

CAM 17 metals, including arsenic, lead, and mercury, were analyzed. Arsenic exceeded industrial particulate screening criteria in samples BB-D-4.1 and BB-D-4.2; lead exceeded residential particulate criteria in sample BB-D-4.2 (**Table 6**). Respirable Dust and Total Dust concentrations were below the California Department of Industrial Relations 8-hour time weighted average PELs.

## 3.19 Vertical Delineation Metals Results

To evaluate the distribution of metals in soil/waste with depth, subsurface data were evaluated in AOCs 4 and 5 (**Table 3B**). Vertical profiles were sampled at five locations in the cemented tailings at AOC 5 (BB-116/116-SO, BB-123, BB-129, BB-023) and two locations in AOC 4 (BB-025/025-SO) on USFS land adjacent to the residential property boundary west of the former mill foundation.

Results of XRF field screening for arsenic and lead for the samples from the AOC 5 locations indicated:

- Arsenic at BB-116-SO was 9,270 ppm at the surface, 33,372 ppm at 0.5 feet bgs, 15,474 ppm at 1 foot bgs, 6,260 ppm at 1.5 feet bgs, 3,997 ppm at 2 feet bgs, and 5,954 ppm at 2.5 feet bgs. Lead at BB-116-SO was 1,229 ppm at the surface, 2,459 ppm at 0.5 feet bgs, 1,289 ppm at 1 foot bgs, 566 ppm at 1.5 feet bgs, 129 ppm at 2 feet bgs, and 298 ppm at 2.5 feet bgs.
- Arsenic at BB-123 was 27,168 ppm at the surface, 11,670 ppm at 0.5 feet bgs, 5,632 ppm at 1 foot bgs, 1,097 ppm at 2 feet bgs, 1,086 ppm at 3 feet bgs, and 3,186 ppm at 4 feet bgs. Lead at BB-123 was 1,801 ppm at the surface, 1,276 ppm at 0.5 feet bgs, 313 ppm at 1 foot bgs, 38 ppm at 2 feet bgs, 59 ppm at 3 feet bgs, and 62 ppm

at 4 feet bgs.

- Arsenic at BB-129 was 19,793 ppm at the surface, 13,786 ppm at 0.5 feet bgs, 10,103 ppm at 1 foot bgs, 9,430 ppm at 2 feet bgs, 8,493 ppm at 3 feet bgs, 4,822 ppm at 4 feet bgs, and 10,622 ppm at 5 feet bgs. Lead at BB-129 was 874 ppm at the surface, 237 ppm at 0.5 feet bgs, 154 ppm at 1 foot bgs, 50 ppm at 2 feet bgs, 62 ppm at 3 feet bgs, 22 ppm at 4 feet bgs, and 38 ppm at 5 feet bgs.
- Arsenic at BB-023 was 31,092 ppm at the surface, 15,526 ppm at 0.5 feet bgs, 40,262 ppm at 1 foot bgs, 25,511 ppm at 2 feet bgs, 13,761 ppm at 3 feet bgs, 4,647 ppm at 4 feet bgs, and 1,105 ppm at 5 feet bgs. Lead at BB-023 was 3162 ppm at the surface, 884 at 0.5 feet bgs, 2287 ppm at 1 foot bgs, 902 ppm at 2 feet bgs, 375 ppm at 3 feet bgs, 172 ppm at 4 feet bgs, and 24 ppm at 5 feet bgs.

XRF field screening of the samples from the AOC 4 locations indicated:

- Arsenic at BB-025 was 10,929 ppm at the surface, 24,390 ppm at 0.5 feet bgs, 3,179 ppm at 1 foot bgs, and 546 ppm at 1.5 feet bgs. Lead at BB-025 was 891 ppm at the surface, 1,757 ppm at 0.5 feet bgs, 131 ppm at 1 foot bgs, and 59 ppm at 1.5 feet bgs.

For AOC 5, arsenic and lead reached maximum concentrations at 1 foot (BB-023), 0.5 foot (BB-116), 0.5 foot (BB-129) and 0.5 feet (BB-123), and then generally decreased with depth (5 feet, 2.5 feet, 5 feet, and 4 feet respectively) since a slight increase was observed in the deepest sample at several locations. Arsenic and lead maximum concentrations occurred at 0.5 feet in BB-025 in AOC 4 and then decreased with depth (1.5 feet). Arsenic concentrations at all depths exceeded the BLM Recreational Visitor SSL and Residential RSL in AOC 4 and AOC 5. Lead concentrations typically exceeded the BLM Recreational Visitor SSL in the upper 0.5 feet. Lead concentrations in cemented mine waste samples near the river (BB-123 and BB-129) exceeded the Residential RSL between 0.5 feet bgs and 1 foot bgs. Samples southeast of the mill foundation (BB-116 and BB-023) exceeded the Residential RSL to depths between 2.5 feet bgs and 4 feet bgs.

Arsenic, chromium, copper, lead, mercury, molybdenum, vanadium, and zinc concentrations exceeded ESVs in samples collected to depths of 5 feet bgs. Antimony, cadmium, and silver concentrations above ESVs were typically reported at depths from 0.5 to 1.5 feet bgs.

## 3.20 Total Threshold Limit Concentrations

As indicated in **Section 3.13**, ECM sampled tailings and site media to assess the distribution of elevated metals attributed to historical milling activities. Total concentrations of CAM-17 metals were analyzed using EPA Methods 6010B and 6020 and total mercury using EPA Method 7471A. The CAM-17 metals are heavy metals whose Total Threshold Limit Concentrations (TTLCs) are used in California hazardous waste classification by virtue of the total metals concentrations. The TTLCs are listed in California Code of Regulations (CCR) Title 22 Chapter 11, Article 3, Table 2. As shown in **Tables 3A** and **3B**, concentrations of arsenic, cadmium, lead, and mercury exceeding the TTLCs (500 mg/kg, 100 mg/kg, 1,000 mg/kg, and 20 mg/kg, respectively) were reported for laboratory samples collected from cemented tailings in AOC 5 (**Exhibit 8**).

## Exhibit 8: TTLC and STLC Results for Select COCs

| **Sample Date** | **Sample ID** | **Location** | **Depth (ft)** | **Waste Extraction Test** | **Arsenic leachate (mg/L)** | **Arsenic soil (mg/kg)** | **Cadmium leachate (mg/L)** | **Cadmium soil (mg/kg)** | **Lead leachate (mg/L)** | **Lead soil (mg/kg)** | **Mercury leachate (mg/L)** | **Mercury soil (mg/kg)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/22/20 | BB-023-1 | Mill foundation | 1 | Deionized Water Extraction Solution | 3.2 | **52,000** | 0.041 | **350** | <0.050 | **2,300** | <0.0020 | **21** |
| 10/22/20 | BB-025-0.5 | Bench area adjacent to the residence | 0.5 | Deionized Water Extraction Solution | 3.8 | **26,000** | 0.045 | **160** | 0.0095 | **1,800** | 0.020 | 7.5 |
| 10/20/20 | BB-123 | Cemented mine waste | 0 | Deionized Water Extraction Solution | **17** | **15,000** | 0.21 | **110** | 0.50 | **1,200** | 0.069 | **350** |
| Soluble Threshold Limit Concentration (STLC)[1,2] | | | | | 5 | | 1 | | 5 | | 5 | |
| Total Threshold Limit Concentration (TTLC)[1,3] | | | | | | 500 | | 100 | | 1,000 | | 20 |

***Notes:***

mg/kg – milligrams per kilogram
mg/L – milligrams per liter
**bold** – bold text indicates an exceedance of a regulatory limit

[1] STLC and TTLC are used for California regulated hazardous waste. Source is California Code of Regulations, Title 22, Chapter 11, Article 3

[2] If a substance is 10 times the STLC value found in the TTLC, the Waste Extraction Test (WET) is indicated. If any substance in the waste extract is equal to or greater than the STLC value, it is considered a hazardous toxic waste.

[3] If a substance in a waste is equal to or greater than the TTLC level, it is considered a hazardous toxic waste.

Ordinarily, samples that exceed the TTLCs are defined as a non-Resource Conservation and Recovery Act (RCRA), California-regulated hazardous waste; however, CCR Title 22 exempts mining wastes meeting specified criteria from classification as hazardous wastes. The California Soluble Threshold Limit Concentration (STLC) is required if the TTLC result equals or exceeds STLC by a factor of 10 or more. To evaluate STLC, three representative samples, BB-023-1, BB-025-0.5, and BB-123, were analyzed with the Waste Extraction Test (WET) to compare results to STLC (see **Section 3.21**).

## 3.21 Acid-Base Accounting/Waste Extraction Test Results

ECM performed ABA analyses on samples with high metals concentrations collected near the mill foundation (BB-023 and BB-116-SO-01-0.5) and from cemented tailings along the North Fork Kern River southwest of the former mill location (BB-123). ABA testing evaluates the amount of acid generating or acid neutralizing potential in a sample as an indication of whether the residual waste material is likely to produce acidic drainage in the environment. ABA analyses involve determinations of the acid-generation potential (AGP) and acid-neutralization potential (ANP) according to EPA method 600/2-078-54. The AGP was evaluated by the modified Sobek method, which provides the sulfur forms (non-extractable, pyritic, and sulfate sulfur) including total sulfide sulfur.

A ratio of ANP to AGP of less than 3 to 1 (<3:1) indicates the waste sample may form an acidic leachate, while a ratio of greater than 3 to 1 (>3:1) conservatively indicates the waste will not form acidic leachate. Interpretation of results is based on the net neutralization potential (NNP). The NNP is equal to the difference between the ANP and AGP:

$$NNP=ANP-AGP$$

If this difference results in a positive number, the mine waste is predicted to produce alkaline drainage that is less likely to leach metals. A negative NNP value indicates the waste is potentially acid generating. **Exhibit 9** presents net negative ABA results and an estimated ratio of less than 3:1 for all samples, indicating mill waste is predicted to produce acid drainage that may leach metals from wastes and surrounding soils. A total sulfur content of greater than 0.5% is generally considered indicative of acid generating potential. Although ABA results were slightly negative, total sulfur and slightly negative NNP do not indicate strong evidence for metals leaching.

**Exhibit 9: Acid-Base Accounting Analytical Results**

| Sample ID | Sample Date | AGP $tCaCO_3/Kt$ | ANP $tCaCO_3/Kt$ | ABA $tCaCO_3/Kt$ | Sulfur Sulfide (%) | Sulfur Sulfate (%) | Total Sulfur (%) |
|---|---|---|---|---|---|---|---|
| BB-023 | 10/20/20 | 0.8 | <0.3 | -0.3 | 0.03 | 0.08 | 0.102 |
| BB-023-1 | 10/22/20 | 0.3 | <0.3 | -0.3 | 0.01 | 0.08 | 0.0902 |
| BB-116-SO-01-0.5 | 10/22/20 | 1.5 | <0.3 | -1.5 | 0.05 | 0.16 | 0.206 |
| BB-127 | 10/20/20 | 0.4 | <0.3 | -0.4 | 0.01 | 0.23 | 0.257 |

***Notes***:
$tCaCO_3/Kt$ = tons calcium carbonate per kiloton
ANP = acid-neutralization potential
AGP = acid-generation potential
ABA = acid-base accounting
ABA is ANP – AGP; if the ABA is negative, then the mill waste may produce acid mine drainage.

The DTSC developed the WET method to simulate waste in a landfill setting with simulated landfill leachates. The WET uses a 10-fold dilution of the solid waste versus waste extract fluid, and requires 48 hours to complete the extraction. Typically results of the WET analysis are compared to California STLC limits to determine if the material is a California hazardous waste. Future evaluation of the results of the WET analysis will enable the USFS to classify mining waste under the California Mining Waste Regulations (Title 27 CCR, Division 2, Subdivision 1, Chapter 7, Subchapter 1, Section 22480). Certain wastes qualify for exclusion as hazardous waste under Title 27 CCR.

When performing the WET method for mining/milling waste, a deionized water (DI) solution is appropriate for any waste with an ANP to AGP ratio of >3:1. Since all ANP results were below the reporting limit (<0.3 tCaCO3/Kt), WET analysis was performed using a DI solution on the 1-foot sample BB-023-1 (arsenic soil concentration of 40,262 mg/kg) near the mill foundation, on the 0.5-foot sample BB-025-0.5 from the bench area adjacent to the residence (arsenic soil concentration of 26,000 mg/kg), and on the surface sample from BB-123 from cemented mine waste. Samples were selected based on TTLC concentrations of arsenic, cadmium, lead, and mercury above 10 times the STLC levels.

The WET results for samples BB-023-1, BB-025-0.5, and BB-123 yielded arsenic concentrations of 3.2 mg/L, 3.8 mg/L, and 17 mg/L, respectively, compared to a STLC of 5 mg/L (**Exhibit 8**). Cadmium results for samples BB-023-1, BB-025-0.5, and BB-123 were 0.041 mg/L, 0.045 mg/L, and 0.21 mg/L, respectively, or less than the STLC of 1 mg/L. Lead and mercury results for samples BB-023-1 (<0.050 mg/L and <0.002 mg/L, respectively), BB-025-0.5 (0.0095 mg/L and 0.020 mg/L, respectively), and BB-123 (0.5 mg/L and 0.069 mg/L, respectively) were also less than the STLC for lead and mercury (5 mg/L).

## 3.22 TCLP Results

TCLP results are used to determine whether the soil would be characterized as a hazardous waste under RCRA, if removed. Arsenic, cadmium, lead, and mercury TCLP concentrations for sample BB-123 collected from cemented mine waste along the North Fork Kern River downriver from the former mill area (soil concentrations 15,000 mg/kg, 110 mg/kg, 1,200 mg/kg, and 350 mg/kg, respectively) were 2.2 mg/L for arsenic, 0.0034 mg/L for cadmium, 0.047 mg/L for lead, and 0.015 mg/L for mercury (**Exhibit 10**). The results did not exceed the RCRA threshold limit concentration of 5 mg/L for arsenic, 1 mg/L for cadmium, 5 mg/L for lead, or 0.2 mg/L for mercury.

TCLP uses an extraction method that simulates leaching through a landfill and can act as a proxy for the process of leaching metals from wastes left onsite. Comparison to water quality criteria may also illustrate the potential for a metal in the waste to generate leachate at concentrations that could impair surface or groundwater quality through overland flow of leachate or leaching to groundwater. Comparison of water quality criteria to the TCLP threshold limit concentration does not consider contaminant fate mechanisms such as dilution and adsorption during contaminant transport.

TCLP extraction results for arsenic, cadmium, lead, and mercury were compared to the surface and groundwater quality criteria protective of beneficial uses specified in the Tulare Lake Basin Plan (Central Valley Water Board, 2018). TCLP concentrations of arsenic and mercury exceeded the EPA National Recommended Water Quality Criteria for human health (**Exhibit 10**). Screening levels for cadmium and lead are not established. Exceedance of a TCLP threshold limit concentration based on comparison to a water quality screening level does not necessarily indicate the need for remedial action. All analytical laboratory reports are presented in **Appendix F**.

**Exhibit 10: TCLP Analytical Results**

| Sample ID | Arsenic mg/L | Cadmium mg/L | Lead mg/L | Mercury mg/L |
|---|---|---|---|---|
| BB-123 | 2.2 | 0.0034J | 0.047J | 0.015 |
| EPA TCLP Limit | 5 | 1 | 5 | 0.2 |
| **Screening Level** | | | | |
| EPA Regional Screening Level for Water[1] | 0.000018 | NE | NE | 0.00005 |

*Notes:*
mg/L - milligrams per liter
EPA - United States Environmental Protection Agency
NE – not established

[1] EPA 2020c.

## 3.23 Field Quality Control Samples

To assist with the analytical data review, field duplicate samples were collected and analyzed. Field duplicate samples were collected to determine the degree of mutual agreement between or among independent measurements of a similar property (reported as a standard deviation or relative percent difference [RPD]). An RPD of less than 25% for soil samples, depending upon the chemical being analyzed, is generally acceptable. The equation for calculating RPD is provided below:

$$RPD = \left[ \underline{(\text{Sample - Sample Duplicate/ (0.5* (Sample + Sample Duplicate})} \right] * 100$$

### 3.23.1 Field Duplicate Samples

Duplicate samples were collected to evaluate the precision of the field collection procedures by calculation of an RPD between the original and duplicate samples as described above. One duplicate total and dissolved surface water sample pair, BB-SW-02 and Dup-01, was collected to support the SI field investigation. The duplicate sample was assigned a separate sample identification. The duplicate sample was preserved, packaged, and sealed in the same manner as the other waste source samples collected. The RPD for the duplicate sample was within acceptable ranges with the exception of cadmium.

The RPD values for total antimony (53.3%) and mercury (55.7%) were above 25% RPD. All other pairs for which both samples reported concentrations above the practical quantitation limit (PQL) were at or below 25% RPD.

### 3.23.2 Rinseate Blank and Trip Blank Samples

Three equipment rinseate blanks were collected during the investigation to evaluate decontamination of reusable equipment. Concentrations of antimony, barium, chromium, copper, and molybdenum were present in the Rinseate-Blank-01 at levels above the MDL but below the PQL. A concentration of mercury (0.26 micrograms per liter [µg/L]) above the PQL was reported in the rinseate blank. Concentrations of antimony, barium, chromium, copper, mercury, and nickel were present in the Rinseate-Blank-02 at levels above the MDL but below the PQL.

Concentrations of antimony, chromium, copper, and molybdenum were present in the Rinseate-Blank-03 at levels above the MDL but below the PQL. A concentration of barium above the PQL and concentrations of lead and mercury slightly above the PQL were reported in the rinseate blank. Low-level concentrations did not revise concentrations reported in the field samples, since field sample concentrations were greater than 5 times the concentration in the blank sample.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. The trip blank consists of a volatile organic analysis (VOA) sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site with the empty VOA vials, handled like an environmental sample, and returned to the laboratory with sample shipment (generally daily) for analysis. Trip blanks are not opened in the field. Since VOC analyses were performed on site samples, one trip blank for VOC analysis was submitted with the site samples. All analyzed VOCs were below their PQL.

## 3.24 Bioaccessibility and Bioavailability

The bioavailability of metals in soil and, consequently, the corresponding potential for exposure vary widely depending upon the physical, chemical, and biological conditions under which a receptor is exposed. Measurements of the bioavailability of metals, in particular arsenic and lead, have been shown in numerous studies and at many sites to be lower than the default assumption for risk assessment. Therefore, the site-specific bioavailability data provided here are available for future incorporation into a more robust risk assessment than required for the purposes of a SI.

Bioavailability is defined as the fraction of a compound that is ingested, inhaled, or applied on the skin that is actually absorbed and reaches the circulatory system in the body. It is expressed as the ratio of an absorbed dose to an administered dose and is described as "absolute bioavailability." The relative bioavailability of a chemical or metal, defined as the difference in extent of absorption among two or more forms of the same chemical or different vehicles (*i.e.*, food, soil or water), accounts for the differences in the bioavailability of a chemical in soil relative to the dosing medium used in the critical toxicity study. Toxicity tests are usually designed using dosing media with high bioavailability. In contrast, the bioavailability of chemicals in soil can vary depending on several factors, including form of chemical present, physical form in the soil, length of time chemical has been present (*i.e.*, aging and weathering), and soil characteristics.

The EPA recommends that site-specific assessments of soil metals relative bioavailability (RBA) be performed for improving the characterization of risk at the site. RBA is the ratio of the absolute bioavailability of the contaminant in the medium of interest to that of the same contaminant in the medium used to dose the test organism in the oral toxicity studies. EPA has validated an *in vitro* bioaccessibility (IVBA) assay for predicting soil arsenic and lead RBA for use in risk assessment and recommends using the IVBA assay for characterizing site-specific soil arsenic or lead RBA. IVBA results represent the fraction of total amount of metal in a soil sample that is soluble in a low pH extraction medium. RBA is predicted from IVBA using a regression model. The bioavailable arsenic would be calculated by multiplying the appropriate total arsenic concentration by the *in vivo* RBA. This concentration would become the EPC for risk evaluation.

IVBA data for samples from BB-116-SO-01-05 and BB-127 are presented in **Exhibit 11**. The data indicate that arsenic risk and hazard are likely overestimated in the SI SRA, but unacceptable risk would likely remain after adjustment given the high concentrations. For contaminants other than lead, RBA can be used to adjust EPC or daily oral intake for the next phase of CERCLA work at the site. For example, the adjusted EPCs could be used to delineate the extent of arsenic exceeding screening criteria for target populations, refine risk characterization, calculate the arsenic 95-95UTL value to develop cleanup goals, and estimate exceedance volumes for removal or remediation.

**Exhibit 11: Bioavailability Results**

| | Sample ID | BB-116-SO-01-0.5 | BB-127 |
|---|---|---|---|
| | Sample Date | 10/22/20 | 10/20/20 |
| Metal | Analysis Type | Result | Result |
| Antimony | Total Metal (mg/kg) | 76.1 | 47.8 |
| | IVBA (mg/kg) | 2.06 | 0.43 |
| | Bioaccessibility (%) | 2.7 | <1.0 |
| Arsenic | Total Metal (mg/kg) | 35200 | 58800 |
| | IVBA (mg/kg) | 1120 | 109 |
| | Bioaccessibility (%) | 3.2 | <1.0 |
| Lead | Total Metal (mg/kg) | 3220 | 2250 |
| | IVBA (mg/kg) | 510 | 2080 |
| | Bioaccessibility (%) | 15.8 | 92.4 |
| Mercury | Total Metal (mg/kg) | 67.6 | 956 |
| | IVBA (mg/kg) | <0.40 | 10.8 |
| | Bioaccessibility (%) | <1.0 | 1.1 |

## 3.25 Volume Estimates

An initial review of the data indicated impacts to surface soils were primarily from lead, arsenic, and mercury sources. Multiple sources may have impacted site areas, as indicated by the presence of mercury at isolated locations north of the former mill as compared to more extensive lead and arsenic concentrations (**Table 3A**). Because arsenic impacts are more extensive throughout the site as shown in **Figure 5** and include areas of mercury and lead impacts, the volume of material will be defined by concentrations of arsenic above the SSL and background (**Exhibit 12**). Estimated thicknesses were assumed based on field observations and require additional vertical delineation during subsequent field investigations.

**Exhibit 12: Estimated Volume of Material Exceeding Screening Levels**

| Location | Estimated Area of AOC ($ft^2$) | Estimated Upslope Thickness (ft) | Estimate Downslope Thickness (ft) | Average Thickness (ft) | Estimated Volume ($ft^3$) | Estimated Volume ($yd^3$) |
|---|---|---|---|---|---|---|
| **AOC 2** | 90,400 | 1 | 1 | 1 | 90,400 | 3,348 |
| **AOC 3** | 49,973 | 1 | 7 | 4 | 199,892 | 7,403 |
| **AOC 4** | 8,669 | 1 | 3 | 2 | 17,338 | 642 |
| **AOC 5** | 13,176 | 1 | 3 | 2 | 26,352 | 976 |
| **AOC 6** | 8,600 | 1 | 1 | 1 | 8,600 | 318 |

## 3.26 Laboratory Data Review and Evaluation

ECM reviewed the analytical results to ensure the laboratory met data quality objectives (DQOs) as defined in the project SAP (ECM, 2020b). Analytical data evaluation included sample results/detection limits, quality assurance (QA)/QC sample analyses, and review of qualifiers applied to data by the laboratory. Results were reported on a dry-weight basis. All analyses requested on the C-O-C forms were present in the data packages and copies of the C-O-C records were included in the laboratory data packages. Extraction and holding times were met by the laboratory. The laboratory data package included a case narrative that identified data qualifiers applicable to the report. The laboratory data package also included information summarizing recoveries for the following analytical QA/QC criteria:

- Method blanks;
- Matrix spike and matrix spike duplicates; and
- Laboratory control sample and laboratory control sample duplicate.

In general, all of the laboratory Measurement Quality Objectives stipulated for the project were met by the data, with specific qualifications as noted in the laboratory reports.

Although some qualifiers were assigned to selected data, the data are considered acceptable for use and satisfy the DQOs described in the SAP (ECM, 2020b).

# 4 STREAMLINED RISK ASSESSMENT

The SRA evaluates potential risk to ecological and human receptors exposed to site-related contaminants in impacted surface/subsurface soil and tailings, river sediment, and surface water associated with the Big Blue Mill site. The multiple lines-of-evidence approach to characterize contamination and risk incorporates a site-specific risk assessment intended to justify a removal action and develop appropriate alternatives to reduce risk.

The SRA characterized the site using XRF and laboratory data collected during the SI. Screening criteria were selected for human and ecological receptors in the SAP (ECM, 2020b) and are discussed in **Section 3.7**. These screening levels are used to characterize risk and noncancer hazards and support volume estimates and recommendations of the SI.

Following SI data review, the site was divided into seven AOCs to determine impacts to environmental media. Evaluating the site by AOC will help delineate higher and lower areas of risk and determine migration pathways. The potential risks and hazards were evaluated by comparing site-specific metals concentrations to established human health and ecological RBSLs for selected (complete) exposure pathways. PAHs and VOCs were also analyzed but were not identified as COPCs or COPECs.

As detailed in **Section 3.11** and summarized in **Appendix H**, Tables H1-1 and H1-2, antimony, arsenic, cadmium, lead, and mercury were retained as human health soil COPCs based on laboratory results, and antimony, arsenic, lead, and mercury were identified as soil COPCs based on XRF results. Antimony, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, selenium, silver, and zinc were retained as soil COPECs for ecological receptors based on laboratory data. Using XRF results, antimony, arsenic, copper, lead, mercury, silver, and zinc were selected as soil COPECs. For river sediment (**Appendix H**, Table H1-3), arsenic was identified as the human health COPC and arsenic, mercury, and selenium were selected as COPECs. Total arsenic and mercury were identified as human health COPCs in surface water (**Appendix H**, Table H1-5) from exposure to total metals concentrations in river water. No COPECs were identified for ecological receptors exposed to dissolved metals (**Appendix H**, Table H1-4).

The SRA follows generally accepted risk assessment policies, procedures, and guidance. The human health risk assessment was conducted in accordance with EPA guidance documents (1989, 1991a, 1991b, 2004, and 2009); EPA soil screening guidance documents (1996 and 2002b); and EPA background guidance (2002a). The ecological risk assessment was conducted in general conformance with EPA guidance (1997, 1998, 2001, and 2005-2008).

## 4.1 Exposure Point Concentrations

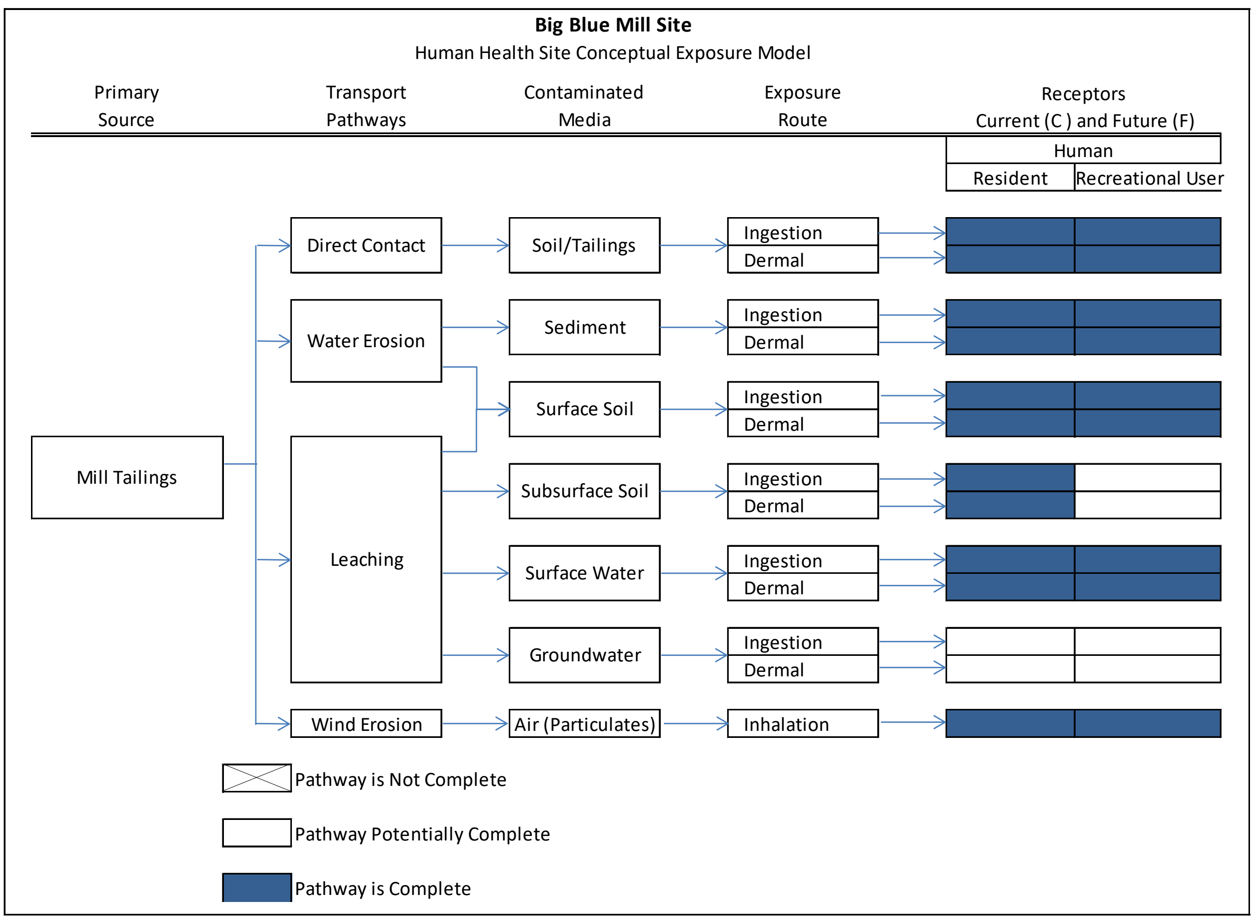
The risk and hazard characterization of XRF metals within each AOC (EPA, 1992b) is based on

EPCs calculated as the average concentration of each analyte (95% UCL) using ProUCL (EPA, 2015). 95% UCL values were also calculated for laboratory results for AOC 5 and AOC 7. An estimate of the average concentration is used because carcinogenic and chronic non-carcinogenic toxicity criteria are based on lifetime average exposures. In addition, the average concentration is most representative of the concentration that would be contacted by ecological receptors foraging at the site. EPCs for laboratory results at AOC 4 and AOC 6 were the maximum concentration of each metal, since there were an insufficient number of samples to calculate 95% UCLs.

## 4.2 Updated Site Conceptual Exposure Models

The SI results have been integrated into SCEMs that represent how metals can migrate through various media-related pathways (soil, air, and water) to vulnerable receptors, such as humans or wildlife. The SCEMs describe potential source areas, release and transport mechanisms, and complete and incomplete exposure pathways. They also identify potentially exposed receptors under the current and reasonably anticipated future land uses. **Exhibit 13** outlines the proposed complete exposure pathways for adult/child Recreational Users and Residents who will be evaluated in the SRA. **Exhibit 14** identifies the potentially exposed community-level receptor groups (*e.g.*, plants, invertebrates) and wildlife receptors.

**Exhibit 13: Human Health Site Conceptual Exposure Model**



## 4.2.1 Identification of Human Receptors

Exposure of human receptors was assessed using conservative default exposure parameters for conditions supportive of current and anticipated future uses. Human receptors include Residents and Recreational Visitors.

### *4.2.1.1 Future Residents*

Residential RSLs (EPA, 2020b/DTSC, 2020) were selected as the most-stringent human screening criteria for the SRA. Remnants of the mill foundation and tailings material are found within 100 feet of an occupied residence that was constructed up to the USFS property boundary in the early 2000s and within 500 and 1,000 feet of two additional occupied residences (**Figure 2).** In addition, COPC concentrations exceeding the Residential RSLs have implications for determining cleanup goals and future site use, as they define the level of cleanup at which all pathways present an acceptable level of risk for all land uses (*i.e.*, unlimited use/unrestricted exposure). The RSLs for soil, river sediment, and surface water are summarized on **Tables 3A** through **3D, 4,** and **5,** and risk tables in **Appendix H2.**

The soil screening levels for adult and child Residents are based on default exposure factors that represent reasonable maximum exposure under specified long-term conditions. Future Residents were evaluated consistent with EPA default exposures of 24 hours per day, 350 days per year, for 26 years (child 6 years and adult 20 years). The Residential RSLs are assumed to be protective at a target excess lifetime cancer risk of 1 x $10^{-6}$ (one in a million) for carcinogenic chemicals and a target non-carcinogenic hazard quotient (HQ) of 1.0 for non-cancer chemicals for human exposures.

### *4.2.1.2 Child and Adult Recreational Visitors*

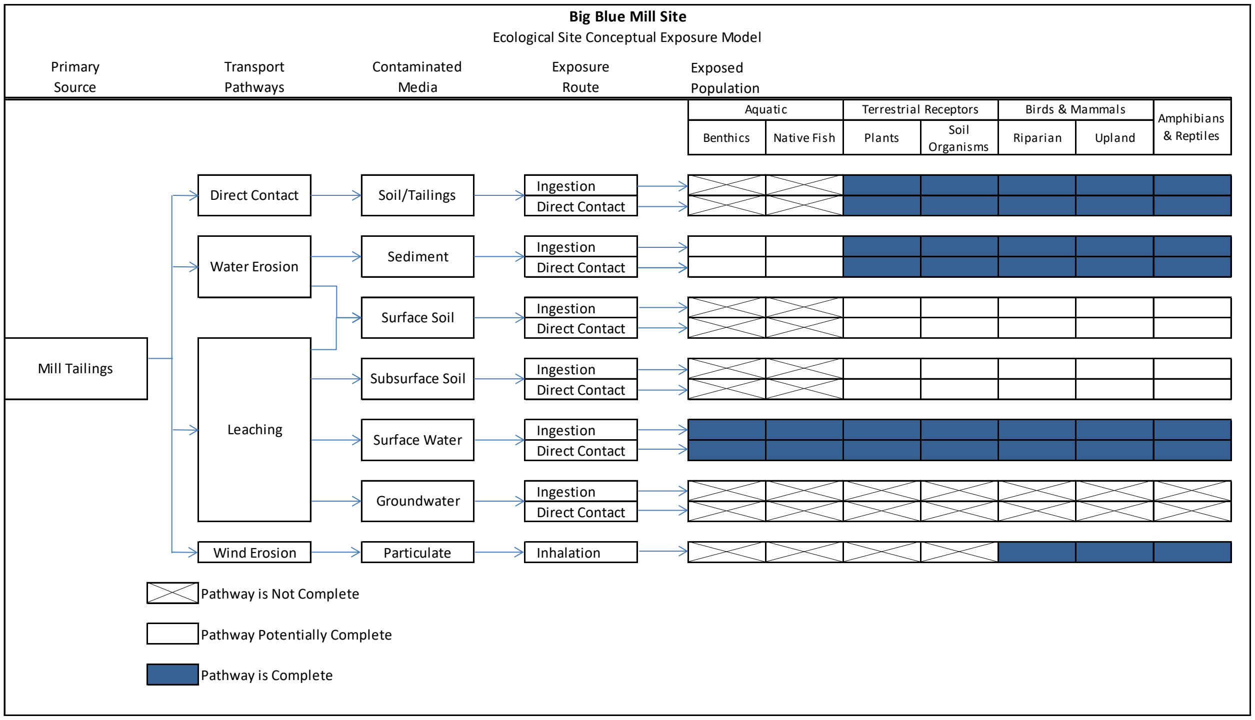
The adult and child Recreational Visitors were also identified as a primary receptor group for evaluation. BLM has developed a set of Recreational screening levels as requirements for metals most commonly found at abandoned mine land sites (BLM, 2017). BLM's Recreational screening levels are derived from Residential RSLs and account for the limited exposures associated with most recreational activities. The primary exposure routes for Recreational Visitors are ingestion of soil, dermal contact with the contaminants, and inhalation of dust and particulates. The Recreational Visitor SSLs are protective of adult/child visitors enjoying recreational pursuits.

The yearly Recreational exposure frequency is assumed to be 14 days/year, based on the assumption that individuals are unlikely to spend more time at an individual site on an annual basis. The exposure duration assumed for Recreational Visitors, 26 years, is the default exposure duration recommended by EPA for residents and is assumed to be relevant for Recreational screening levels. Note that the exposed population is combined child/adult. BLM's Recreational Visitor SSLs assume that an older child (5-6 years of age) could participate in the recreational activities for 2 years and for 24 years as an adult. The soil Recreational Visitor SSLs are summarized on **Tables 3A** and **3B** and presented on the **Appendix H2** risk tables.

## 4.2.2 Identification of Ecological Receptors

An organism may be at risk from exposures to COPECs, if there is a complete exposure pathway between the COPEC source (environmental media) and the organism. Plants and animals contacting the contaminated media may serve as conduits for exposure to higher trophic level organisms to site-related chemicals via food-web transfer. As described below, the project area supports resident plants, invertebrates, and animals (birds and mammals), and provides foraging habitat for them (**Section 2.10**).

**Exhibit 14: Ecological Site Conceptual Exposure Model**




The selected receptor groups for this SRA are:

- Plants – Vegetation present at the site is generally representative of riparian woodland and disturbed herbaceous woody shrub cover with local freshwater emergent wetlands. Riparian woodlands are common upstream of the limnetic zone of Lake Isabella along the North Fork Kern River. The riparian cover is dominated by Goodding's willow, Fremont cottonwood, and red willow. Tree canopy height can be up to 80 feet and is typically open in the project area (USACE, 2012). Common shrubs include mule-fat, coyote brush, and redosier dogwood, which can form open to continuous cover. The herbaceous layer is variable and can contain rough cocklebur, stinging nettle, goosegrass, common rush, common knotweed, common plantain, and cress (USACE, 2012). Well-drained sand and gravel soils support sagebrush-scrub cover, especially in disturbed settings. This cover type is characterized by rubber rabbitbrush, Mormon tea, California buckwheat, western juniper, and bitterbrush. The herbaceous layer is sparse or grassy and supports annual grasses and herbs.
- Invertebrates – There are a multitude of invertebrates living on and in soils. The most exposed invertebrates are likely to be insects such as ants and termites (and similar biota), in direct contact with the soil. As terrestrial soil invertebrates burrow through soils, their cuticle is in direct contact with the surrounding material, which may permit the uptake of contaminants. Additionally, terrestrial invertebrates may ingest soils along with their food. Therefore, both the dermal and ingestion pathways were considered complete for invertebrates.
- Wildlife – The broad floodplain along the river is frequently inundated, contributing to regeneration of Goodding's willow and maintenance of the riparian forest at the site. These characteristics serve to maintain diverse species composition and forest structure necessary for federally listed species such as southwestern willow flycatchers and least Bell's vireos. Upland habitat in the Lake Isabella area hosts species adapted to arid

environments, such as lizards and snakes. Bird species may include California quail, scrub jay, goldfinches, and wrentits. Mammals include pocket gophers, mice, tree and ground squirrels, mule deer, mountain lion, and bats. The Kern River supports a variety of aquatic species, including native and introduced fishes. The USFWS IPaC database identifies one mammal (fisher), four birds (California condor, least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo), one amphibian (California red-legged frog), and one fish (delta smelt) as federally endangered or threatened species that potentially occur within the project area. Bald eagles and 11 migratory birds of conservation concern could be present. No critical habitat is present on the site.

Incidental ingestion of surface soil during foraging and grooming activities was assumed to be a complete exposure pathway for birds and mammals. Bioaccumulation and ingestion of COPECs in food items (*i.e.*, plants, invertebrates, and smaller birds and mammals) that have been exposed to contaminants from the site were assumed to be a complete exposure pathway for birds and mammals. Direct contact and inhalation of particulates are assumed to be insignificant and were not quantitatively evaluated. Specific screening levels for reptiles, amphibians, and fish are not readily available. These species will be evaluated qualitatively using mammal and bird criteria.

## 4.3 Exposure Pathways

During precipitation or flood events in this arid area, arsenic (dissolved phase or sorbed to sediment particles) and other metals may potentially be transported in storm water runoff and deposited in floodplain sediments. Waste materials are now largely eroded and locally washed downriver, buried or comingled with alluvial deposits, or present as cemented tailings. No specific data are available indicating that surface water or sediments in Lake Isabella have been impacted. In addition to water erosion and potential leaching pathways, direct contact with tailings, soil, and sediment, as well as wind erosion of particulates are pathways that could result in the exposure to human and ecological receptors. The following sources, potentially impacted media, transport mechanisms, and exposure pathways are considered for the site:

- The SI data indicate that historical mining and milling activities have released metals to the environment. The sources of contamination at the site include the former mill foundation and associated remnants of walls and former structures. Cemented tailings are present near the former mill foundation and downriver along the bank of the Kern River. Cemented tailings are eroding at some locations and dispersed tailings have impacted soil downriver of the former process area. Possible source areas are shown on **Figure 2**.
- Constituents can migrate from a source area via a variety of mechanisms. Transport mechanisms include aeolian processes, potential leaching, surface water runoff, and associated erosion during storm events. Storm water flows during infrequent precipitation events have eroded and mobilized finer-grained materials, resulting in potential elevated metals concentrations in wash sediments and low-lying areas. Storm water may also transport dissolved metals leached from waste materials into subsurface soil and shallow groundwater at the site or downgradient of the source features. Exposed fine-grained material is subject to wind erosion and strong winds may potentially cause migration of metals via airborne dust in areas with limited vegetation.
- Secondary sources include impacted surface soil, sediments, and airborne particulates. Subsurface soil is a potential source of contamination for residents depending on the activity. Airborne particulates could be produced during activities that disturb potentially impacted surficial material in the former processing, stockpile, and wash areas as demonstrated by the dust/particulate sample results. Storm water flows and flood events

may have resulted in erosion and transport of fine-grained materials. Leaching of metals to surface water or into the subsurface during flood events may occur.

- Mobility of arsenic in the environment depends on several factors (Agency for Toxic Substances and Disease Registry, 2016). These include arsenic species, oxidation state of the arsenic, oxidation/reduction conditions, presence of metals such as iron and magnesium, presence of anions such as nitrate and sulfate, and pH. Arsenic tends to be less mobile (leachable) in oxidizing environments and weakly acidic soil, suggesting that slightly acidic storm water may mobilize dissolved arsenic for transport to surface water or groundwater. Evaluation of TCLP and WET results indicates there is some potential for leaching to occur. Sufficient generation of leachate could potentially impact surface water and groundwater.

The following complete, potentially complete, and incomplete pathways have been identified:

- Air Pathway: This pathway is complete; human and ecological receptors may be exposed to dust generated from impacted soils, sediment, or processed/unprocessed ore and tailings/mill-related waste. Based on the extent of ground surface covered with vegetation versus loose fine-grained material and particulate/dust sample results collected during field work, disturbance of surface materials may generate dust.
- Waste Rock/Tailings/Process Waste: This pathway is complete with human and ecological receptors exposed to potentially impacted materials. The magnitude of contamination in source media was assessed to determine risk to receptors and quantities that exceed regulatory criteria. The cemented tailings present onsite contain elevated metals concentrations.
- Surface and Subsurface Soil: The surface soil pathway is complete as human and ecological receptors may be exposed to impacted surficial materials. Residents may be exposed to COPCs in subsurface soil during gardening or landscaping activities and recreational users may be exposed to subsurface soil when digging. Plants and burrowing wildlife could also contact COPECs in potentially impacted subsurface soil. Subsurface profiles were evaluated at seven locations to depths between 2 and 5 feet bgs. Elevated metals are present to depth at each profile location. Arsenic TCLP and WET results indicate a potential for leaching is present, but no additional data are available.
- Surface Water: The surface water pathway is complete for human and ecological receptors due to proximity to the Kern River. The river flows year-round. Beneficial uses of the North Fork Kern River are discussed in **Section 2.6**.
- Sediment: Storm water flows over the source areas have likely transported contaminated sediments into the Kern River and dispersed material downriver of the site. The exposure pathway is considered complete for human and ecological receptors.
- Groundwater: The groundwater exposure pathway evaluates the likelihood that sources at a site have released, or potentially could release, hazardous substances to groundwater. Although the site is in a heavily mineralized and mined area with multiple sources of contamination that could impact groundwater, no well is present at the site; therefore, this pathway is considered potentially complete. According to USFS there is a well on private land adjacent to the site; however, no information regarding the well was available in the PA.

## 4.4 Exposure Routes

COPCs were identified to address the Residential scenario and activities of adult/child Recreational Visitors. The following exposure routes are assumed to be complete for these receptor groups:

- Inhalation of dust in outdoor air;
- Incidental ingestion of milling-related material; and
- Dermal contact with milling-related material.

Lack of habitat in the disturbed areas of the site, including flood plains, and high metals concentrations in impacted surface and near-subsurface soil and cemented tailings may significantly limit the diversity of ecological receptors in some areas. However, the site supports terrestrial plants, soil invertebrates, birds, and mammals adapted to a desert environment. Wildlife may be exposed to metal contamination via several environmental pathways. The potential exposure routes for ecological receptors include:

- Uptake or dermal contact with soil (plants and invertebrates);
- Uptake or dermal contact with waste (plants and invertebrates); and
- Ingestion of impacted prey, soil, and mine waste (birds and mammals).

## 4.5 Evaluating Risk and Hazard

Hazard and risk were evaluated for metals at the Big Blue Mill site in each AOC. Potential human and ecological non-carcinogenic hazards for individual COPCs/COPECs are expressed as Hazard Quotients (HQs). HQs are calculated for each complete pathway by dividing the exposure point concentrations (average concentration) for each analyte by the receptor-specific RBSL. Hazard indices (HIs) are developed by summing the individual HQs for each COPEC. HIs represent the cumulative non-carcinogenic hazard of all detected compounds based on non-carcinogenic effects, and accounts for all metals evaluated. HIs can be used to compare characterization results of AOCs for priority ranking.

The HIs for each receptor group are compared to the EPA acceptable hazard levels. A HI of 1 is used as a threshold to indicate whether adverse health effects are likely to occur from exposure to COPCs. HIs greater than 1 indicate that adverse noncarcinogenic health effects may occur, whereas HIs equal to or less than 1 indicate that adverse noncarcinogenic health effects are unlikely. EPA considers HIs of 1 or lower as acceptable.

Theoretical excess lifetime cancer risk for receptors is expressed as the estimated upper-bound probability of additional lifetime cancer risk due to exposure to site-related COPCs. Site-Specific cancer risks for the Resident and Recreational Visitor are calculated based on the analyte EPC and RBSL. The total excess cancer risk estimates are compared to the point of departure of $10^{-6}$. In general, total risks greater than $10^{-4}$ (*e.g.*, $10^{-3}$ or $10^{-2}$) require action; risks between $10^{-6}$ and $10^{-4}$ are in the risk management range and require the stakeholders to discuss and decide whether the risk estimates are acceptable; risks less than $10^{-6}$ (*e.g.*, $10^{-7}$ and $10^{-8}$) are unconditionally acceptable.

## 4.6 Risk Characterization

Tables H2-1 through H2-9 (**Appendix H**) present estimated arsenic risks, and antimony, arsenic, cadmium (laboratory data), lead, and mercury HQs/HIs for Residents and Recreational Visitors exposed to surface and subsurface soil. Plant, invertebrate, mammal, and avian HQs/HIs are presented for antimony, arsenic, copper, lead, mercury, silver, and zinc (based on XRF and laboratory EPCs) and cadmium, chromium, molybdenum, and selenium based on laboratory EPCs. **Table 7** (XRF data) and **Table 8** (laboratory data) summarize cancer risks and HQs/HIs for human and ecological receptor groups exposed to metals in surface soil. **Table 9** describes risks associated with exposure to metals in subsurface soil. **Appendix H**, Table H2-10 and **Table 10** present estimated risks for human and ecological receptors exposed to metals in river sediment and **Appendix H**, Table H2-11 and **Table 11** summarize risks associated with surface water exposures. Arsenic, mercury, and lead are the main risk drivers. Risks and hazards are summarized for human and ecological receptors in the following sections.

## 4.6.1 Soil

### *4.6.1.1 Human Receptors – Surface Soil*

Antimony, arsenic, cadmium, lead, and mercury were identified as COCs for Residential and Recreational Visitor receptor groups. XRF data for antimony, arsenic, lead, and mercury were used to characterize risk site wide (**Table 7**). Limited laboratory data collected from the background area and AOCs 4 through 7 were used to estimate cadmium HQs and confirm XRF characterization results (**Table 8**). Risk characterization results for surface soil are described below:

- Estimated Residential cancer risks for exposure to arsenic based on XRF results exceeded the target risk of 1 x $10^{-6}$ in background samples and in all seven AOCs. Risks ranged from 1 x $10^{-4}$ to 1 x $10^{-1}$ site wide. Residential arsenic risk in the background area was 2 x $10^{-4}$. Estimated XRF risk estimates in AOCs 4 through 7 were 2 x $10^{-4}$ to 1 x $10^{-1}$.
- Arsenic risks were within the EPA's risk management range of 1 x $10^{-6}$ to 1 x $10^{-4}$ for the Recreational Visitor at AOCs 2, 3, 4, 5, and 6 using XRF data. Risks were highest at AOC 5 (1 x $10^{-3}$) and AOC 4 (3 x $10^{-4}$), exceeding the upper bound risk range.
- The highest risks were reported for AOCs 4 and 5, where the estimated Residential arsenic cancer risks based on XRF EPCs (1 x $10^{-1}$ and 3 x $10^{-1}$) exceeded the upper bound risk management range of 1 x $10^{-4}$. Arsenic Residential risks in AOCs 2, 3, 6, and 7 also exceeded the upper bound risk management range based on XRF data, ranging from 2 x $10^{-4}$ to 6 x $10^{-3}$.
- The lowest XRF arsenic risks were reported for background, AOC 1, and AOC 7, where Recreational Visitor risks were less than the target risk (4 x $10^{-7}$ to 6 x $10^{-7}$). For the Resident, estimated arsenic risks using XRF results met or exceeded 1 x $10^{-4}$ for background (2 x $10^{-4}$), AOC 1 (1 x $10^{-4}$) and AOC 7 (2 x $10^{-4}$).
- Estimated Residential and Recreational Visitor cancer risks based on arsenic laboratory results confirmed the XRF results.
- Residential arsenic cancer risk in AOCs 4, 5, and 6 ranged from 1 x $10^{-3}$ to 4 x $10^{-1}$ based on laboratory EPCs compared to 1 x $10^{-3}$ to 3 x $10^{-1}$ using XRF EPCs. Arsenic risk based on laboratory data at AOC 7 was 1 x $10^{-4}$ similar to risk based on XRF results (2 x $10^{-4}$). The estimated Residential risk for laboratory background was 2 x $10^{-4}$, the same as for XRF data.
- Estimated cancer risk for exposure of Recreational Visitors to arsenic exceeded 1 x $10^{-4}$ in AOCs 4 and 5 and exceeded the target risk of 1 x $10^{-6}$ in AOC 6. At AOC 4, the risk was 2 x $10^{-4}$ compared to 3 x $10^{-4}$ for XRF data. At AOC 5, Recreational Visitor risk was 1 x $10^{-3}$ based on laboratory and XRF data. Recreational Visitor risks based on laboratory data were lowest in AOC 7 (4 x $10^{-7}$) and in background (7 x $10^{-7}$), which confirms XRF risk results (6 x $10^{-7}$ in AOC 7 and 6 x $10^{-7}$ in background).

HIs exceeding the threshold of 1 for potential noncarcinogenic adverse effects for human receptor groups exposed to surface soil (presented in **Appendix H**, Tables H2-1 through H2-8 and summarized in **Tables 7** and **8**), are described below:

- HIs for Residential exposures exceeded the threshold of 1 in all AOCs, including background, based on XRF results. HIs were highest in AOC 4 (26,304) and AOC 5 (89,748) and lowest in AOCs 1 (35) and 7 (45). Recreational Visitor HIs exceeded 1 at AOC 4 (24) and AOC 5 (50).
- Residential arsenic HQs based on XRF results ranged from 31 to 46 in background soil, AOC 1, and AOC 7. Intermediate arsenic HQs were reported at AOC 2 (189) and AOC 3 (1,579). The highest HQs for arsenic were reported in AOC 4 (26,007) and AOC 5 (88,334). Arsenic HQs for Recreational Visitors exceeded 1 at AOC 4 (12) and AOC 5 (41) based on XRF results.
- XRF mercury HQs for human receptors exceeded the threshold of 1 at all AOCs, ranging from 3 to 34 in background soil and AOCs 1 through 4, 6, and 7. The mercury HQ was highest in the AOC 5 cemented tailings (1,373). Mercury HQ for Recreational Visitors exceeded 1 at AOC 5 (5).
- Lead HQs calculated using XRF data exceeded 1 for Residential exposure in AOCs 3, 4, and 5. Lead HQs associated with Recreational Visitor exposure exceeded 1 only in AOC 5 based on XRF results.
- Antimony HQs exceeded 1 based on XRF data for Residential exposure in AOC 4 (283) and AOC 5 (3). Antimony HQs for Recreational Visitor exposure exceeded 1 at AOC 4 (11).
- HIs and HQs calculated for metals based on laboratory data confirmed the XRF results. Residential HIs ranged from 50 in background soil, to 106 and 270 in AOC 7 and AOC 6, and 18,065 and 99,233 in AOCs 4 and 5. Recreational Visitor HIs were 64 in AOC 5 and 9 in AOC 4. Differences between the laboratory HIs and XRF HIs are related to the limited laboratory data sets, high bias of XRF compared to laboratory data, and use of the maximum concentration as the EPC for some AOCs.
- Similar to XRF results, the highest laboratory HQs were for arsenic (ranging from 98,720 in AOC 5 to 27 in AOC 7 for Residential exposure and equal to 46 in AOC 5 and 8 in AOC 4 for Recreational Visitors). Residential lead HQs were 157 in AOC 5 and 8 in AOC 4; the Recreational Visitor lead HQ exceeded 1 in AOC 5 (16). Residential antimony HQs were equal to 5 at AOC 4 and 2 at AOC 5. Residential mercury HQs were 3 for AOC 4, 350 for AOC 5, and 4 for AOC 7. Antimony and mercury HQs did not exceed 1 for Recreational Visitor exposures.
- Cadmium HQs calculated using laboratory data exceeded 1 for Residential exposure in AOC 5.

#### *4.6.1.2 Ecological Receptors*

Eleven metals were identified as COCs for the four ecological receptor groups. Risk characterization results for surface soil are presented in the tables in **Appendix H2** and summarized in **Tables 7** and **8.** HQs exceeded 1 for one or more ecological receptors in the following AOCs:

- The largest hazards were associated with exposure to metals in AOCs 5 and 4, followed by AOC 3, AOC 2, and AOC 6. The lowest hazards were calculated for exposure to metals in AOC 1, AOC 7, and background soil.
- Mercury HQs for XRF data exceeded 1 for all receptor groups in all AOCs and were highest for birds. The largest mercury HQ was reported in AOC 5 (105,615), followed by

AOC 3 (2,600), AOC 2 (751), AOC 4 (624), AOC 6 (538), AOC 1 (300), and AOC 7 (269). site wide, HQs ranged from 2 for mammals (background and AOC 1) to 105,615 for birds (AOC 5). The laboratory results confirmed the XRF results in AOCs 4, 5, 6, and 7; mercury HQs were highest for birds, exceeding 1 for all AOCs sampled. Mercury HQs also exceeded 1 for plants, invertebrates, and mammals in AOCs 4, 5, and 7, and plants and invertebrates in background soil and AOC 6.

- Arsenic HQs exceeded 1 for plant, invertebrate, mammal, and avian receptors in AOCs 3, 4, 5, and 6, with the highest arsenic values reported in AOCs 4 and 5. In AOC 2, arsenic HQs exceeded 1 for plants, mammals, and birds. For laboratory data, arsenic HQs exceeded 1 for all receptor groups in AOCs 4, 5, and 6, with the highest values in AOC 5. Arsenic values were less than 1 in background and AOC 7.
- Lead HQs exceeded 1 for one or more ecological receptors in background soil and in AOCs 2, 3, 4, 5, and 6 based on XRF data. Avian HQs exceeded 1 in background soil, and AOCs 2 through 6; mammal HQs exceed 1 in AOCs 2, 3, 4, and 5. Plant HQs also exceeded 1 in AOCs 4 and 5. The laboratory results confirm the XRF data; lead HQs exceeded 1 for at least one receptor group in background soil and in AOCs 4, 5, and 6, with the highest values reported in AOC 5.
- Antimony was evaluated using both XRF and laboratory results in AOCs 4 through 7, since the XRF LODs were elevated for some samples. The laboratory results confirmed the XRF data trends. HQs calculated based on XRF and laboratory data exceeded 1 for plants and mammals in AOCs 4 and 5 and invertebrates in AOC 4.
- Laboratory results were used to estimate cadmium risk to ecological receptors, since the XRF LODs were elevated above screening criteria and cadmium was not selected as a COPEC. Laboratory results for cadmium were only available for AOCs 4 through 7. Cadmium HQs exceeded 1 for plants, invertebrates, mammals, and birds in AOC 5; plants, mammals, and birds in AOC 4; and mammals and birds in AOC 6.
- Laboratory data were used to estimate chromium risk to ecological receptors, since XRF concentrations did not exceed the XRF background value and chromium was not selected as a COPEC. Laboratory data are limited in extent and were only collected in AOCs 4, 5, 6, and 7, and the background area. Chromium HQs exceeded 1 for plants and invertebrates for background soil and AOCs 4, 5, 6, and 7.
- Copper was identified as a COC based on XRF and laboratory results. Based on the 95% UCL EPCs for XRF concentrations, copper HQs were less than 1 in background soil and at all AOCs. Copper 95% UCLs were also calculated using laboratory data at AOCs 4, 5, 6, and 7. The avian HQ at AOC 5 exceeded the threshold value of 1 for potential adverse effects.
- Laboratory results were used to estimate molybdenum risk to ecological receptors, since XRF concentrations did not exceed the XRF background value and molybdenum was not selected as a COPEC. Laboratory data are limited in extent and were only collected in the background area and in AOCs 4, 5, 6, and 7. Molybdenum HQs exceeded 1 for plants and mammals in AOC 5.
- Silver HQs were developed based on XRF data and confirmed by evaluating laboratory results, since silver data may be biased high. HQs based on XRF and laboratory data exceeded 1 for mammals and birds in AOC 5 and birds in AOC 4.

- Selenium HQs were determined by evaluating laboratory data, since this metal was not identified as a COC for XRF data based on low rate of detection. Selenium HQs exceeded 1 for plants, mammals, and birds in AOC 6.
- Zinc HQs calculated using XRF data exceeded 1 for mammals and birds in background and AOCs 2, 3, 4, and 5. Zinc HQs also exceeded 1 for birds in AOCs 1 and 6, and invertebrates in AOCs 4 and 5. For laboratory data, zinc HQs exceeded 1 for birds in background soil, all receptor groups in AOC 4, and mammals and birds in AOC 5. The differences between the XRF and laboratory results are due to the small sample size of laboratory data compared to representative zinc levels based on gridded sample collection using XRF.

#### *4.6.1.3 Human Receptors – Subsurface Soil*

Subsurface soils were evaluated from 0 to 1.5 feet bgs in AOC 4 and from 0.5 to 5 feet bgs in AOC 5 to determine whether risks from exposure to metals in tailings varied with depth. Two locations in AOC 4 (BB-025 and BB-025-SO) and five locations in AOC 5 (BB-123, BB-129, BB-116, BB-116-SO, and BB-023) were selected for vertical delineation and sampled using XRF at the surface and 0.5- to 1-foot intervals to native material, refusal, or depth. The soil results are provided in **Table 3B**. Mean metals concentrations were calculated for each sample interval (surface; 0-1 foot bgs; 1.5-2 feet bgs; 2.5-3 feet bgs; 4 feet bgs; and 5 feet bgs) to represent EPCs for risk characterization (**Appendix H**, Table H2-9; **Table 9**). The SI results indicate a range of metals are present in exposed and buried tailings at elevated concentrations.

- Arsenic is the risk driver. Arsenic occurs naturally at the site, with background concentrations (19 mg/kg laboratory) that exceed the Residential RSL (0.1 mg/kg). Arsenic concentrations exceeded background and screening criteria in AOC 4 and AOC 5.
- Arsenic risk estimates for Residential exposure to surface and subsurface soil for test pits in AOCs 4 and 5 exceeded the upper bound risk management range of $1 \times 10^{-4}$. For Recreational Visitors, estimated arsenic risk exceeded $1 \times 10^{-4}$ for all sampled intervals at AOC 5 and the surface and 0-1 foot interval at AOC 4. Arsenic risk for the 1-2 foot interval at AOC 4 exceeded the target cancer risk of $1 \times 10^{-6}$.
- Residential arsenic HQs for subsurface soil in AOC 4 increased from 19,033 at the surface to 25,289 for the 0-1 foot interval and decreased to 1,332 for the interval from 1-2 feet bgs. For Recreational exposures, a similar pattern occurred. HQs increased from 9 in surface soil to 12 for the 0-1 foot interval and decreased to 1 for the 1-2 foot interval; the increase in estimated risk for shallow soil/tailings compared to results for surface soils is expected since the EPCs for surface soil included data from mixed soil-tailings material.
- Residential arsenic HQs for subsurface soil at AOC 5 showed a similar trend. HQs increased from the surface (43,491) to 57,051 for the 0-1 foot interval and then decreased with depth. The HQ at 4 feet bgs was 10,289 and at 5 feet bgs was 14,301. For Recreational exposures, arsenic HQs increased from 20 at the surface to 27 in the 0-1 foot interval and decreased to 5 at 4 feet bgs and 7 at 5 feet bgs.
- Decreasing trends were observed for Residential antimony and lead HQs in subsurface soil at AOC 4 (surface to 2 feet bgs) and AOC 5 (surface to 5 feet bgs). At AOCs 4 and 5, antimony and lead HQs exceeded 1 at the surface and 0-1 foot interval. Lead HQs at AOC 5 also exceeded 1 from 1-2 feet bgs and 2-3 feet bgs. For Recreational Visitors, lead HQs were less than 1 in subsurface samples at AOC 4, and exceeded 1 in the surface sample and 0-1 foot interval in AOC 5 (HQ = 2).

- Mercury HQs for Residential exposure exceeded 1 at the surface (7) and 0-1 foot interval (15) at AOC 4. At AOC 5, mercury HQs decreased from 170 at the surface and 103 at 0-1 feet bgs to 38 at 4 feet bgs, and less than 1 at 5 feet bgs. For Recreational Visitors, mercury HQs were below 1 in all depth intervals at both AOCs.

#### *4.6.1.4 Ecological Resources – Subsurface Soil*

The following is a summary of metals with HQs/HIs that exceed 1 for one or more ecological receptors in subsurface soil:

- At AOC 4, HIs increased from 3,109 at the surface to 3,671 for tailings at 0-1 feet bgs, followed by 145 at 1-2 feet bgs. At AOC 5, HIs decreased from 18,647 at the surface to 702 at 5 feet bgs. The lower risk for surface soil at AOC 4 compared to shallow subsurface soil may reflect tailings mixed with soil. At AOC 5, less mixing of material is expected in the cemented tailings.
- At AOC 4, antimony, arsenic, cadmium, lead, mercury, silver, and zinc HQs exceed 1 at the surface and 0-1 foot interval for one or more receptor groups. At 1-2 feet bgs, arsenic, cadmium, lead, and zinc HQs exceed 1 for one or more receptor groups.
- At AOC 5, antimony, arsenic, cadmium, lead, mercury, silver, and zinc HQs exceeded 1 at the surface and 0-1 foot interval. Cadmium HQs were less than 1 below 1 feet bgs and silver and antimony HQs were below 1 at depths greater than 2 feet. Lead and mercury HQs were less than 1 below 4 feet bgs, but the copper HQ exceeded 1.
- HQs for arsenic were highest for plants, HQs for lead and antimony were highest for mammals and birds, and mercury HQs were highest for birds.
- The highest HQs for ecological receptors were reported for exposure to mercury. Mercury HQs for birds varied from 538 to 1,154 from 0 to 2 feet at AOC 4 and from 2,885 to 13,108 from 0 to 5 feet bgs at AOC 5. Lead HQs were also most elevated for birds, ranging from 5 to 67 at AOC 4 and from 3 to 153 at AOC 5.

### 4.6.2 Sediment

Sediment was analyzed at four locations (**Appendix H**, Table H2-10; **Table 10**), including upriver (BB-SW-01-SED), adjacent to the site (BB-SW-02-SED), downriver at the sand bar (BB-SW-03-SED), and downriver of the site (BB-M1-SED-01) (**Figure 2**). Arsenic was identified as a COPC and arsenic, mercury, and selenium were identified as COPECs in river sediment. Estimated Residential arsenic cancer risks for stream sediment increased from $2 \times 10^{-5}$ at the upriver location to $3 \times 10^{-4}$ adjacent to the site. At the sand bar location, the estimated cancer risk decreased to $1 \times 10^{-4}$ and was $2 \times 10^{-4}$ downriver of the site. The estimated risk for Recreational Visitor exposure to arsenic is less than or equal to the target risk of $1 \times 10^{-6}$ at all locations. The arsenic HQs in river sediment ranged from 7 upriver of the site to 78 adjacent to the site and decreased to 32 and 54 downriver. HQs were less than 1 for Recreational Visitor exposure for all metals. For ecological receptors, arsenic, mercury, and selenium HQs were equal to or less than 1 at the upriver and downriver locations. Adjacent to the site, the HI exceeded the threshold of 1 for potential adverse effects due to arsenic (HQ=3), mercury (HQ=3), and selenium (HQ=2). At the downriver location, mercury and selenium HQs were less than 1, and arsenic HQs were less than 1 in one sample and slightly elevated (HQ=2) in the field duplicate. The data indicate that arsenic concentrations are elevated upriver of the site and are generally lower downriver from the site with the exception of the slight increase in the downriver sandbar. Therefore, impacts to sediment under flow conditions experienced during the sampling event are likely minor.

### 4.6.3 Surface Water

Surface water samples co-located with sediment samples (Appendix H, **Table H2-11**; **Table 11**) were collected at locations upriver (BB-SW-01), adjacent to (BB-SW-02), and downriver (BB-SW-03) of the site (**Figure 2**). Arsenic and mercury were identified as COPCs. No COPECs were identified. Typically, arsenic occurrence in water is caused by the weathering and dissolution of arsenic bearing rocks, minerals and ores, but arsenic contamination in water is also caused by its use in industrial and agricultural applications; mining and smelting also contribute to arsenic release.

Total arsenic and mercury concentrations exceeded the most-stringent human health screening criteria developed for surface water based on beneficial use of the Kern River, including the sample collected upriver of the site. Arsenic cancer risks were $3 \times 10^{-4}$ at the locations upriver and adjacent to the site and slightly higher ($4 \times 10^{-4}$) at the locations adjacent to and downriver of the site. The mercury HQ was equal to 4 in the sample collected upriver of the site and 8 in the sample collected adjacent to the site. The mercury HQ decreased to 3 downriver of the site, less than the value for the upriver sample.

The EPA promulgated the CTR in April 2000 (EPA, 2000b). The CTR contains a water quality criterion of 0.05 µg/L total recoverable mercury for freshwater sources of drinking water. The CTR criterion protects humans from exposure to mercury in drinking water and contaminated fish. Although the North Fork Kern River is not a drinking water source at the site, the CTR criterion is enforceable for all waters with a municipal and domestic water supply beneficial use designation, including the Kern River. The CTR should be compared with averages of aqueous concentrations of total recoverable mercury occurring over 30-day periods. While the federal rule did not specify duration or frequency terms, the Water Board has previously employed a 30-day averaging interval with an allowable exceedance frequency of once every three years for protection of human health. For the SI, the mercury concentrations represent a snapshot in time, as samples have not been collected continuously. Data therefore do not exist to show whether the CTR is exceeded. Concentrations of mercury in North Fork Kern River could exceed the CTR during periods with high runoff events. However, since mercury concentrations are elevated upriver of the site, non-site-related impacts are reflected in surface water quality at the site.

### 4.6.4 Streamlined Risk Assessment Uncertainty Analysis

Several potential sources of uncertainty may affect human health risk estimates in an SRA. Uncertainties that may have been introduced into the risk calculations are discussed below.

**Protective Nature of Risk Assessments.** The screening levels used to estimate risks are based on upper-bound values for soil ingestion, and other parameters that are meant (in general) to be protective of the reasonable maximum exposure. Thus, the risk estimates presented likely overestimate risks for the non-Residential users, but are unlikely to underestimate the upper-bound risks.

**Use of Conservative Human Health RBSLs.** Recreational exposures are based on 14-day exposures for children over 6 years and adults for 20 years. Actual exposures of visitors to contaminants at the site is likely to be much less. This has the effect of overestimating risk when compared to exposure concentrations, and so comparisons under the industrial exposure scenario are conservative. The industrial RSLs are expected to be protective of all human receptors who are routinely exposed to contamination at the site, including children and adults in the vicinity of the site for recreation.

**Exposure Point Concentrations**. The use of maximum concentrations as the EPCs for laboratory data could over or underestimate risk compared to EPCs established as 95% UCLs based on gridded data collected across an AOC. Separate EPCs were calculated for XRF and laboratory metals datasets in AOCs 4 through 7 for risk assessment because the XRF analyzer may not provide reliable measurements of barium, beryllium, cadmium, cobalt, selenium, and thallium due to limitations of the method or sample-specific LODs for these metals may exceed relevant screening criteria. While XRF data were intended to characterize nature and extent and risk assessment, laboratory data collected to satisfy EPA method 6200 (12 percent of XRF samples) were used to confirm XRF results and evaluate risk where XRF data are not available. As shown in **Appendix H2**, 95% UCLs were calculated for XRF metals at AOCs 1 through AOC 7. 95% UCLs were calculated for laboratory metals detected at AOC 5 and AOC 7. EPCs were the maximum reported value for laboratory metals reported at AOCs 4 and 6. Since the XRF data were collected from a randomized grid and laboratory samples were analyzed for a small percent of samples, the maximum concentration based on limited laboratory samples likely will not represent average concentrations within an AOC. The laboratory data do provide information for a weight-of-evidence evaluation of contamination extent and risk information for metals not recorded using XRF. As-reported concentrations were used as EPCs to evaluate sediment and surface water data, which were divided into upstream, on-site, and downstream segments.

**Background Metal Concentrations**. A 20-point composite sample collected upgradient of the site was used to establish XRF and laboratory background concentrations. SI results were compared to background screening criteria (developed as three times background) to confirm releases and identify COPCs and COPECs for risk assessment. Soil background values were used to evaluate dry sediment. Upgradient/upriver co-located sediment and surface water samples were used as background samples to evaluate impacts to these media from site operations. Since concentrations below background are not subject to removal actions, using background screening criteria to select COCs and delineate areas of the site where metals concentrations are less than background levels will allow the AOCs to be prioritized for remediation and could decrease cleanup costs and complexity. This evaluation is possible for metals with detection limits that are less than natural background and applicable screening levels (Residential RSLs, Recreational SSLs, or ESVs).

A single set of background values (*i.e.*, laboratory background) was not used to identify COPCs/COPECs. XRF field data were compared to the XRF background values and laboratory data were compared to laboratory background concentrations. Comparing XRF metals data to corresponding laboratory background values would be overly conservative for COC identification since the XRF dataset is biased high compared to the laboratory dataset for measurements above the LOD. Evaluation of additional XRF COPCs/COPECs would add complexity to the risk assessment. Therefore, XRF COPCs/COPECs were used to characterize risk for all AOCs. Laboratory COPCs/COPECs were evaluated to confirm XRF characterization results and evaluate metals not reported using XRF. The laboratory data are quantitative but may not represent average conditions throughout an AOC since they are of limited extent.

Uncertainty was introduced since background concentrations for some XRF metals were reported as elevated LODs that exceed one or more screening criteria. Examples include antimony (<376 ppm), cadmium (<164 ppm), cobalt (<80 ppm), mercury (<3 ppm), selenium (<3 ppm), and silver (<131 ppm). This introduced uncertainty into the characterization. Three-times background screening criteria could not be established for these metals, and all detected values were therefore considered releases. Detected concentrations of these XRF metals can be used to characterize nature and extent of contamination, but delineation was not possible at locations with non-detects. For this reason, laboratory confirmation data, where available, was used to refine the nature and extent and risk characterizations.

Mercury is a primary COC at the site due to processing of gold ore. The elevated mercury LOD of 3 ppm exceeds both the Residential RSL and most stringent ESV. Therefore, mercury XRF data only partially delineate areas where concentrations potentially exceed the RSL and ESV. Nature and extent characterization for mercury, and estimated risk, were augmented using laboratory data in AOCs 4 through 7. However, use of the maximum mercury concentration or 95% UCL based on limited data could result in an over or underestimate of risk.

**Use of Conservative ESVs**. The ESVs were derived to clearly identify concentrations of contaminants that may result in adverse ecological impacts due to exposures to site-related materials and are purposely conservative. The models used to derive the ESVs were developed using primarily conservatively skewed parameter values. This inherently conservative approach makes them inappropriate to be used as cleanup standards and should only be used to support the SI and the decision to conduct further assessment or non-time-critical removal action.

**Use of No-effect Screening Levels**. The ESVs used here are generally based on no-effect toxicity data, with actual effects being expected at higher concentrations. An exceedance of the ESVs used in this risk assessment does not necessarily indicate that adverse effects will occur; however, these effect levels do represent the highest concentration at which adverse effects are not expected. Thus, the screening levels should be regarded as highly protective. However, as noted above, no-effect screening levels and toxicity values should be used to evaluate the potential risks to listed species to ensure that no adverse effects occur.

**Lack of Chromium VI Data**. Chromium in the natural environment occurs as two oxidation (valence) states: chromium III and chromium VI. Chromium VI, the more toxic form, is not anticipated to be present at the site based on site history and conditions, and only total chromium analyses were performed. Since chromium VI is more toxic than chromium III, and the typical ratio of chromium III to chromium VI in the natural environment is approximately 90% chromium III to 10% chromium VI, using chromium VI screening criteria overestimates risk for ecological receptors.

**Lack of Habitat.** The site lacks favorable habitat for wildlife, plants, and invertebrates in areas containing high concentrations of heavy metals, especially mercury. The ecological component of the SRA assumes that site conditions support viable ecological receptor populations. If diversity of plants, invertebrates, mammals, and birds is limited by the presence of mercury, then overall risk may be overestimated considering that many species may be absent from the local ecosystem.

**Correlation Between XRF and Laboratory Data**. XRF samples were submitted for laboratory analysis at a rate of 12% to confirm usability of the XRF data. Correlation coefficients between the XRF and laboratory data sets indicate that arsenic, lead, and zinc $R^2$ values exceed 0.8, indicating suitability to support quantitative risk evaluation. Antimony, chromium, and copper $R^2$ values support screening level assessments and are appropriate for the SRA. Cadmium and silver $R^2$ values could not be calculated due to non-detect concentrations in XRF-laboratory sample pairs, but are appropriate for screening level assessment. Risks estimated based on screening level data may be over or underestimated but positive correlations suggest data trends will be representative of conditions. Nickel and vanadium $R^2$ values did not meet project DQOs and these metals were not selected as COCs.

**Risk/hazards Estimated from Co-Located XRF and Laboratory Data Sets**. XRF data were intended to characterize the nature and extent of metals site wide. Sample locations were gridded to reduce bias and ensure data represented conditions within each AOC. XRF samples were submitted for laboratory analysis at a rate of 12% in accordance with EPA method 6200 to confirm usability of the XRF data. The distribution of these samples was limited to the background area (one composite sample) and AOCs 4 through 7 and included XRF-laboratory pairs in areas with low, medium, and high concentration ranges to improve statistical evaluation. The laboratory data may, therefore, overestimate or underestimate concentrations of metals in soil and bias EPCs due to the small sample size. For this reason, risk and hazard were estimated in AOCs 1, 2, and 3 based on XRF data. In AOCs 4, 5, 6, and 7, risk and hazard were estimated using XRF data and confirmed using laboratory data. Laboratory data were also used to characterize risk for metals not recorded using XRF, or for specific samples reporting concentrations as elevated LODs.

# 5 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this investigation was to characterize the site for potential threats posed to human health and the environment and to determine the need for additional CERCLA or other appropriate action.

## 5.1 Summary

***XRF Metals Results for Surface Soil/Mill Waste***

The XRF data for each AOC were compared to Residential criteria and the 2017 BLM Recreational Visitor SSLs. Site-wide, antimony, arsenic, lead, and mercury exceeded one or both human health screening levels in one or more XRF samples. In addition to these metals, cadmium also exceeded the Residential human health screening level in laboratory samples. Several metals were detected in surface soil/mill waste at concentrations that exceed the ESVs and were identified as potential COCs. The exceedances were wide-spread, with arsenic, chromium, lead, mercury, molybdenum, vanadium, and zinc concentrations reported above ecological screening criteria in one or more samples in all seven AOCs.

The highest metals concentrations were observed in AOC 3, AOC 4, and AOC 5 (**Figures 4A**, **4B**, and **4C**). Arsenic in AOC 3; antimony, arsenic, and lead in AOC 4; and arsenic, lead, and mercury in AOC 5 exceeded the BLM Recreational Visitor SSLs (**Table 3A**). XRF concentrations of arsenic ranging from 250 ppm to 8,226 ppm are present at the USFS boundary with private property (**Figure 5**) in AOC 4. The highest arsenic and lead concentrations on site are observed in surface samples from the cemented tailings of AOC 5 (**Figures 4A** and **4C**). Arsenic and lead concentrations are lower in the distributed tailings and mill waste of AOC 6 than in the cemented tailings of AOC 5. Generally, arsenic and lead concentrations in AOC 6 show a decreasing trend downriver with distance from the mill source area (**Figure 4A**) and lead concentrations are at or near background levels (**Figure 4C**). Lead and arsenic concentrations in AOC 1 and AOC 7 surface soils are generally at or below background.

Arsenic concentrations in AOC 2 decrease north and northwest of AOC 3 except at locations along the trail bisecting the AOC (249 ppm at BB-124, 297 ppm at BB-107, and 368 ppm at BB-088; **Figure 4A**). In AOC 2, elevated lead concentrations are present along and west of the trail (BB-083 [193 ppm] and BB-084 [202 ppm]; **Figure 4C**). Deposits of slag were observed in this area.

The distribution of mercury is shown on **Figure 4B**. Mercury concentrations in surface samples are elevated in the cemented tailings (AOC 5) and area northwest of the former mill foundation in AOC 3. Elevated mercury concentrations as isolated occurrences are present in other AOCs, but no distribution trends were obvious. The distribution of mercury is not expected to align with other metals since it was used to process the gold ore.

**Exhibit 15: Summary of XRF Metal Exceedances for Subsurface Samples by AOC**

| | Antimony | Arsenic | Lead | Mercury |
|---|---|---|---|---|
| **AOC4** | | | | |
| Depth (ft bgs) | BB-025 | | | |
| 0 | 414 | 10929 | 891 | <52 |
| 0.5 | 157 | 24390 | 1757 | <64 |
| 1 | 27 | 3179 | 131 | <34 |
| 1.5 | <396 | 546 | 59 | <30 |
| **AOC5** | | | | |
| Depth (ft bgs) | BB-123 | | | |
| 0 | <272 | 27168 | 1801 | 693 |
| 0.5 | <343 | 11670 | 1276 | 346 |
| 1 | <376 | 5632 | 313 | 79 |
| 2 | <396 | 1097 | 38 | 17 |
| 3 | <373 | 1086 | 59 | 51 |
| 4 | <368 | 3186 | 62 | 40 |
| Depth (ft bgs) | BB-129 | | | |
| 0 | <306 | 19793 | 874 | 21 |
| 0.5 | <343 | 13786 | 237 | 8 |
| 1 | <368 | 10103 | 154 | <52 |
| 2 | <366 | 9430 | 50 | <50 |
| 3 | <372 | 8493 | 62 | <47 |
| 4 | <389 | 4822 | 22 | <40 |
| 5 | <343 | 10622 | 38 | <47 |
| Depth (ft bgs) | BB-116-SO | | | |
| 0 | 95 | 9270 | 1229 | 11 |
| 0.5 | 152 | 33372 | 2459 | <71 |
| 1 | 58 | 15474 | 1289 | 12 |
| 1.5 | 40 | 6260 | 566 | 47 |
| 2 | <367 | 3997 | 129 | 8 |
| 2.5 | <353 | 5954 | 298 | 65 |
| Depth (ft bgs) | BB-023 | | | |
| 0 | 79 | 31092 | 3162 | 108 |
| 0.5 | 42 | 15526 | 884 | 72 |
| 1 | <10 | 40262 | 2287 | <79 |
| 2 | <295 | 25511 | 902 | 156 |
| 3 | <307 | 13761 | 375 | 40 |
| 4 | <343 | 4647 | 172 | 35 |
| 5 | <375 | 1105 | 24 | <29 |

### *XRF Metals Results for Subsurface Soil/Mill Waste*

Subsurface concentrations were evaluated in AOCs 4 and 5 (**Table 3B**). For AOC 5, arsenic and lead reached maximum concentrations at 1 foot (BB-023), 0.5 foot (BB-116), 0.5 foot (BB-129) and 0.5 feet (BB-123), and then decreased with depth (5 feet, 2.5 feet, 5 feet, and 4 feet respectively). Arsenic and lead maximum concentrations occurred at 0.5 feet in BB-025 in AOC 4 and then decreased with depth (1.5 feet). Concentrations of antimony, arsenic, lead, and mercury for the vertical profile locations in AOC 4 and AOC 5 are summarized in **Exhibit 15**.

Arsenic, chromium, copper, lead, molybdenum, vanadium, and zinc concentrations exceeded ESVs in samples collected to depths of 5 feet bgs; mercury exceeded the ESV at 4 feet bgs. Antimony, cadmium, and silver concentrations above ESVs were typically reported at depths from 0.5 to 1.5 feet bgs. Arsenic and lead concentrations exceeded human health Residential and Recreational Visitor screening levels in both AOC 4 and AOC 5 and mercury concentrations exceeded Residential RSLs in AOC 5. Antimony exceeded residential SSLs in AOC 4 at BB-025 and BB-025-SO and in AOC 5 at BB-116 and BB-023.

### *Laboratory Results for Surface Soil/Mill Waste*

Samples co-located with XRF measurement locations within AOCs 4, 5, 6, and 7 were submitted to BC, located in Bakersfield, California, for analysis of CAM-17 metals. Laboratory analytical results indicate arsenic in AOCs 4, 5, and 6 and lead and mercury in AOC 5 exceed the BLM Recreation Visitor SSLs. Arsenic and mercury in AOC 7; antimony, lead, and mercury in AOCs 4 and 5; and cadmium in AOC 5 exceed the Residential RSLs. Based on limited laboratory data, distributions of Laboratory and XRF data for metals were consistent (**Exhibit 16** and **Exhibit 17**).

**Exhibit 16: Summary of XRF Metal Exceedances by AOC**

| | Antimony | Arsenic | Lead | Mercury |
|---|---|---|---|---|
| **AOC1** | **Total 72 samples** | | | |
| Concentration Range - XRF | ND | 5 – 37 ppm | ND – 21 ppm | ND – 5 ppm |
| > Background | 0 | 7 | 0 | 11 |
| > Residential RSL | 0 | 72 | 0 | 36 |
| > Recreational SSL | 0 | 1 | 0 | 0 |
| > Most Stringent ESV | 0 | 7 | 12 | 36 |
| **AOC2** | **Total 49 samples** | | | |
| Concentration Range - XRF | ND – 33 ppm | 12 – 368 ppm | 12 – 480 ppm | ND – 31 ppm |
| > Background | 2 | 42 | 24 | 30 |
| > Residential RSL | 1 | 49 | 18 | 44 |
| > Recreational SSL | 0 | 29 | 0 | 0 |
| > Most Stringent ESV | 2 | 42 | 49 | 44 |
| **AOC3** | **Total 25 samples** | | | |
| Concentration Range - XRF | ND – 69 ppm | 13 – 2183 ppm | 12 - 435 | ND – 76 ppm |
| > Background | 3 | 24 | 15 | 15 |
| > Residential RSL | 1 | 25 | 12 | 17 |
| > Recreational SSL | 0 | 24 | 0 | 0 |
| > Most Stringent ESV | 3 | 24 | 25 | 17 |
| **AOC4** | **Total 15 samples** | | | |
| Concentration Range - XRF | ND – 8764 ppm | 35 – 10929 ppm | 10 – 891 ppm | ND – 16 ppm |
| > Background | 7 | 15 | 10 | 9 |
| > Residential RSL | 5 | 15 | 9 | 10 |
| > Recreational SSL | 2 | 15 | 1 | 0 |
| > Most Stringent ESV | 7 | 15 | 14 | 10 |
| **AOC5** | **Total 15 samples** | | | |

| | Antimony | Arsenic | Lead | Mercury |
|---|---|---|---|---|
| Concentration Range - XRF | ND – 95 ppm | 65 – 90,189 ppm | 8 – 6956 ppm | ND – 1485 ppm |
| > Background | 6 | 15 | 13 | 13 |
| > Residential RSL | 4 | 15 | 11 | 13 |
| > Recreational SSL | 0 | 15 | 8 | 3 |
| > Most Stringent ESV | 6 | 15 | 14 | 13 |
| **AOC6** | **Total 16 samples** | | | |
| Concentration Range - XRF | ND | 22 – 369 ppm | 6 – 56 ppm | ND – 17 ppm |
| > Background | 0 | 16 | 0 | 9 |
| > Residential RSL | 0 | 16 | 0 | 13 |
| > Recreational SSL | 0 | 13 | 0 | 0 |
| > Most Stringent ESV | 0 | 16 | 14 | 13 |
| **AOC7** | **Total 10 samples** | | | |
| Concentration Range - XRF | ND | 4 – 26 ppm | 6 – 10 ppm | ND – 4 ppm |
| > Background | 0 | 3 | 0 | 1 |
| > Residential RSL | 0 | 10 | 0 | 6 |
| > Recreational SSL | 0 | 0 | 0 | 0 |
| > Most Stringent ESV | 0 | 3 | 0 | 6 |
| **Background** | **Total 20 samples** | | | |
| > Residential RSL | 0 | 20 | 0 | 11 |
| > Recreational SSL | 0 | 1 | 0 | 0 |
| > Most Stringent ESV | 0 | 3 | 20 | 11 |

Notes:

ND – Not detected above the XRF LOD

## Exhibit 17: Summary of Laboratory Metal Exceedances by AOC

| | Antimony | Arsenic | Lead | Mercury |
|---|---|---|---|---|
| **AOC4** | **Total 2 samples** | | | |
| Concentration Range - Lab | 120–160 mg/kg | 7100–7400 mg/kg | 520–610 mg/kg | 2-3 mg/kg |
| > Background | 2 | 2 | 2 | 2 |
| > Residential RSL | 2 | 2 | 2 | 2 |
| > Recreational SSL | 0 | 2 | 0 | 0 |
| > Most Stringent ESV | 2 | 2 | 2 | 2 |
| **AOC5** | **Total 8 samples** | | | |
| Concentration Range - Lab | 0.83 – 74 mg/kg | 1100-88000 mg/kg | 66-13000 mg/kg | 5.7–350 mg/kg |
| > Background | 8 | 8 | 8 | 8 |
| > Residential RSL | 1 | 8 | 7 | 8 |
| > Recreational SSL | 0 | 8 | 7 | 1 |
| > Most Stringent ESV | 8 | 8 | 8 | 8 |
| **AOC6** | **Total 1 sample** | | | |
| Concentration Range - Lab | ND | 110 mg/kg | 34 mg/kg | 0.77 mg/kg |
| > Background | 0 | 1 | 0 | 1 |
| > Residential RSL | 0 | 1 | 0 | 0 |
| > Recreational SSL | 0 | 1 | 0 | 0 |

| | Antimony | Arsenic | Lead | Mercury |
|---|---|---|---|---|
| > Most Stringent ESV | 0 | 1 | 1 | 1 |
| **AOC7** | **Total 10 samples** | | | |
| Concentration Range - Lab | ND | ND – 17 mg/kg | ND | ND–4.3 mg/kg |
| > Background | 0 | 0 | 0 | 1 |
| > Residential RSL | 0 | 9 | 0 | 1 |
| > Recreational SSL | 0 | 0 | 0 | 0 |
| > Most Stringent ESV | 0 | 0 | 0 | 6 |

Notes:

ND – Not detected above the XRF LOD

Soil samples collected at BB-022, BB-043, BB-097, and BB-116-SO-01 were submitted for PAH and VOC analyses. Low-level concentrations of PAHs were reported in all samples (**Table 3C**). Toluene (0.0014J mg/kg) was reported in sample BB-043, and benzene (0.0011 mg/kg) and toluene (0.0012) were present in sample BB-022 (**Table 3D**). All PAH and VOC concentrations were below human health and ecological screening criteria.

### *Particulate Sample Results*

Arsenic exceeded industrial particulate screening criteria in samples BB-D-4.1 and BB-D-4.2 and lead exceeded residential particulate criteria in sample BB-D-4.2 (**Table 6**).

### *ABA, WET, and TCLP Results*

Although ABA results were slightly negative, total sulfur and slightly negative NNP does not indicate strong evidence for metals leaching. The DI WET concentration of arsenic at BB-123 exceeded the STLC indicating the possibility for leaching in surface water and to groundwater. None of the remaining WET results exceeded the STLC. The arsenic, cadmium, lead, and mercury concentrations in sample BB-123 did not exceed TCLP thresholds.

### *Risk Characterization Summary*

<u>Human Health Assessment</u>

The SRA documented complete pathways for human exposures to surface soil/waste, river sediments, subsurface soil, windblown particulates, and surface water. Risks and hazards were estimated for Residents and child/adult Recreational Visitors. Arsenic is the driver for cancer risk, and non-cancer hazards exceeding the threshold 1 for potential adverse effects are attributed to antimony, arsenic, cadmium, lead, and mercury. The estimated risks and hazards posed by exposure of human receptors to soil COCs in background samples and AOCs 1 through 7 are summarized in **Appendix H**, Tables H2-1 through H2-8 and **Tables 7** and **8**.

Estimated arsenic risks exceeded the EPA upper bound risk management range of $1 \times 10^{-4}$ for Residential exposures. **Figure 6** displays the estimated arsenic risk for assumed Residential exposure. Green indicates arsenic risk below background ($2 \times 10^{-4}$), blue represents arsenic risk greater than $1 \times 10^{-4}$, gold represents arsenic risk greater than $1 \times 10^{-3}$, and red indicates arsenic risk greater than $1 \times 10^{-2}$. The highest risks are associated with AOC 5 and AOC 4. AOC 2, AOC 3, and AOC 6 contain areas of elevated risk; however, additional data would be required to refine the exposure area for AOC 2 and AOC 6. Risk at AOCs 1 and 7 from exposure to metals in surface soil are within the range of background.

Arsenic cancer risks to the adult/child Recreational Visitor ranged from $3 \times 10^{-6}$ at AOC 2 to $1 \times 10^{-3}$ at AOC 5, above the target risk of $1 \times 10^{-6}$. HIs for non-cancer health effects to Residents ranged from 35 at AOC-1 to 89,748 at AOC 5 and HIs for the Recreational Visitor were 24 and 50 for AOC 4 and AOC 5. HIs exceeding 1 indicate potential adverse non-cancer effects could occur based on site-specific exposure factors. HIs exceeding the threshold of 1 for human receptors are driven by exposure to elevated concentrations of antimony, arsenic, lead, and mercury at AOCs 4 and 5; arsenic, lead, and mercury at AOC 3; and arsenic and mercury at AOCs 1, 2, 6, and 7. Arsenic is naturally occurring, and the Residential risk is 2 x $10^{-4}$ for background exposures, with an HI of 50.

To evaluate the distribution of metals in shallow subsurface soil, subsurface samples were evaluated in AOCs 4 and 5 (**Appendix H**, Table H2-9 and **Table 9**). Subsurface soil shows arsenic risks extend to 2 feet bgs at AOC 4 and 5 feet bgs at AOC 5.

Ecological Risk Assessment for Soil and Tailings

The 95% UCLs for each metal in surface soil/mill tailings at seven AOCs were compared to receptor-specific ESVs for plants, invertebrates, mammals, and birds (**Appendix H**, Tables H2-2 through H2-8). The COPECs that exceed the receptor-specific ESVs in surface soil and waste material are presented as HQs and HIs and summarized in **Tables 7** and **8**. The following COPECs were identified for ecological receptors exposed to metals at the AOCs: antimony, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, selenium, silver, and zinc. The calculated HQs are provided for use during evaluation of potential removal action alternatives.

All 12 COPECs exceeded 1 in one or more AOCs at the site. Metal concentrations exceeding ESVs are widespread, but indicator metals vary by receptor. For plants and invertebrates, HIs were most elevated for antimony, arsenic, lead, and zinc. Chromium is also elevated; however, the HQs are based on chromium VI, the most toxic form. Actual risk is likely overestimated. For mammals, the highest HQs were observed for antimony, cadmium, lead, mercury, and molybdenum. Birds were most impacted by exposure to arsenic, cadmium, lead, mercury, and zinc.

Metals in shallow subsurface soil were evaluated to delineate concentration trends with depth. Subsurface concentrations were evaluated in AOCs 4 and 5 (**Appendix H**, Table H2-9 and **Table 9**). Subsurface soil shows arsenic risks extend to 2 feet bgs at AOC 4 and 5 feet bgs at AOC 5.

If potentially toxic chemicals have contaminated or may reasonably be expected to contaminate media that may contact wildlife or wildlife habitats, either on site, or off site, directly or indirectly, the potential for exposure is considered to exist and further action may be warranted. Removal of impacted surface and near-surface waste/soil would mitigate adverse impacts due to exposure of ecological receptors to metals at the site.

River Sediment

Sediment was analyzed at four locations (**Appendix H**, Table B2-10; **Table 10**), including upriver, adjacent to the site, downriver at the sand bar, and downriver of the site (**Figure 2**). Arsenic was identified as a COPC and arsenic, mercury, and selenium were identified as COPECs in river sediment. Estimated Residential arsenic cancer risks for stream sediment were 2 x $10^{-5}$ at the upriver location and ranged from 3 x $10^{-4}$ to 1 x $10^{-4}$ at the site and downriver locations. Arsenic HQs were reported at 7 in the upriver location, exceeding the threshold of 1 for potential adverse effects. At the site and downriver, HQs varied from 78 at the site to 34 and 54 at downriver locations. Hazard to aquatic organisms (HI = 8) resulted from arsenic, mercury, and selenium HQs exceeding 1. The data indicate that arsenic concentrations are elevated upriver of the site, and site-related impacts to sediment are likely minor. There is minimal evidence of migration of metals to downriver sediment.

<u>Surface Water</u>

Surface water samples co-located with sediment samples (**Appendix H**, Table H2-11; **Table 11**) were collected with sediment samples at locations upriver, adjacent to, and downriver of the site (**Figure 2**). Arsenic and mercury were identified as COPCs. Total arsenic and mercury concentrations exceeded the most-stringent human health screening criteria developed for surface water based on Water Quality Control Board beneficial use designations of the Kern River, including the sample collected upriver of the site. Arsenic and mercury exceeded the California Toxic Rule water quality standards at upriver locations, as well as locations adjacent to the site and downriver. The data indicate impacts to the Kern River are present from non-site sources, and significant migration of arsenic or mercury downriver is not expected.

## 5.2 Conclusions

The following conclusions are based on review and analysis of the SI XRF and laboratory data, past history, and observation of site conditions:

- Antimony, arsenic, cadmium, lead, mercury, molybdenum, selenium, silver, and zinc concentrations exceeded three-times background screening criteria in one or more surface samples, indicating that a release of metals from historical milling operations has occurred
- In addition to these metals, copper concentrations also exceeded the background screening criterion. PAHs and VOCs are not COCs/COPCs at the site.
- The highest XRF field screening and laboratory results occurred in AOC 5 for exposure to cemented tailings, followed by AOC 4 on USFS land near the private property boundary, and AOC 3, the process area. Arsenic concentrations exceeded the Residential RSL in all investigation areas across the site, and arsenic exceeded the BLM Recreational Visitor SSL in AOC 4 and AOC 5. **Figure 5** shows the extent of arsenic in surface soils throughout the investigation area at concentrations above the BLM Recreational Visitor SSL.
- Historical records do not include scaled drawings or geo-referenced locations, resulting in uncertainty regarding the actual locations of the mill facilities and associated operations buildings. Some of these historical facilities may be located northeast of the current site Inspection boundary.
- Historical maps and photographs indicate that structures associated with the Big Blue Mill may have been located on present day private property. The distribution of elevated arsenic along the private property boundary with USFS (western boundary of AOC 4 and northwestern boundary of AOC 6) indicates that the extent of arsenic to the west of AOC 4 and northwest of AOC 6 is not defined and likely extends on private property.
- Mercury characterization using site-wide XRF results was limited since the LOD was elevated at 3 ppm. Mercury extent could not be delineated below 3 ppm, which exceeds human and ecological screening criteria. Partial delineation below 3 ppm was conducted using laboratory data. XRF results in AOCs 2, 3, 4, 5, and 6 indicate some concentrations exceed human health and ecological criteria. Laboratory detections of mercury exceeding screening criteria were reported in AOC 4, 5, 6, and 7.
- Arsenic in river sediment exceeded both human health and ecological screening values in upriver, adjacent to the site, and downriver samples. The data indicate sediment quality is impacted by upriver sources; however, there is minimal evidence of off-site migration downriver.

- In accordance with the approved sample program, vertical delineation samples were limited to locations with the highest surface concentration, location of waste material, proximity to the mill, and knowledge of natural processes that affect material transport in AOC 4 and AOC 5 to assist in preliminary subsurface characterization. No vertical delineation samples were collected in any areas of the remaining AOCs. In areas of the site that may have been inundated during periodic flood events, river sediment may have been deposited over material impacted by historical mill operations.
- The results for AOC 4 and AOC 5 indicate that metals concentrations generally decrease with depth. However, deeper concentrations of select metals still exceeded human health and/or ecological screening values.
- Dust containing arsenic and lead exceeded DTSC modified industrial and residential screening levels at the site.
- Based on the SRA results, several metals are present at the site at concentrations greater than background levels and the conservative RBSLs. The risk characterization results show arsenic is the risk driver, exceeding the target risk level for Residential exposure in all AOCs and Recreational Visitor exposure in five AOCs. HQs exceeding 1 indicate that potential adverse effects may occur to human and ecological receptors from exposure to metals.
- Although other metals contribute risk to the site, remediation of arsenic will largely address potential risk to human health and the environment.

## 5.3 Recommendations

Based on the conclusions of the SI, soil/waste at the site represents a potential threat to public health, welfare, and/or the environment, and further action is recommended to mitigate long-term impacts. ECM recommends conducting an Engineering Evaluation/Cost Analysis to collect additional data to fully evaluate the site. Recommendations include the following:

- Additional sampling on the private property west and north-west of the current USFS boundary to determine the nature and extent of arsenic and other metals.
- Surface and subsurface sampling to determine if additional impacts are present outside of the current investigation area to the east and northeast. Historical aerial photos and engineering drawings provide evidence that mill activities may have occurred in this area.
- Collect data to better define the magnitude and vertical extent of waste material associated with former milling activities and estimate removal volumes throughout the site. Only limited subsurface data were collected from approved locations at two AOCs during the SI. Isolated occurrences of elevated metals in AOC 2 and AOC 6 may require additional sampling to fully characterize areas requiring cleanup. Additionally, impacted material may be present beneath sediment deposited in areas of the site susceptible to flooding such as AOC 1.
- Collect 10 discrete laboratory background samples to calculate 95-95 upper tolerance limit (UTL) values and establish metal background threshold values to refine risk assessment and derive cleanup goals.
- Gauge and sample groundwater from the well on adjacent property to evaluate whether the groundwater pathway is complete.

- Conduct additional evaluation (Designated Levels) and sampling to better evaluate leaching conditions and determine whether exceptions to hazardous waste determination are applicable.
- Evaluate whether material can be placed in the associated Kern Floodplain repository if mitigation measures are determined to be necessary at the site.
- Dust monitoring and suppression are recommended during site activities that create dust or when windy conditions are present.
- The site-specific bioavailability data should be incorporated into a future assessment to improve risk characterization at the site.

# 6 REFERENCES

Agency for Toxic Substances and Disease Registry. 2016. *Arsenic Toxicological Profile*. Accessed at http://www.atsdr.cdc.gov/toxprofiles

American Fact Finder. www.factfinder.census.gov

Bureau of Land Management (BLM). 2017. *BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites*.

California Division of Mines and Geology. 1962. *Mines and Mineral Resources of Kern County, California. Report 1*.

California Geological Survey. 2010. *Geologic Map of California*.

California State Mining Bureau. 1896. *Thirteenth Report (Third Biennial) of the State Mineralogist for the Two Years ending September 15, 1896*.

California Journal of Mines and Geology. 1934. Volume 30, "Quarterly Chapter of State Mineralogist's Report XXX." January.

_____. 1940. Volume 36, "Quarterly Chapter of State Mineralogist's Report XXXVI." January.

California Department of Water Resources. Current version. *California's Groundwater (Bulletin 118)*.

Central Valley Regional Water Quality Control Board. 2018. *Water Quality Control Plan for the Tulare Lake Basin, Third Edition*.

County of Kern. 2011a*. Draft Environmental Impact Report for Kern River Valley Specific Plan, Volume 1.* January.

_____. 2011b. *Draft Environmental Impact Report for Kern River Valley Specific Plan, Hydrology and Water Quality Existing Conditions Report (Appendix F)*. July.

Department of Toxic Substances Control (DTSC). 2020. *DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3*. June.

ECM Consultants ECM. 2020a. *Project Work Plan for Expanded Site Inspection, Big Blue Mill Site, Kern County, California.*

_____. 2020b. *Sampling and Analysis Plan and Quality Assurance Project Plan for Expanded Site Inspection, Big Blue Jill Site, Kern County, California.*

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. "Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ." Manag. 19:81-97.

Los Alamos National Laboratory (LANL). 2017. *ECORISK Database (Release 4.1)*, https://www.lanl.gov/envirohment/protection/eco-risk-assessment.php

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. "Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems." Arch. Environ. Contam. Toxic.

Oak Ridge National Laboratory (ORNL). 2018. **RAIS - The Risk Assessment Information System Ecological Benchmark Tool**. Https://rais.ornl.gov/tools/eco_search.php/

Thompson, P.A., J. Kurias, and S. Mihok. 2005. *Derivation and use of sediment guidelines for ecological risk assessment of metals and radionuclides released to the environment from uranium mining and milling activities in Canada*.

U.S. Army Corps of Engineers (USACE). 2012. *Isabella Lake Dam Safety Modification Project Draft Environmental Impact Statement, Kern County, California, Volume I*. March.

United States Department of Agriculture, Forest Service (USFS). 2020a. *Removal Preliminary Assessment for the Big Blue Mill Site, Kernville Ranger District, Sequoia National Forest, California*.

_____. 2020b. *Time Critical Removal Action Memorandum for the Big Blue Mill Site, Sequoia National Forest.*

United States Department of Agriculture, Natural Resources Conservation Service, 2021. *Custom Soil Map of the Former Big Blue Mill Site, Kern County, California*.

United States Environmental Protection Agency (EPA). 1989. *Risk Assessment Guidance for Superfund (RAGS). Human Health Evaluation Manual Part A. Interim Final.* OSWER 9285.701A. EPA/540/1-89/002.

_____. 1990. *National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Final Rule).* 40 CFR Part 300: 55 Federal Register 8666.

_____. 1991a. *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual Supplemental Guidance. Standard Default Exposure Factors. Interim Final*. OSWER Directive 9385.6-03. March 25.

_____. 1991b. *Risk Assessment Guidance for Superfund (RAGS): Part B.* EPA/540/R-92/003. December.

_____. 1992a. *Guidance for Performing Site Inspections Under CERCLA.* Office of Emergency and Remedial Response, OSWER Directive 9345.1-05, September.

_____. 1992b. *Supplemental Guidance to RAGS: Calculating the Concentration Term*. Publication 9285.7-08i. May.

_____. 1993. *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*. EPA/540-R-93-057, Publication 9360.0.32. August.

_____. 1995. *Establishing an Observed Release*. OSWER Directive 9285.7-20FS, EPA/540/F-94/031. September.

_____. 1996. *Soil Screening Guidance: Fact Sheet*. EPA/540/F-95/041.

_____. 1997. *Ecological Risk Assessment for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final*. Environmental Response Team, Edison, NJ. EPA/540/R-97/006.

_____. 1998. *Guidelines for Ecological Risk Assessment*, USEPA/630/R-95/002F. Final. Risk Assessment Forum. Washington DC. April 1998.

_____. 1999. *Improving Site Assessment: Combined PA/SI Assessments.* Office of Solid Waste and Emergency Response. October.

_____. 2000a. *Improving Site Assessment: Integrating Removal and Remedial Site Evaluations.* EPA-540-F-99-006. April.

_____. 2000b. *Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, Rule. Human Health Criteria Protective of Consumption of Water and Organisms and Protective of Freshwater Aquatic Life.*

_____. 2001. *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments*. EPA/540/F-01/014.

_____. 2002a. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites.* OSWER 9285.7-41. September.

_____. 2002b. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

_____. 2004. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R/99/005. OSWER 9285.7-02EP.

_____. 2005-2008. Ecological Soil Screening Levels. Interim Final. OSWER Directive 9285.7-61. U.S. EPA OSWER. Last Updated May 2008. http://www.USEPA.gov/ecotox/ecossl/

_____. 2007a. *SW-846 Test Method 6200: Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment*. February.

_____. 2007b. *Tulare Lake Basin Hydrology and Hydrography: A Summary of the Movement of Water and Aquatic Species*. April.

_____. 2009. *Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual. Part F, Supplemental Guidance for Inhalation Risk Assessment*. EPA-540-R-070-002. OSWER 9285.7-82.

_____. 2014. *National Functional Guidelines for Inorganic Superfund Data Review*. OSWER 9355.0-131, EPA-540-R-013-001, August.

_____. 2015. *ProUCL Version 5.1 User Guide. Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations*.

_____. 2020a. EPA ECOTOX Website. *Ecological Screening Levels (EcoSSLs).* 2020. https://cfpub.epa.gov/ecotox/

_____. 2020b. *Regional Screening Levels (RSLs) - Generic Tables (Residential Soil, Industrial Soil). November 2020 Update*. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2020.

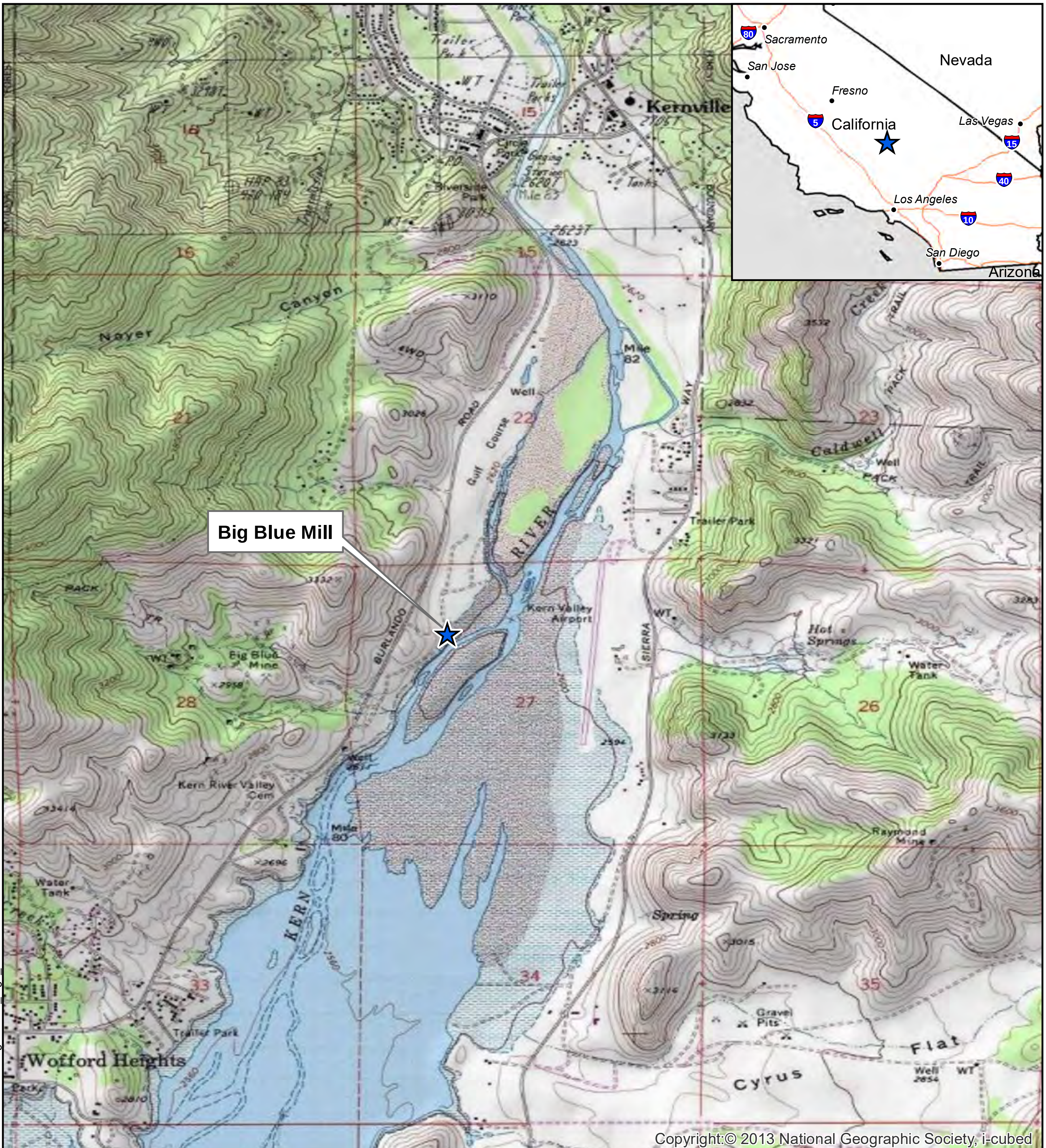
_____. 2020c. *National Recommended Water Quality Criteria for Human Health, Consumption of Water and Organisms and Aquatic Life Criteria Table. Various updates*. Available online at: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table and http://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table.

United States Fish and Wildlife Service (USFW). 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. FWS/OBS-79/31, December 1979. Reprinted 1992.

_____. 2010. *National Wetlands Inventory – Wetlands Mapper*. USFWS Website http://www.fws.gov/wetlands/Data/Mapper.html Accessed February 2021.

_____. 2021. *Information for Planning and Consultation, Migratory Birds by Area*. https://ecos.fws.gov/ipac/location/25P7EMWBHVDEFIEEOY44G5ACRY/resources#migratory-birds.

# Figures




Document Name: BigBlueMill_Fig1_SiteLocation.mxd

**Legend**

★ Site Location

0 0.25 0.5

Miles

1 inch = 0.5 Miles

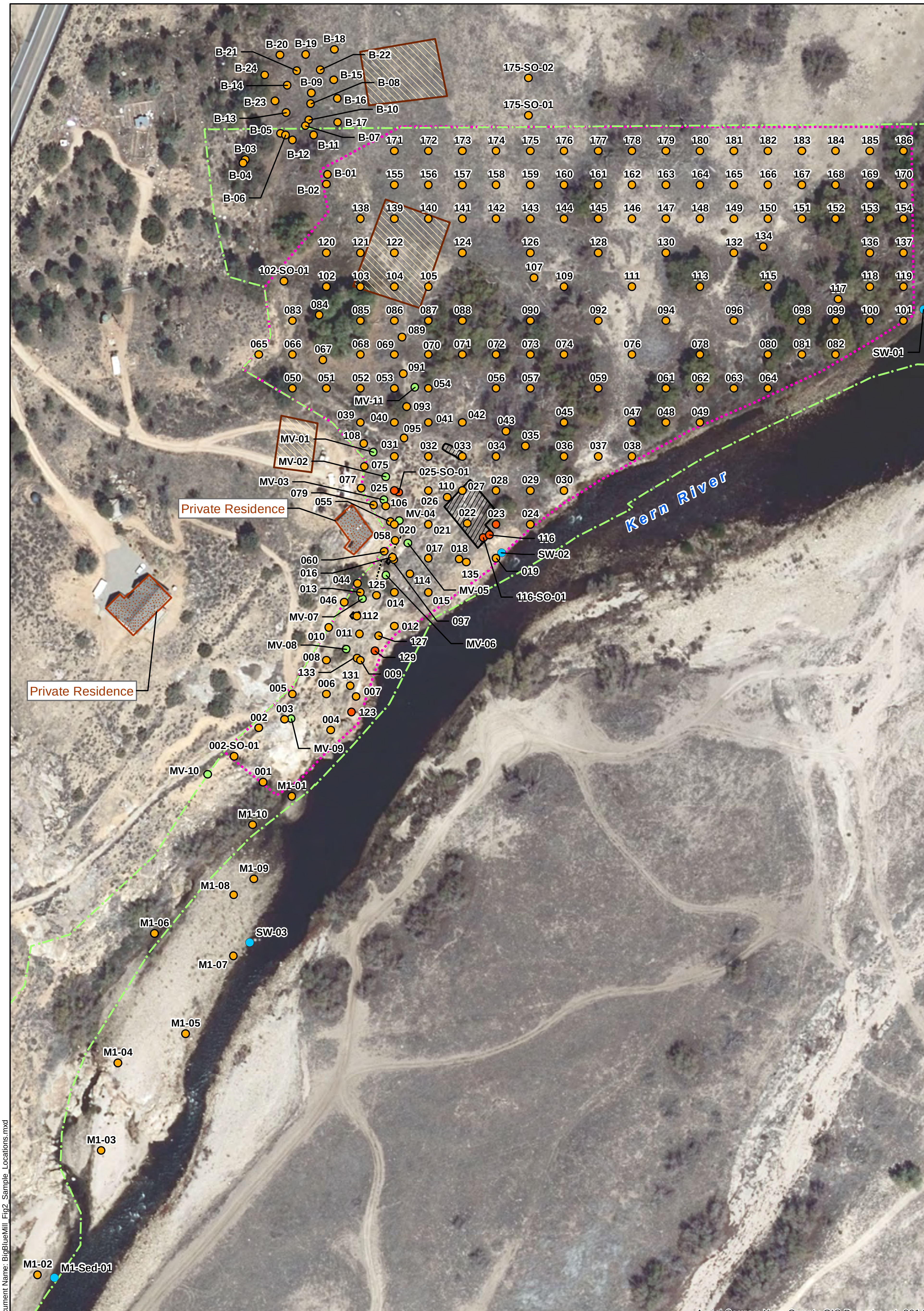
## SITE VICINITY MAP

Big Blue Mill
U.S. Department Of Agriculture
U.S. Forest Service
Kern County, CA

DATE: 7/28/2020 | ANALYST: MWHEL

ECM Consultants

*Figure:* 1




**Legend**

- XRF Surface Sample Location
- XRF Surface/Subsurface Sample Location
- Mercury Vapor Sample Location
- Surface Water/Sediment Sample Location
- Wall
- Approximate Site Boundary
- Forest Closure Area
- Estimated Historical Structure Location
- Mill Foundation
- Private Residence

0 25 50 75 100 125

Feet

1 inch = 125 feet

**Note:**
The locations names have been abbreviated for readability.
The first 3 characters of each name have been removed.
For Example: **BB-001** is displayed as **001**

**SAMPLE LOCATIONS AND SITE FEATURES**

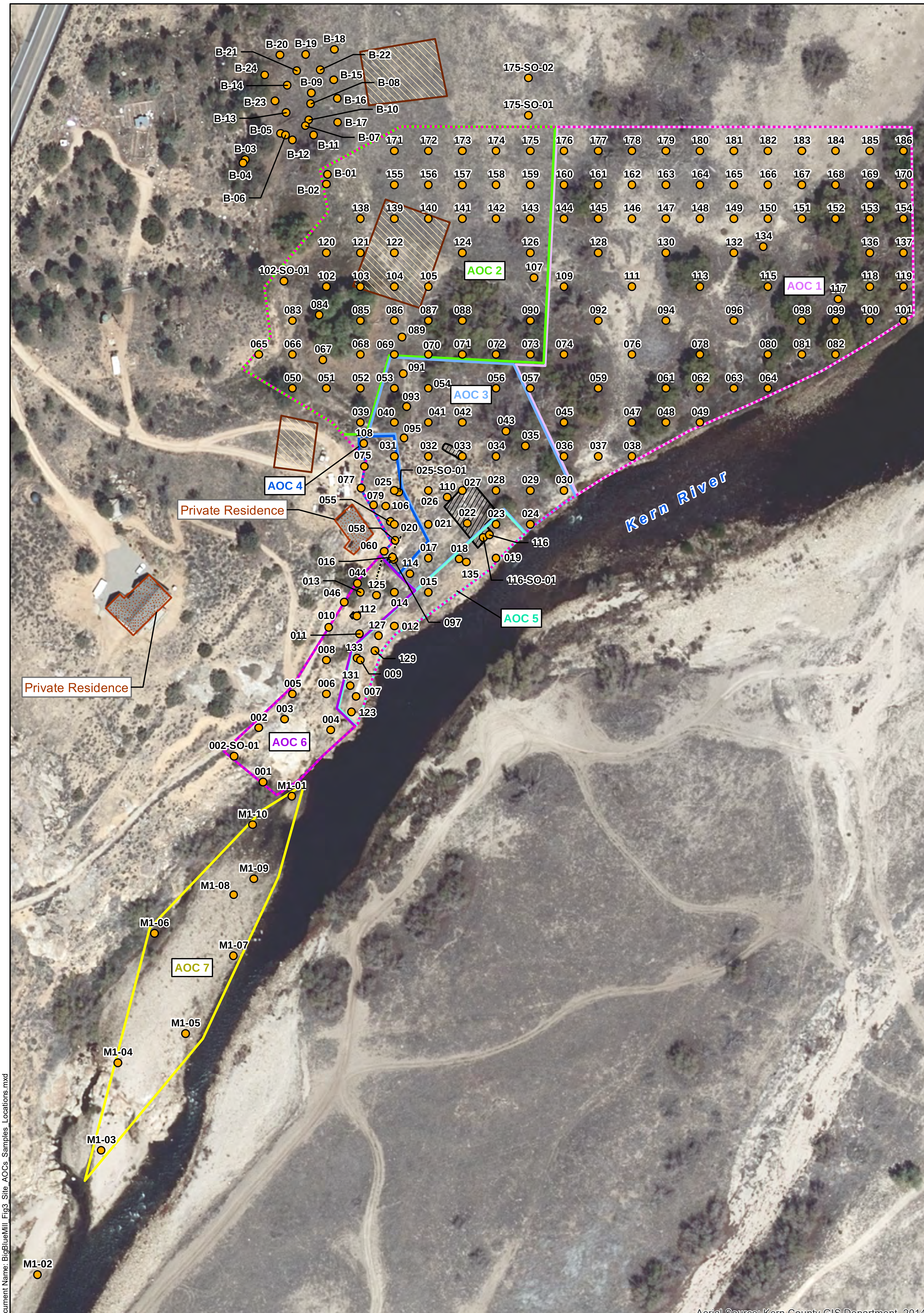
Big Blue Mill
Site Inspection
Department of Agriculture
U.S. Forest Service

DATE: 6/10/2021 | ANALYST: MWHEL

*Figure:* 2

ECM Consultants

Document Name: BigBlueMill_Fig2_Sample_Locations.mxd




**Legend**

- XRF Sample Location
- Wall
- Approximate Site Boundary
- AOC 1 - Area of Concern Boundary
- Estimated Historical Structure Location
- Mill Foundation
- Private Residence

0 25 50 75 100 125

Feet

**1 inch = 125 feet**

**Note:**
The locations names have been abbreviated for readability.
The first 3 characters of each name have been removed.
For Example: **BB-001** is displayed as **001**

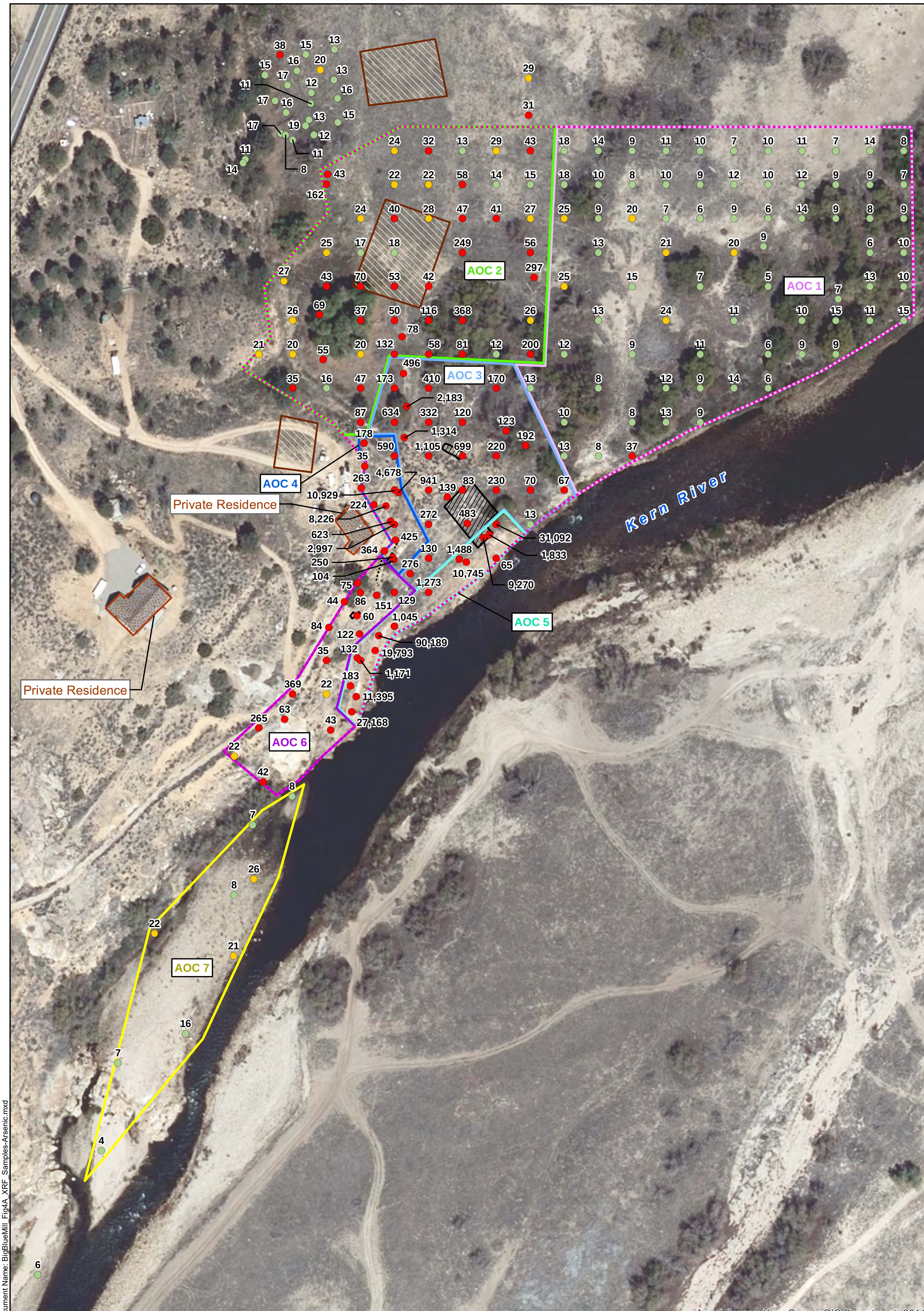
**SITE AREAS OF CONCERN**

Big Blue Mill
Preliminary Assessment/Site Inspection
U.S. Department Of Agriculture
U.S. Forest Service

DATE: 3/11/2021 | ANALYST: MWHEL

ECM Consultants

*Figure:* 3




**Legend**

Arsenic XRF Sample Location

- <20 ppm
- 20 - 30.6 ppm
- >=30.6 ppm
- Wall

- Approximate Site Boundary
- AOC 1 - Area of Concern Boundary
- Estimated Historical Structure Location
- Mill Foundation
- Private Residence

0 25 50 75 100 125

Feet

1 inch = 125 feet

Note: Background concentration is 20 mg/kg.

**DISTRIBUTION OF ARSENIC CONCENTRATIONS IN XRF SURFACE SAMPLES**

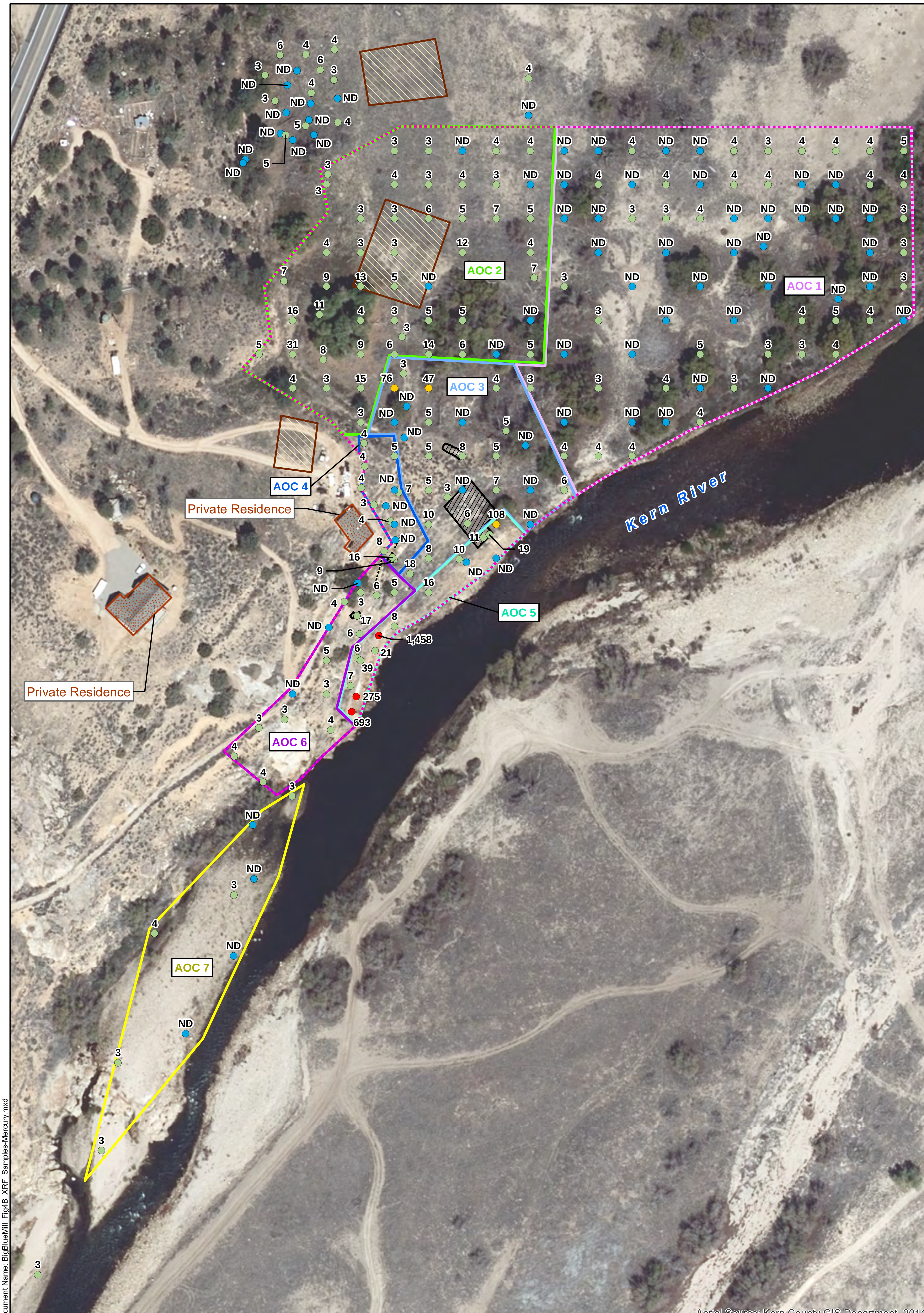
Big Blue Mill
Preliminary Assessment/Site Inspection
U.S. Department Of Agriculture
U.S. Forest Service

DATE: 3/11/2021 | ANALYST: MWHEL

ECM Consultants

Figure: 4A

Document Name: BigBlueMill_Fig4A_XRF_Samples-Arsenic.mxd




Document Name: BigBlueMill_Fig4B_XRF_Samples-Mercury.mxd

**Legend**

Mercury XRF Sample Location
- < 1 ppm
- 1 - 46 ppm
- 46 - 271 ppm
- >= 271 ppm
- Wall

- Approximate Site Boundary
- AOC 1 - Area of Concern Boundary
- Estimated Historical Structure Location
- Mill Foundation
- Private Residence

0 25 50 75 100 125
Feet
1 inch = 125 feet

Note: Background concentration is 0.62 mg/kg.

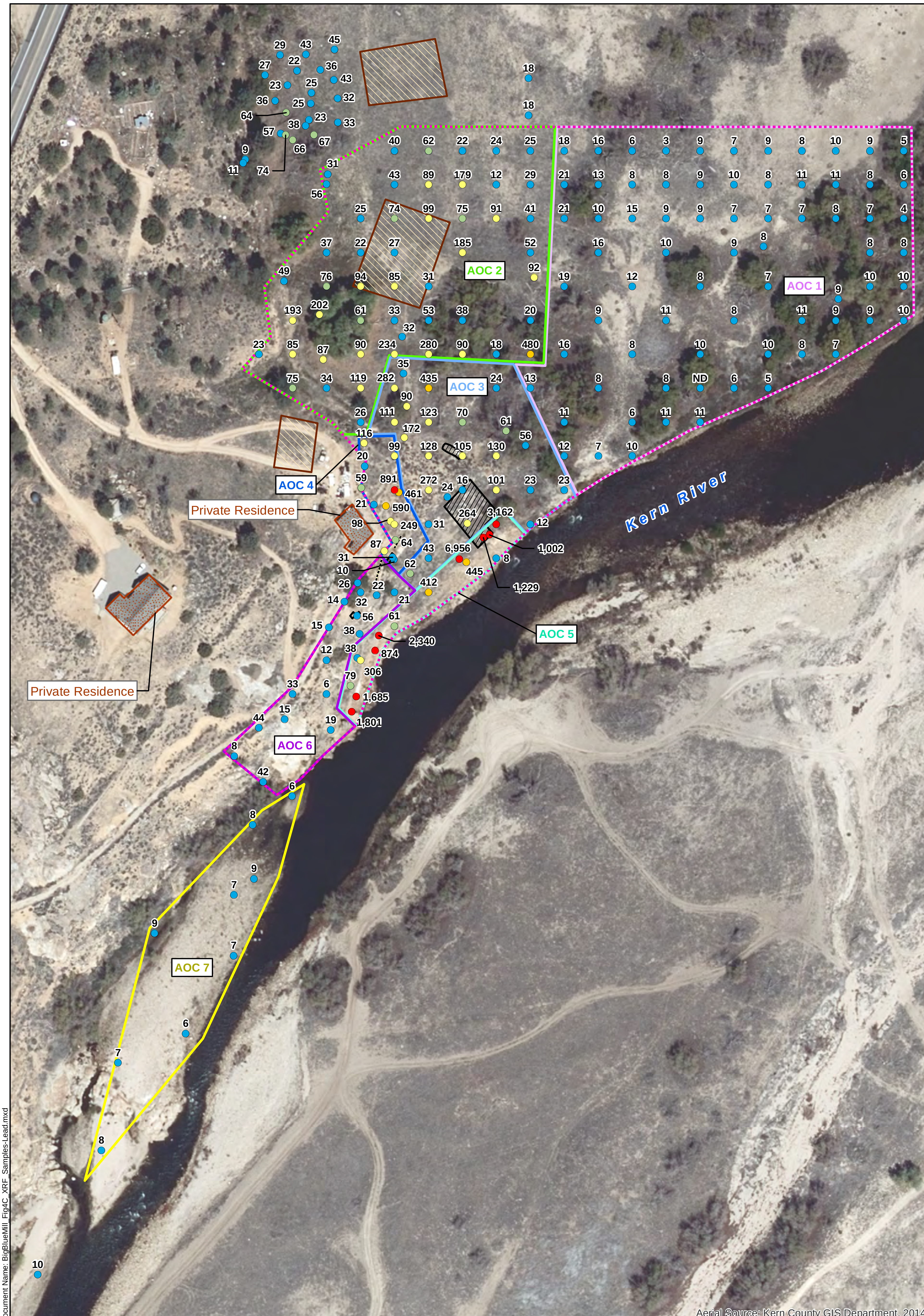
**DISTRIBUTION OF MERCURY CONCENTRATIONS IN XRF SURFACE SAMPLES**

Big Blue Mill
Preliminary Assessment/Site Inspection
U.S. Department Of Agriculture
U.S. Forest Service

DATE: 3/11/2021 | ANALYST: MWHEL

ECM Consultants

Figure: 4B




**Legend**

Lead XRF Sample Location

- < 59 ppm
- 59 - 80 ppm
- 80- 400 ppm
- 400 - 800 ppm
- >= 800 ppm
- Wall
- Approximate Site Boundary
- AOC 1 - Area of Concern Boundary
- Estimated Historical Structure Location
- Mill Foundation
- Private Residence

0 25 50 75 100 125
Feet
1 inch = 125 feet

Note: Background concentration is 59 mg/kg.

**DISTRIBUTION OF LEAD CONCENTRATIONS IN XRF SAMPLES**

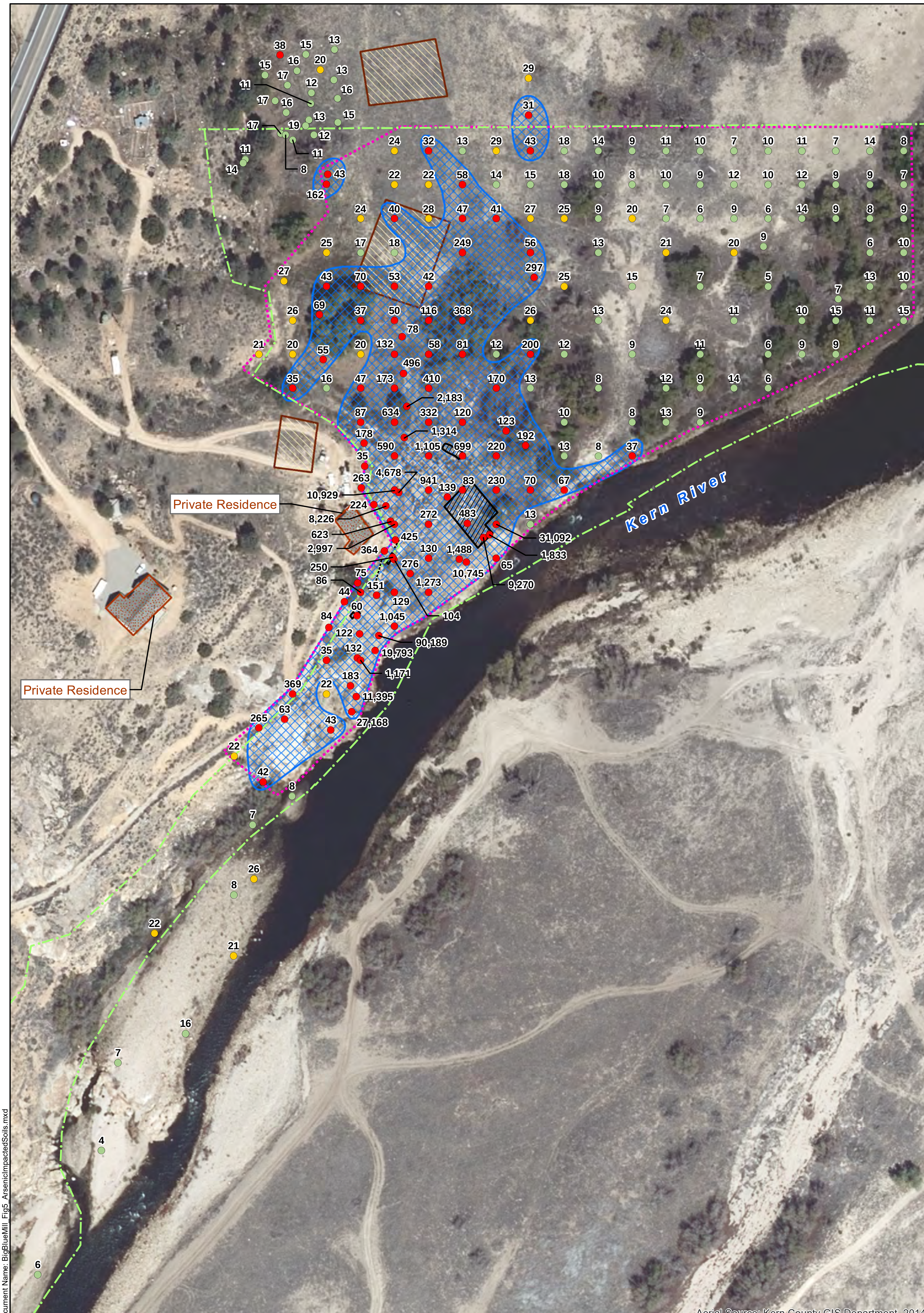
Big Blue Mill
Site Inspection
Department of Agriculture
U.S. Forest Service

DATE: 6/8/2021 | ANALYST: MWHEL

ECM Consultants

Figure: 4C

Document Name: BigBlueMill_Fig4C_XRF_Samples-Lead.mxd




**Legend**

Arsenic XRF Sample Location
- <20 ppm
- 20 - 30.6 ppm
- >=30.6 ppm
- Wall
- Areas of Arsenic > 30.6 ppm (Recreational Visitor SSL)
- Approximate Site Boundary
- Estimated Historical Structure Location
- Forest Closure Area
- Mill Foundation
- Private Residence

0 25 50 75 100 125
Feet
1 inch = 125 feet

Note: Background concentration is 20 mg/kg.

**OBSERVED EXTENT OF ARSENIC-IMPACTED SOILS**

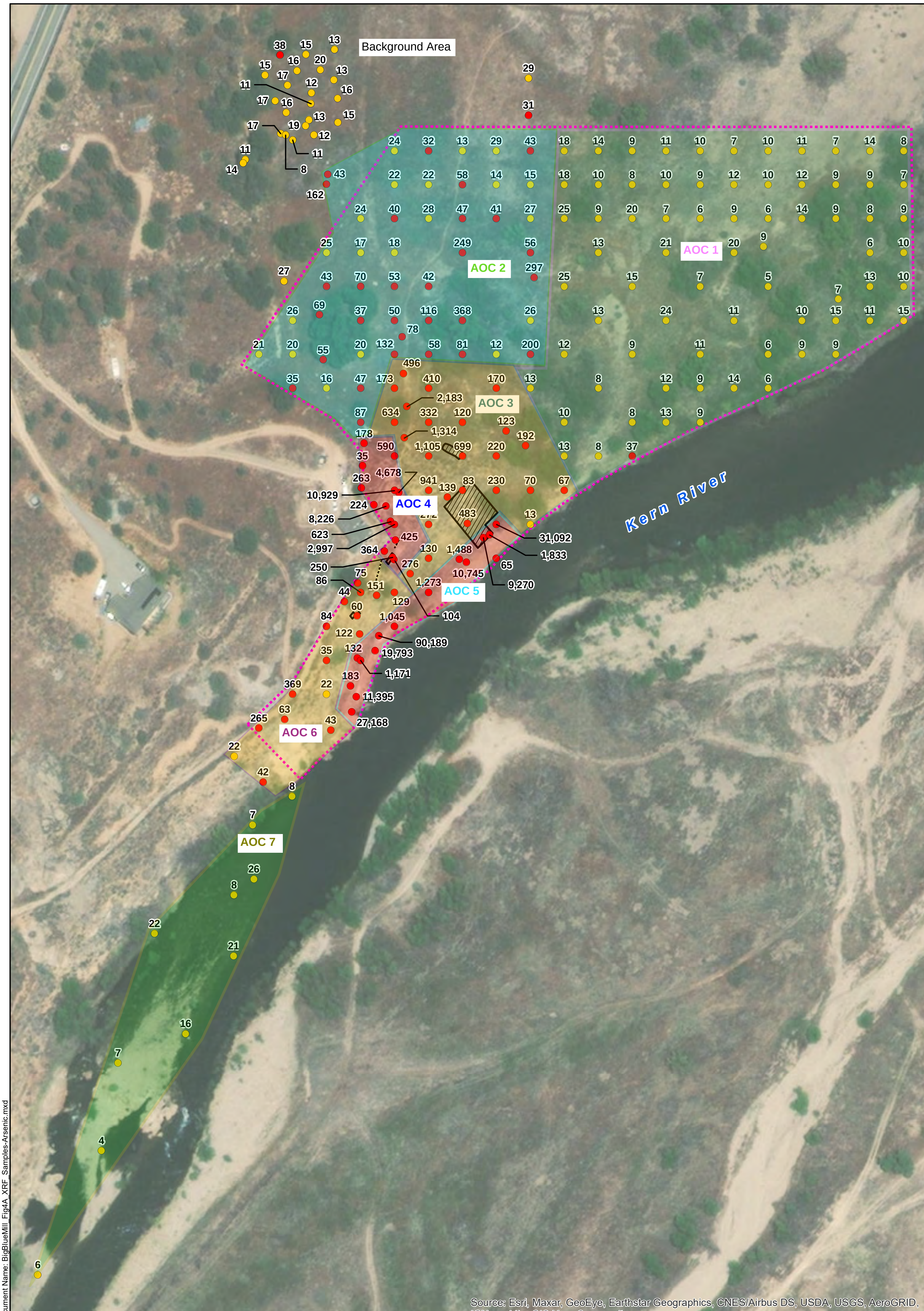
Big Blue Mill
Site Inspection
Department of Agriculture
U.S. Forest Service

DATE: 3/12/2021 | ANALYST: MWHEL

Figure: 5

ECM Consultants

Document Name: BigBlueMill_Fig5_ArsenicImpactedSoils.mxd




Document Name: BigBlueMill_Fig4A_XRF_Samples-Arsenic.mxd

0 25 50 75 100 125
Feet
1 inch = 125 feet

**Legend**

Arsenic XRF Sample
- <0.68 ppm
- 0.68 - 3 ppm
- 3 - 30.6 ppm
- >= 30.6 ppm
- Wall
- AOC 1 - Area of concern boundary
- Approximate Site Boundary
- Mill Foundation
- Risk < 2E-04 (background)
- Risk >1E-04
- Risk >1E-03
- Risk >1E-02

**ARSENIC RESIDENTIAL RISK FOR AOCS**

Big Blue Mill
Preliminary Assessment/Site Inspection
U.S. Department Of Agriculture
U.S. Forest Service

DATE: 11/19/2020 | ANALYST: MWHEL

*Figure:* 6

ECM Consultants

# Tables

**Table 1: Summary of Sampling and Analysis Program**



| Media | Sample Type | Method | Discrete | Composite | Total |
|---|---|---|---|---|---|
| Background | XRF | Metals | 24 | 1 | 25 |
| | Lab - Metals | 6010/6020/7471 | -- | 1 | 1 |
| Downgradient Sand Deposits along River Bank | XRF | Metals | 10 | -- | 10 |
| | Lab - Metals | 6010/6020/7471 | 10 | -- | 10 |
| Step-Out Soil Samples (Modification) | XRF | Metals | 4 | -- | 4 |
| | Lab - Metals | 6010/6020/7471 | -- | -- | -- |
| Surface Soil | XRF | Metals | 191 | -- | 191 |
| | Lab - Metals | 6010/6020/7471 | 11 | -- | 11 |
| | Lab - Metals (Duplicate) | 6010/6020/7471 | 1 | -- | 1 |
| | VOCs | 8260B | 4 | -- | 4 |
| | PAHs | 8270-SIM | 4 | -- | 4 |
| | TCLP/WET | 1311/66700 | 1 | -- | 1 |
| | Bioavailability | 1340 | 2 | -- | 2 |
| Subsurface Soil | XRF | Metals | 28 | -- | 28 |
| | Lab - Metals | 6010/6020/7471 | 5 | -- | 5 |
| Stream Sediment | Metals | 6010/6020/7471 | 4 | -- | 4 |
| Surface Water | Total Metals | 6010/6020/7470 | 3 | -- | 3 |
| | Dissolved Metals | 6010/6020/7470 | 3 | -- | 3 |
| | Total Metals Duplicate | 6010/6020/7470 | 1 | -- | 1 |
| | Dissolved Metals Duplicate | 6010/6020/7470 | 1 | -- | 1 |
| | Hardness | SM-2340B | -- | -- | -- |
| | Water Quality Parameters | pH, temperature, conductivity | 3 | -- | 3 |
| | | | | | |
| Site Dust/Air Particulates | Total Dust | NIOSH 0500 | 4 | -- | 4 |
| | Dust in Respirable Fraction | NIOSH 0600 | 4 | -- | 4 |
| | Dust - Metals | NIOSH 7307 | 4 | -- | 4 |

**Notes:**

**Acronyms and Abbreviations:**

"--" - not sampled
WET - Waste Extraction Test
TCLP - Toxicity Characteristic Leaching Procedure
VOC - volatile organic compound
PAH - polynuclear aromatic hydrocarbon
XRF - x-ray fluoresence

| Description/Location | Sample ID | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Background #1 [3] | BB-B-01 | 10/19/2020 | XRF | <379 | 43 | -- | -- | <164 | 26 | <77 | 16 | 31 | 3 | <29 | 21 | <3 | <130 | -- | 244 | 139 |
| Background #2 [3] | BB-B-02 | 10/19/2020 | XRF | <386 | 162 | -- | -- | <167 | 28 | <75 | 20 | 56 | 3 | <30 | 23 | <3 | <132 | -- | 227 | 106 |
| Background, uphill, disturbed road cut area [3] | BB-B-03 | 10/19/2020 | XRF | <415 | 11 | -- | -- | <181 | <30 | <81 | 15 | 9 | <27 | 4 | 15 | <4 | <144 | -- | 191 | 79 |
| Background, uphill, disturbed road cut area [3] | BB-B-04 | 10/19/2020 | XRF | <410 | 14 | -- | -- | <178 | 26 | <82 | 15 | 11 | <27 | 4 | 11 | <3 | <141 | -- | 230 | 76 |
| Background, slightly uphill of flood plain | BB-B-05 | 10/19/2020 | XRF | <372 | 17 | -- | -- | <163 | 28 | <81 | 27 | 57 | <25 | 4 | 23 | <3 | <129 | -- | 227 | 137 |
| Background, slightly uphill of flood plain | BB-B-06 | 10/19/2020 | XRF | <388 | 8 | -- | -- | <168 | 26 | <73 | 24 | 74 | 5 | 4 | 15 | <3 | <134 | -- | 274 | 94 |
| Background, slightly uphill of flood plain | BB-B-07 | 10/19/2020 | XRF | <392 | 19 | -- | -- | <170 | <29 | <84 | 14 | 38 | 5 | 4 | 20 | <3 | <135 | -- | 242 | 112 |
| Background flood plain | BB-B-08 | 10/19/2020 | XRF | <418 | 11 | -- | -- | <182 | <29 | <75 | 17 | 25 | <28 | 6 | 12 | <3 | <145 | -- | 133 | 135 |
| Background flood plain | BB-B-09 | 10/19/2020 | XRF | <393 | 12 | -- | -- | <171 | 33 | <75 | 20 | 25 | 4 | 4 | 15 | <3 | <136 | -- | 220 | 112 |
| Background flood plain | BB-B-10 | 10/19/2020 | XRF | <402 | 13 | -- | -- | <176 | <28 | <70 | 10 | 23 | <26 | 7 | 13 | <3 | <140 | -- | 199 | 84 |
| Background flood plain | BB-B-11 | 10/19/2020 | XRF | <397 | 12 | -- | -- | <174 | <28 | <68 | 18 | 67 | <26 | 3 | 13 | <3 | <138 | -- | 203 | 88 |
| Background flood plain | BB-B-12 | 10/19/2020 | XRF | <381 | 11 | -- | -- | <169 | <28 | <81 | 37 | 66 | <27 | 11 | 13 | <3 | <134 | -- | 149 | 172 |
| Background flood plain | BB-B-13 | 10/19/2020 | XRF | <355 | 16 | -- | -- | <160 | <27 | <83 | 36 | 64 | <25 | 16 | 14 | <3 | <129 | -- | 111 | 236 |
| Background flood plain | BB-B-14 | 10/19/2020 | XRF | <406 | 17 | -- | -- | <178 | <28 | <76 | 14 | 23 | <27 | 7 | 14 | <3 | <142 | -- | 198 | 103 |
| Background flood plain | BB-B-15 | 10/19/2020 | XRF | <409 | 13 | -- | -- | <177 | 27 | <80 | 16 | 43 | 3 | 4 | 13 | <3 | <141 | -- | 194 | 109 |
| Background flood plain | BB-B-16 | 10/19/2020 | XRF | <413 | 16 | -- | -- | <180 | <29 | <79 | 16 | 32 | <28 | 7 | 14 | <3 | <143 | -- | 229 | 101 |
| Background flood plain | BB-B-17 | 10/19/2020 | XRF | <397 | 15 | -- | -- | <174 | <29 | <76 | 17 | 33 | 4 | 6 | 16 | <3 | <139 | -- | 204 | 115 |
| Background flood plain | BB-B-18 | 10/19/2020 | XRF | <410 | 13 | -- | -- | <181 | <31 | <90 | 24 | 45 | 4 | 13 | 19 | <4 | <145 | -- | 214 | 162 |
| Background flood plain | BB-B-19 | 10/19/2020 | XRF | <383 | 15 | -- | -- | <166 | 36 | <77 | 19 | 43 | 4 | 4 | 24 | <3 | <132 | -- | 226 | 109 |
| Background flood plain | BB-B-20 | 10/19/2020 | XRF | <356 | 38 | -- | -- | <163 | <39 | 871 | 20 | 29 | 6 | 33 | <14 | <4 | <132 | -- | 114 | 213 |
| Background flood plain | BB-B-21 | 10/19/2020 | XRF | <406 | 16 | -- | -- | <177 | <29 | <77 | 14 | 22 | <27 | 6 | 17 | <3 | <141 | -- | 163 | 111 |
| Background flood plain | BB-B-22 | 10/19/2020 | XRF | <388 | 20 | -- | -- | <170 | <29 | <80 | 21 | 36 | 6 | 6 | 16 | <3 | <135 | -- | 236 | 108 |
| Background flood plain | BB-B-23 | 10/19/2020 | XRF | <379 | 17 | -- | -- | <165 | 25 | <77 | 21 | 36 | 3 | 5 | 18 | <3 | <131 | -- | 199 | 106 |
| Background flood plain | BB-B-24 | 10/19/2020 | XRF | <397 | 15 | -- | -- | <172 | <29 | <79 | 17 | 27 | 3 | 3 | 14 | <3 | <137 | -- | 229 | 98 |
| Background flood plain composite [3] | BB-B-COMP-01 | 10/19/2020 | XRF | <376 | 19 | -- | -- | <164 | 24 | <80 | 26 | 59 | 3 | 6 | 13 | <3 | <131 | -- | 209 | 128 |
| Background flood plain composite [3] | BB-B-COMP-01 | 10/19/2020 | Lab | <0.8 A07 | 20 A07 | 82 A07 | <0.47 A07 | <0.52 A07 | 10 A07 | 6.3 J,A07 | 10 A07 | 43 A07 | 0.62 | <0.5 A07 | 4.9 J,A07 | <1.1 A07 | <0.67 A07 | <0.49 A07 | 30 A07 | 78 A07 |
| **ARAR/TBC** | | | **RECEPTOR** | **Soil and Dry Sediment Screening Criteria (mg/kg)** | | | | | | | | | | | | | | | | |
| **Three Times Background (Laboratory)** | | | All | 0.8 | **60** | **246** | **0.47** | **0.52** | **30** | **18.9** | **30** | **129** | **1.86** | **0.5** | **14.7** | **1.1** | **0.67** | **0.49** | **90** | **234** |
| **Three Times Background (XRF)** | | | All | <376 | 57 | -- | -- | <164 | 72 | <80 | 78 | 177 | 9 | 18 | 39 | <3 | <131 | -- | 627 | 384 |
| Ecological Soil Screening Levels [a,b,c,d] | | | Avian | NE | 43 [a] | 720 [c] | NE | 0.77 [a] | 26 [a,1] | 120 [a] | 28 [a] | 11 [a] | 0.013 [c] | 15 [c] | 210 [a] | 1.2 [a] | 4.2 [a] | 4.5 [c] | 7.8 [a] | 46 [a] |
| | | | Invertebrates | 78 [a] | 60 [b] | 330 [a] | 40 [a] | 140 [a] | 0.4 [b,2] | NE | 80 [a] | 1,700 [a] | 0.1 [b] | NE | 280 [a] | 4.1 [a] | NE | NE | NE | 120 [a] |
| | | | Mammals | 0.27 [a] | 46 [a] | 2,000 [a] | 21 [a] | 0.36 [a] | 34 [a,1] | 230 [a] | 49 [a] | 56 [a] | 1.7 [c] | 0.52 [d] | 130 [a] | 0.63 [a] | 14 [a] | 0.42 [c] | 280 [a] | 79 [a] |
| | | | Plants | 5 [b] | 18 [a] | 110 [c] | 2.5 [c] | 32 [a] | 1 [b,2] | 13 [a] | 70 [a] | 120 [a] | 0.3 [b] | 2 [b] | 38 [a] | 0.52 [a] | 560 [a] | 1 [b] | 2 [b] | 160 [a] |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Ecological Receptors | | | Ecological | 0.27 | 18 | 110 | 2.5 | 0.36 | 0.4 | 13 | 28 | 11 | 0.013 | 0.52 | 38 | 0.52 | 4.2 | 0.42 | 2 | 46 |
| EPA Regional Screening Levels - Generic Tables [e] | | | Residents | 31 | 0.68 | 15,000 | 160 | 71 | 120,000 [1] | 23 | 3,100 | 400 | 11 | 390 | 1,500 | 390 | 390 | 0.78 | 390 | 23,000 |
| DTSC-Modified Screening Levels [f] | | | Residents | NE | 0.11 | NE | 16 | 71 | NE | NE | NE | 80 | 1 | NE | 820 | NE | NE | NE | NE | NE |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Residential Human Receptors | | | Residents | 31 | 0.11 | 15000 | 16 | 71 | 120,000 | 23 | 3100 | 80 | 1 | 390 | 820 | 390 | 390 | 0.78 | 390 | 23,000 |
| BLM Child/Adult Recreational Visitors [g] | | | Visitors | 782 | 30.6 | 390,000 | 3,910 | 1,780 | 1,000,000 [1] | 586 | 78,200 | 800 | 271 | 9,780 | 39,000 | 9,780 | 9,780 | 19.60 | 9,850 | 587,000 |
| EPA Method | | | | 6020 | 6020 | 6010B | 6010B | 6010B | 6010B | 6010B | 6010B | 6010B | 7471A | 6010B | 6010B | 6020 | 6010B | 6020 | 6010B | 6010B |
| Laboratory Method Detection Limits (Soil/Dry Sediment) | | | | 0.08 | 0.17 | 0.18 | 0.05 | 0.052 | 0.05 | 0.098 | 0.05 | 0.28 | 0.016 | 0.05 | 0.15 | 0.11 | 0.067 | 0.49 | 0.11 | 0.087 |
| Laboratory Reporting Limits (Soil/Dry Sediment) | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 2.5 | 1 | 2.5 | 0.16 | 2.5 | 0.5 | 0.5 | 1 | 0.25 | 0.5 | 2.5 |

**Notes:**

[1] Screening values are for chromium III.
[2] Screening values are for total chromium (underlying toxicity data are for chromium VI).
[3] Samples BB-B-01, BB-B-02, BB-B-03, and BB-B-04 were not included in the composite sample because concentrations in BB-B-01 and BB-B-02 did not represent background concentrations for arsenic, and BB-B-03 and BB-B-04 were located in a different depositional environment.

**Acronyms and Abbreviations:**

ARAR = Applicable or Relevant and Appropriate Requirement
BLM = Bureau of Land Management
DTSC = Department of Toxic Substances Control
EcoSSL = Ecological Soil Screening Levels
EPA = United States Environmental Protection Agency
mg/kg = Milligrams per Kilogram
NE = Not Established
TBC = To-Be-Considered Requirement

**Sources:**

[a] EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https://cfpub.epa.gov/ecotox/
[b] Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. Https://rais.ornl.gov/tools/eco_search.php
[c] Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1), https://www.lanl.gov/envirohnment/protection/eco-risk-assessment.php
[d] Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June.
[e] EPA. 2020. Regional Screening Levels (RSLs) - Generic Tables. May 2020.
[f] DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3. June.
[g] BLM. 2017. Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites.

**Table 3A: Summary of Soil/Dry Sediment XRF and Laboratory Analytical Results for Surface Metals**



| AOC | Description/Location | Sample ID | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 1 - Northeastern Floodplain Area | Floodplain | BB-036 | 10/21/2020 | XRF | <384 | 13 | -- | -- | <165 | 34 | <80 | 15 | 12 | 4 | <30 | 29 | <3 | <131 | -- | 299 | 65 |
| | Floodplain | BB-109 | 10/21/2020 | XRF | <369 | 25 | -- | -- | <161 | <28 | <84 | 25 | 19 | 3 | 3 | 25 | <3 | <128 | -- | 243 | 112 |
| | Floodplain | BB-111 | 10/21/2020 | XRF | <371 | 15 | -- | -- | <162 | 40 | <79 | 23 | 12 | <25 | 5 | 29 | <3 | <128 | -- | 277 | 105 |
| | Floodplain | BB-128 | 10/20/2020 | XRF | <395 | 13 | -- | -- | <170 | <27 | <68 | 17 | 16 | <26 | 3 | 24 | <3 | <135 | -- | 300 | 72 |
| | Floodplain | BB-130 | 10/20/2020 | XRF | <363 | 21 | -- | -- | <160 | <28 | <85 | 35 | 10 | <26 | 9 | 29 | <3 | <128 | -- | 203 | 127 |
| | Floodplain | BB-132 | 10/20/2020 | XRF | <352 | 20 | -- | -- | <156 | <29 | <89 | 36 | 9 | <25 | 11 | 26 | <3 | <125 | -- | 219 | 148 |
| | Floodplain | BB-081 | 10/22/2020 | XRF | <408 | 9 | -- | -- | <176 | <27 | <63 | 13 | 8 | 3 | <31 | 23 | <3 | <140 | -- | 286 | 55 |
| | Floodplain | BB-082 | 10/22/2020 | XRF | <397 | 9 | -- | -- | <173 | <28 | <73 | 20 | 7 | 4 | 4 | 17 | <3 | <137 | -- | 271 | 73 |
| | Floodplain | BB-092 | 10/22/2020 | XRF | <391 | 13 | -- | -- | <172 | <28 | <69 | 15 | 9 | 3 | 7 | 15 | <3 | <137 | -- | 214 | 70 |
| | Floodplain | BB-094 | 10/22/2020 | XRF | <398 | 24 | -- | -- | <177 | <30 | <89 | 31 | 11 | <29 | 10 | 23 | <4 | <141 | -- | 182 | 115 |
| | Floodplain | BB-096 | 10/22/2020 | XRF | <401 | 11 | -- | -- | <176 | <29 | <75 | 16 | 8 | <26 | 7 | 17 | <3 | <140 | -- | 245 | 85 |
| | Floodplain | BB-098 | 10/22/2020 | XRF | <396 | 10 | -- | -- | <172 | <27 | <65 | 16 | 11 | 4 | 4 | 22 | <3 | **9** | -- | 268 | 67 |
| | Floodplain | BB-099 | 10/22/2020 | XRF | <383 | 15 | -- | -- | <167 | 32 | <83 | 27 | 9 | 5 | 7 | 26 | <3 | <133 | -- | 235 | 108 |
| | Floodplain | BB-100 | 10/22/2020 | XRF | <398 | 11 | -- | -- | <172 | <27 | <71 | 13 | 9 | 4 | <30 | 22 | <3 | <137 | -- | 295 | 72 |
| | Floodplain | BB-101 | 10/22/2020 | XRF | <393 | 15 | -- | -- | <171 | <28 | <76 | 17 | 10 | <26 | 5 | 26 | <3 | <136 | -- | 291 | 75 |
| | Floodplain | BB-144 | 10/20/2020 | XRF | <372 | 25 | -- | -- | <165 | <28 | <83 | 22 | 21 | <27 | 9 | 22 | <3 | <132 | -- | 224 | 122 |
| | Floodplain | BB-145 | 10/20/2020 | XRF | <382 | 9 | -- | -- | <166 | 39 | <70 | 23 | 10 | <25 | <29 | 24 | <3 | <131 | -- | 308 | 80 |
| | Floodplain | BB-146 | 10/20/2020 | XRF | <391 | 20 | -- | -- | <170 | 32 | <77 | 20 | 15 | 3 | 4 | 21 | <3 | <135 | -- | 212 | 84 |
| | Floodplain | BB-147 | 10/20/2020 | XRF | <380 | 7 | -- | -- | <165 | <28 | <78 | 18 | 9 | 3 | <29 | 25 | <3 | <131 | -- | 258 | 71 |
| | Floodplain | BB-148 | 10/20/2020 | XRF | <400 | 6 | -- | -- | <173 | <28 | <71 | 12 | 9 | 4 | 7 | 23 | <3 | <138 | -- | 225 | 56 |
| | Floodplain | BB-149 | 10/20/2020 | XRF | <388 | 9 | -- | -- | <167 | 33 | <72 | 18 | 7 | <26 | <30 | 29 | <3 | <133 | -- | 273 | 63 |
| | Floodplain | BB-150 | 10/20/2020 | XRF | <405 | 6 | -- | -- | <175 | <27 | <63 | 14 | 7 | <26 | <31 | 18 | <3 | <139 | -- | 242 | 54 |
| | Floodplain | BB-151 | 10/20/2020 | XRF | <375 | 14 | -- | -- | <165 | <29 | <85 | 32 | 7 | <26 | 9 | 29 | <3 | <131 | -- | 235 | 115 |
| | Floodplain | BB-152 | 10/20/2020 | XRF | <382 | 9 | -- | -- | <168 | <28 | <80 | 22 | 8 | <26 | 6 | 19 | <3 | <133 | -- | 227 | 102 |
| | Floodplain | BB-153 | 10/20/2020 | XRF | <372 | 8 | -- | -- | <165 | <28 | <79 | 27 | 7 | <26 | 11 | 22 | <3 | <132 | -- | 158 | 118 |
| | Floodplain | BB-154 | 10/20/2020 | XRF | <367 | 9 | -- | -- | <163 | <28 | <78 | 21 | 4 | 3 | 7 | 21 | <3 | <130 | -- | 122 | 108 |
| | Floodplain | BB-160 | 10/20/2020 | XRF | <393 | 18 | -- | -- | <170 | 35 | <73 | 18 | 21 | <26 | <31 | 21 | <3 | <135 | -- | 265 | 86 |
| | Floodplain | BB-161 | 10/20/2020 | XRF | <390 | 10 | -- | -- | <170 | <27 | <69 | 14 | 13 | 4 | 3 | 16 | <3 | <135 | -- | 241 | 64 |
| | Floodplain | BB-162 | 10/20/2020 | XRF | <394 | 8 | -- | -- | <171 | 25 | <72 | 19 | 8 | <26 | 5 | 18 | <3 | <136 | -- | 280 | 68 |
| | Floodplain | BB-163 | 10/20/2020 | XRF | <384 | 10 | -- | -- | <168 | <29 | <80 | 24 | 8 | 4 | 7 | 24 | <3 | <134 | -- | 302 | 105 |
| | Floodplain | BB-164 | 10/20/2020 | XRF | <385 | 9 | -- | -- | **13** | 26 | <76 | 17 | 9 | <27 | 7 | 19 | <3 | <134 | -- | 194 | 91 |
| | Floodplain | BB-165 | 10/20/2020 | XRF | <380 | 12 | -- | -- | <165 | 37 | <80 | 22 | 10 | 4 | 4 | 25 | <3 | <131 | -- | 257 | 89 |
| | Floodplain | BB-166 | 10/20/2020 | XRF | <393 | 10 | -- | -- | <170 | 33 | <80 | 23 | 8 | 4 | 3 | 24 | <3 | <135 | -- | 243 | 95 |
| | Floodplain | BB-167 | 10/20/2020 | XRF | <385 | 12 | -- | -- | <168 | <29 | <86 | 26 | 11 | <27 | 7 | 26 | <3 | <133 | -- | 231 | 114 |
| | Floodplain | BB-168 | 10/20/2020 | XRF | <385 | 9 | -- | -- | <168 | <29 | <84 | 26 | 11 | <27 | 6 | 27 | <3 | <133 | -- | 215 | 110 |
| | Floodplain | BB-169 | 10/20/2020 | XRF | <383 | 9 | -- | -- | <167 | <29 | <84 | 24 | 8 | 4 | 10 | 22 | <3 | <133 | -- | 212 | 114 |
| | Floodplain | BB-74 | 10/22/2020 | XRF | <376 | 12 | -- | -- | <166 | 23 | <83 | 28 | 16 | <27 | 6 | 21 | <3 | <133 | -- | 236 | 122 |
| | Floodplain | BB-76 | 10/22/2020 | XRF | <412 | 9 | -- | -- | <179 | <27 | <60 | 10 | 8 | <26 | 5 | 16 | <3 | <142 | -- | 235 | 45 |
| | Floodplain | BB-78 | 10/22/2020 | XRF | <379 | 11 | -- | -- | <165 | 23 | <79 | 20 | 10 | 5 | 5 | 31 | <3 | <131 | -- | 254 | 94 |
| | Floodplain | BB-80 | 10/22/2020 | XRF | <409 | 6 | -- | -- | <178 | <28 | <63 | 9 | 10 | 3 | 3 | 12 | <3 | <141 | -- | 242 | 43 |
| | Floodplain in brush | BB-113 | 10/21/2020 | XRF | <394 | 7 | -- | -- | <171 | 28 | <78 | 14 | 8 | <26 | 5 | 17 | <3 | <136 | -- | 241 | 66 |
| | Floodplain in brush | BB-115 | 10/21/2020 | XRF | <408 | 5 | -- | -- | <177 | <26 | <52 | 9 | 7 | <26 | <31 | 16 | <3 | <140 | -- | 238 | 38 |
| | Floodplain in brush | BB-118 | 10/21/2020 | XRF | <374 | 13 | -- | -- | <166 | <29 | <80 | 36 | 10 | <26 | 9 | 26 | <3 | <132 | -- | 177 | 182 |
| | Floodplain in brush | BB-119 | 10/21/2020 | XRF | <380 | 10 | -- | -- | <166 | 24 | <82 | 31 | 10 | 3 | 5 | 29 | <3 | <132 | -- | 253 | 97 |
| | Floodplain in brush | BB-136 | 10/20/2020 | XRF | <386 | 6 | -- | -- | <169 | <28 | <72 | 18 | 8 | <26 | 4 | 19 | <3 | <135 | -- | 186 | 83 |
| | Floodplain in brush | BB-137 | 10/21/2020 | XRF | <378 | 10 | -- | -- | <166 | <29 | <84 | 28 | 8 | 3 | 8 | 21 | <3 | <132 | -- | 255 | 110 |
| | Floodplain in brush | BB-057 | 10/23/2020 | XRF | <403 | 13 | -- | -- | <177 | <27 | <64 | 13 | 13 | 3 | 5 | 15 | <3 | <140 | -- | 208 | 70 |
| | Floodplain in brush | BB-045 | 10/23/2020 | XRF | <400 | 10 | -- | -- | <174 | <28 | <67 | 14 | 11 | <27 | 4 | 18 | <3 | <139 | -- | 248 | 63 |
| | Floodplain in brush | BB-059 | 10/23/2020 | XRF | <421 | 8 | -- | -- | <183 | <29 | <64 | 10 | 8 | 3 | 5 | 9 | <4 | <146 | -- | 203 | 37 |
| | Floodplain in brush | BB-061 | 10/23/2020 | XRF | <388 | 12 | -- | -- | <171 | <29 | <77 | 25 | 8 | 4 | 9 | 19 | <3 | <136 | -- | 185 | 114 |
| | Floodplain in brush | BB-062 | 10/23/2020 | XRF | <345 | 9 | -- | -- | <158 | <25 | <70 | 18 | <28 | <24 | 15 | 7 | <3 | <128 | -- | 93 | 122 |
| | Floodplain in brush | BB-063 | 10/23/2020 | XRF | <389 | 14 | -- | -- | <171 | <29 | <84 | 26 | 6 | 3 | 10 | 20 | <3 | <136 | -- | 189 | 100 |
| | Floodplain in brush | BB-064 | 10/23/2020 | XRF | <415 | 6 | -- | -- | <181 | <26 | <57 | 9 | 5 | <26 | 3 | 12 | <3 | <144 | -- | 197 | 78 |
| | Floodplain in brush | BB-049 | 10/23/2020 | XRF | <381 | 9 | -- | -- | <167 | <28 | <79 | 23 | 11 | 4 | 5 | 27 | <3 | <133 | -- | 218 | 101 |
| | Floodplain in brush | BB-048 | 10/23/2020 | XRF | <374 | 13 | -- | -- | <167 | <29 | <82 | 27 | 11 | <27 | 10 | 17 | <3 | <133 | -- | 185 | 129 |
| | Floodplain in brush | BB-047 | 10/23/2020 | XRF | <418 | 8 | -- | -- | <183 | <28 | <57 | 8 | 6 | <27 | 5 | 12 | <3 | <146 | -- | 252 | 45 |
| | Floodplain in brush. Relocated due to thick brush. | BB-117 | 10/21/2020 | XRF | <401 | 7 | -- | -- | <176 | <29 | <74 | 19 | 9 | <27 | 11 | 12 | <4 | <140 | -- | 252 | 83 |
| | Floodplain mole hill sand | BB-134 | 10/20/2020 | XRF | <389 | 9 | -- | -- | <168 | 33 | <73 | 18 | 8 | <26 | <30 | 27 | <3 | **11** | -- | 237 | 68 |
| | Near water level on beach | BB-037 | 10/21/2020 | XRF | <403 | 8 | -- | -- | <174 | <27 | <61 | 8 | 7 | 4 | <30 | 15 | <3 | <138 | -- | 265 | 44 |
| | Near water level on beach | BB-038 | 10/21/2020 | XRF | <378 | 37 | -- | -- | <163 | <30 | <93 | 15 | 10 | 4 | 8 | 29 | <3 | <129 | -- | 272 | 75 |
| | North and west grid boundaries | BB-170 | 10/19/2020 | XRF | <381 | 7 | -- | -- | <165 | 33 | <87 | 16 | 6 | 4 | 5 | 24 | <3 | <131 | -- | 286 | 74 |
| | North and west grid boundaries | BB-176 | 10/19/2020 | XRF | <386 | 18 | -- | -- | <172 | <29 | <83 | 22 | 18 | <28 | 10 | 17 | <3 | <138 | -- | 129 | 148 |
| | North and west grid boundaries | BB-177 | 10/19/2020 | XRF | <396 | 14 | -- | -- | <174 | <29 | <84 | 26 | 16 | <27 | 8 | 16 | <3 | <139 | -- | 195 | 104 |
| | North and west grid boundaries | BB-178 | 10/19/2020 | XRF | <413 | 9 | -- | -- | <178 | <28 | <67 | 11 | 6 | 4 | 3 | 27 | <3 | <141 | -- | 315 | 48 |
| | North and west grid boundaries | BB-179 | 10/19/2020 | XRF | <369 | 11 | -- | -- | <166 | <27 | <69 | 31 | 3 | <25 | 18 | 12 | <3 | <133 | -- | 86 | 156 |
| | North and west grid boundaries | BB-180 | 10/19/2020 | XRF | <392 | 10 | -- | -- | <172 | <29 | <80 | 21 | 9 | <27 | 7 | 16 | <3 | <137 | -- | 208 | 97 |
| | North and west grid boundaries | BB-181 | 10/19/2020 | XRF | <408 | 7 | -- | -- | <177 | <29 | <74 | 18 | 7 | 4 | 8 | 17 | <3 | <141 | -- | 197 | 78 |
| | North and west grid boundaries | BB-182 | 10/19/2020 | XRF | <387 | 10 | -- | -- | <169 | <29 | <83 | 23 | 9 | 3 | 8 | 26 | <3 | <135 | -- | 257 | 93 |

**Table 3A: Summary of Soil/Dry Sediment XRF and Laboratory Analytical Results for Surface Metals**



| AOC | Description/Location | Sample ID | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 1 - Northeastern Floodplain Area | North and west grid boundaries | BB-183 | 10/19/2020 | XRF | <395 | 11 | -- | -- | <170 | 51 | <70 | 20 | 8 | 4 | <30 | 29 | <3 | <135 | -- | 288 | 68 |
| | North and west grid boundaries | BB-184 | 10/19/2020 | XRF | <394 | 7 | -- | -- | <171 | 30 | <71 | 18 | 10 | 4 | 6 | 20 | <3 | <135 | -- | 294 | 65 |
| | North and west grid boundaries | BB-185 | 10/19/2020 | XRF | <381 | 14 | -- | -- | <166 | 32 | <88 | 34 | 9 | 4 | 8 | 27 | <3 | <133 | -- | 276 | 130 |
| | North and west grid boundaries | BB-186 | 10/19/2020 | XRF | <384 | 8 | -- | -- | <171 | <29 | <82 | 27 | 5 | 5 | 12 | 15 | <3 | <136 | -- | 142 | 118 |
| AOC 2 - North Area | Background #1 | BB-B-01 | 10/19/2020 | XRF | <379 | 43 | -- | -- | <164 | 26 | <77 | 16 | 31 | 3 | <29 | 21 | <3 | <130 | -- | 244 | 139 |
| | Background #2 | BB-B-02 | 10/19/2020 | XRF | <386 | **162** | -- | -- | <167 | 28 | <75 | 20 | 56 | 3 | <30 | 23 | <3 | <132 | -- | 227 | 106 |
| | Canal/ditch beach | BB-050 | 10/20/2020 | XRF | <378 | 35 | -- | -- | <165 | <28 | <77 | 18 | 75 | 4 | 7 | 20 | <3 | <131 | -- | 205 | 121 |
| | Canal/ditch beach | BB-051 | 10/20/2020 | XRF | <392 | 16 | -- | -- | <170 | <29 | <78 | 22 | 34 | 3 | 5 | 20 | <3 | <135 | -- | 197 | 100 |
| | Canal/ditch beach | BB-066 | 10/20/2020 | XRF | <381 | 20 | -- | -- | <165 | <28 | <77 | 31 | 85 | **31** | 5 | 25 | <3 | <131 | -- | 198 | 119 |
| | Ditch bench near house | BB-039 | 10/20/2020 | XRF | <388 | **87** | -- | -- | <167 | <27 | <73 | 16 | 26 | 3 | 3 | 28 | <3 | <133 | -- | 236 | 98 |
| | Floodplain | BB-085 | 10/20/2020 | XRF | <383 | 37 | -- | -- | <166 | 32 | <78 | 21 | 61 | 4 | 3 | 25 | <3 | <132 | -- | 225 | 119 |
| | Floodplain | BB-104 | 10/20/2020 | XRF | <386 | 53 | -- | -- | <167 | <28 | <74 | 23 | 85 | 5 | 3 | 27 | <3 | <133 | -- | 250 | 114 |
| | Floodplain | BB-121 | 10/20/2020 | XRF | <384 | 17 | -- | -- | <166 | 21 | <69 | 14 | 22 | 3 | <29 | 16 | <3 | <132 | -- | 231 | 77 |
| | Floodplain | BB-122 | 10/20/2020 | XRF | <391 | 18 | -- | -- | <170 | 24 | <67 | 14 | 27 | 3 | <30 | 18 | <3 | <135 | -- | 256 | 89 |
| | Floodplain | BB-139 | 10/20/2020 | XRF | **22** | 40 | -- | -- | <163 | <28 | <78 | 24 | 74 | 3 | 5 | 22 | <3 | <130 | -- | 233 | 165 |
| | Floodplain | BB-156 | 10/20/2020 | XRF | <389 | 22 | -- | -- | <168 | 44 | <75 | 24 | 89 | 3 | <30 | 25 | <3 | <133 | -- | 257 | 197 |
| | Floodplain | BB-140 | 10/20/2020 | XRF | <381 | 28 | -- | -- | <165 | 28 | <78 | 40 | 99 | 6 | 3 | 20 | <3 | <131 | -- | 233 | 159 |
| | Floodplain near parking | BB-086 | 10/20/2020 | XRF | <405 | 50 | -- | -- | <175 | 29 | <68 | 17 | 33 | 3 | <31 | 19 | <3 | <139 | -- | 224 | 85 |
| | Floodplain, under tree | BB-103 | 10/20/2020 | XRF | <365 | **70** | -- | -- | <162 | <27 | <72 | 24 | 94 | **13** | 8 | 18 | <3 | <129 | -- | 175 | 139 |
| | Floodplain, under trees | BB-052 | 10/20/2020 | XRF | <382 | 47 | -- | -- | <166 | 22 | <82 | 30 | 119 | **15** | 5 | 22 | <3 | <131 | -- | 227 | 152 |
| | Floodplain, under trees | BB-067 | 10/20/2020 | XRF | <379 | 55 | -- | -- | <165 | 39 | <80 | 26 | 87 | 8 | 6 | 19 | <3 | <131 | -- | 206 | 161 |
| | Floodplain, under trees | BB-068 | 10/20/2020 | XRF | <378 | 20 | -- | -- | <165 | <28 | <75 | 30 | 90 | 9 | 6 | 24 | <3 | <132 | -- | 232 | 142 |
| | Floodplain, under trees | BB-084 | 10/20/2020 | XRF | <375 | **69** | -- | -- | <164 | <28 | <79 | 33 | **202** | **11** | 4 | 19 | <3 | <130 | -- | 191 | 175 |
| | North and west grid boundaries | BB-171 | 10/19/2020 | XRF | <389 | 24 | -- | -- | <171 | 23 | <74 | 24 | 40 | 3 | 8 | 18 | <3 | <136 | -- | 189 | 127 |
| | North and west grid boundaries | BB-172 | 10/19/2020 | XRF | <381 | 32 | -- | -- | <169 | <28 | <78 | 24 | 62 | 3 | 11 | 16 | <3 | <135 | -- | 118 | 162 |
| | North boundary delineation | BB-083 | 10/20/2020 | XRF | <372 | 26 | -- | -- | <162 | 27 | <74 | 32 | **193** | **16** | 4 | 20 | <3 | <129 | -- | 204 | 129 |
| | North boundary delineation | BB-102 | 10/20/2020 | XRF | <387 | 43 | -- | -- | <168 | <28 | <75 | 15 | 76 | 9 | 3 | 17 | <3 | <134 | -- | 191 | 116 |
| | North boundary delineation | BB-120 | 10/20/2020 | XRF | <384 | 25 | -- | -- | <167 | <28 | <73 | 20 | 37 | 4 | <30 | 21 | <3 | <132 | -- | 264 | 95 |
| | North boundary delineation | BB-138 | 10/20/2020 | XRF | <390 | 24 | -- | -- | <169 | 34 | <76 | 20 | 25 | 3 | <30 | 17 | <3 | <134 | -- | 212 | 100 |
| | North boundary delineation | BB-155 | 10/20/2020 | XRF | <396 | 22 | -- | -- | <171 | 29 | <71 | 22 | 43 | 4 | 3 | 22 | <3 | <136 | -- | 223 | 93 |
| | North boundary delineation, hillside above ditch | BB-065 | 10/20/2020 | XRF | <386 | 21 | -- | -- | <168 | 39 | <75 | 18 | 23 | 5 | <30 | 23 | <3 | <133 | -- | 248 | 110 |
| | Floodplain | BB-124 | 10/20/2020 | XRF | <386 | **249** | -- | -- | <168 | <28 | <76 | 57 | **185** | **12** | 6 | 25 | <4 | <134 | -- | 198 | 176 |
| | Floodplain | BB-126 | 10/20/2020 | XRF | <377 | 56 | -- | -- | <165 | <29 | <82 | 31 | 52 | 4 | 6 | 22 | <3 | <132 | -- | 221 | 131 |
| | Floodplain | BB-090 | 10/22/2020 | XRF | <372 | 26 | -- | -- | <166 | <29 | <87 | 29 | 20 | <27 | 10 | 22 | <3 | <133 | -- | 232 | 155 |
| | Floodplain | BB-141 | 10/20/2020 | XRF | <368 | 47 | -- | -- | <159 | 29 | <75 | 36 | 75 | 5 | 3 | 30 | <3 | <126 | -- | 205 | 145 |
| | Floodplain | BB-142 | 10/20/2020 | XRF | <378 | 41 | -- | -- | <163 | 40 | <78 | 77 | 91 | 7 | <29 | 35 | <3 | <129 | -- | 271 | 165 |
| | Floodplain | BB-143 | 10/20/2020 | XRF | <385 | 27 | -- | -- | <168 | 23 | <79 | 22 | 41 | 5 | 5 | 23 | <3 | **9** | -- | 208 | 131 |
| | Floodplain | BB-157 | 10/20/2020 | XRF | <387 | **58** | -- | -- | <169 | 27 | <78 | 54 | **179** | 4 | 5 | 18 | <4 | <134 | -- | 254 | 376 |
| | Floodplain | BB-158 | 10/20/2020 | XRF | <390 | 14 | -- | -- | <170 | 28 | <67 | 14 | 12 | 3 | <29 | 21 | <3 | <135 | -- | 188 | 64 |
| | Floodplain | BB-159 | 10/20/2020 | XRF | <388 | 15 | -- | -- | <168 | 25 | <75 | 20 | 29 | <27 | <30 | 22 | <3 | <134 | -- | 235 | 105 |
| | Floodplain | BB-071 | 10/22/2020 | XRF | <372 | **81** | -- | -- | <165 | <29 | <83 | 29 | 90 | 6 | 11 | 21 | <4 | <132 | -- | 176 | 142 |
| | Floodplain | BB-072 | 10/22/2020 | XRF | <400 | 12 | -- | -- | <173 | 37 | <66 | 12 | 18 | <28 | 3 | 15 | <3 | <138 | -- | 272 | 95 |
| | Floodplain near parking | BB-069 | 10/20/2020 | XRF | <374 | **132** | -- | -- | <167 | <29 | <82 | 38 | **234** | 6 | 9 | 14 | <4 | <134 | -- | 151 | 228 |
| | Floodplain near parking | BB-070 | 10/20/2020 | XRF | <378 | **58** | -- | -- | <167 | <29 | <83 | 68 | **280** | **14** | 7 | 21 | <4 | **10** | -- | 213 | 176 |
| | Floodplain near parking | BB-087 | 10/20/2020 | XRF | <389 | **116** | -- | -- | <170 | 35 | <75 | 19 | 53 | 5 | 4 | 19 | <3 | <135 | -- | 178 | 124 |
| | Floodplain near parking | BB-105 | 10/20/2020 | XRF | <396 | 42 | -- | -- | <172 | <28 | <73 | 21 | 31 | <27 | 4 | 18 | <3 | <137 | -- | 205 | 88 |
| | Floodplain. Small pieces of slag located. | BB-107 | 10/21/2020 | XRF | <423 | **297** | -- | -- | <183 | 24 | <84 | 28 | 92 | 7 | 5 | 19 | <4 | <145 | -- | 178 | 148 |
| | North and west grid boundaries | BB-173 | 10/19/2020 | XRF | <410 | 13 | -- | -- | <180 | <28 | <63 | 15 | 22 | <27 | 6 | 12 | <3 | <144 | -- | 224 | 74 |
| | North and west grid boundaries | BB-174 | 10/19/2020 | XRF | <392 | 29 | -- | -- | <171 | <29 | <81 | 26 | 24 | 4 | 6 | 26 | <3 | <136 | -- | 269 | 137 |
| | North and west grid boundaries | BB-175 | 10/19/2020 | XRF | <387 | 43 | -- | -- | <167 | 26 | <74 | 17 | 25 | 4 | <29 | 23 | <3 | <133 | -- | 203 | 99 |
| | Trail from flooplain to houses | BB-089 | 10/22/2020 | XRF | <385 | **78** | -- | -- | <166 | 32 | <70 | 18 | 32 | 3 | <29 | 16 | <3 | <132 | -- | 248 | 91 |
| | Under trees in low depression | BB-088 | 10/22/2020 | XRF | <375 | **368** | -- | -- | <167 | <27 | <77 | 27 | 38 | 5 | 12 | 16 | <4 | <134 | -- | 123 | 149 |
| | Northeast of mill foundation | BB-073 | 10/22/2020 | XRF | **33** | **200** | -- | -- | <173 | <28 | <74 | 23 | **480** | 5 | 6 | 17 | <4 | <137 | -- | 261 | 105 |
| AOC 3 - Mill Process Area | Above drainage | BB-033 | 10/20/2020 | XRF | <386 | **699** | -- | -- | <166 | 29 | <77 | 22 | 105 | 8 | <29 | 18 | <4 | **14** | -- | 236 | 100 |
| | Above drainage | BB-034 | 10/20/2020 | XRF | <364 | **220** | -- | -- | <161 | <29 | <88 | 39 | 130 | 5 | 11 | 31 | <4 | <129 | -- | 153 | 266 |
| | Above mill foundations | BB-021 | 10/20/2020 | XRF | <410 | **272** | -- | -- | <177 | 27 | <74 | 51 | 31 | **10** | 4 | 18 | <4 | <140 | -- | 266 | 109 |
| | Above mill foundations | BB-026 | 10/20/2020 | XRF | <397 | **941** | -- | -- | <171 | 39 | <75 | 22 | **272** | 5 | <30 | 18 | <4 | <135 | -- | 260 | 128 |
| | Base of foundation | BB-114 | 10/20/2020 | XRF | <432 | **276** | -- | -- | <189 | <32 | <87 | 22 | 62 | **18** | 11 | 16 | <5 | **15** | -- | 176 | 180 |
| | Beach below house | BB-032 | 10/20/2020 | XRF | **22** | **1105** | -- | -- | <166 | 33 | <76 | 18 | 128 | 5 | <30 | 21 | <4 | <132 | -- | 242 | 110 |
| | Bench below house | BB-040 | 10/20/2020 | XRF | <388 | **634** | -- | -- | <168 | 24 | <74 | 17 | 111 | <30 | 5 | 19 | <4 | <134 | -- | 208 | 97 |
| | Between house and beach | BB-017 | 10/20/2020 | XRF | <407 | **130** | -- | -- | <176 | 28 | <75 | 23 | 43 | 8 | 5 | 15 | <4 | <139 | -- | 297 | 135 |
| | Drainage channel, moved point due to thick brush | BB-035 | 10/21/2020 | XRF | <361 | **192** | -- | -- | <160 | <28 | <83 | 39 | 56 | <30 | 11 | 32 | <4 | <128 | -- | 170 | 162 |
| | Hillside below bench | BB-041 | 10/20/2020 | XRF | <376 | **332** | -- | -- | <163 | 26 | <78 | 29 | 123 | 5 | 5 | 25 | <4 | **9** | -- | 193 | 184 |
| | Hillside below house | BB-042 | 10/20/2020 | XRF | <378 | **120** | -- | -- | <164 | 46 | <80 | 24 | 70 | <30 | 4 | 22 | <4 | <130 | -- | 251 | 273 |
| | In mill foundation | BB-022 | 10/20/2020 | XRF | <388 | **483** | -- | -- | <168 | 42 | <77 | 77 | **264** | 6 | <30 | 17 | <4 | <133 | -- | 179 | 144 |
| | Mill area | BB-110 | 10/20/2020 | XRF | <402 | **139** | -- | -- | <174 | 49 | <59 | 11 | 24 | 3 | <30 | 18 | <3 | <138 | -- | 265 | 90 |
| | Near mill foundations | BB-027 | 10/21/2020 | XRF | <420 | **83** | -- | -- | <182 | <26 | <54 | 14 | 16 | <28 | <32 | <12 | <3 | <145 | -- | 246 | 96 |

**Table 3A: Summary of Soil/Dry Sediment XRF and Laboratory Analytical Results for Surface Metals**



| AOC | Description/Location | Sample ID | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 3 - Mill Process Area | Near mill foundations | BB-028 | 10/21/2020 | XRF | <401 | 230 | -- | -- | <173 | <28 | <74 | 28 | 101 | 7 | <31 | 17 | <4 | <138 | -- | 206 | 111 |
| | Near mill foundations | BB-029 | 10/21/2020 | XRF | <385 | 70 | -- | -- | <168 | <29 | <86 | 31 | 23 | <28 | 8 | 23 | <3 | <134 | -- | 217 | 112 |
| | Near water level on beach | BB-024 | 10/21/2020 | XRF | <384 | 13 | -- | -- | <166 | 27 | <100 | 12 | 12 | <26 | 7 | 16 | <3 | <131 | -- | 316 | 63 |
| | Near water level on beach | BB-030 | 10/21/2020 | XRF | <379 | 67 | -- | -- | <163 | 31 | <79 | 18 | 23 | 6 | <29 | 20 | <3 | <129 | -- | 303 | 71 |
| | Floodplain in dense brush | BB-056 | 10/20/2020 | XRF | <382 | 170 | -- | -- | <171 | <29 | <85 | 22 | 24 | 4 | 13 | 20 | <4 | <137 | -- | 151 | 146 |
| | Floodplain near parking | BB-053 | 10/20/2020 | XRF | 23 | 173 | -- | -- | <170 | <29 | <85 | 88 | 282 | 76 | 5 | 18 | <4 | <135 | -- | 231 | 171 |
| | Floodplain near parking | BB-054 | 10/20/2020 | XRF | <362 | 410 | -- | -- | <158 | <28 | <87 | 53 | 435 | 47 | 6 | 21 | <4 | <126 | -- | 142 | 173 |
| | Location of former power turbine | BB-043 | 10/20/2020 | XRF | <374 | 123 | -- | -- | <168 | <29 | <85 | 34 | 61 | 5 | 13 | 22 | <4 | <135 | -- | 147 | 163 |
| | Trail from flooplain to houses | BB-091 | 10/22/2020 | XRF | <397 | 496 | -- | -- | <172 | <26 | <59 | 14 | 35 | 3 | <31 | 20 | <4 | <136 | -- | 228 | 79 |
| | Trail from flooplain to houses | BB-093 | 10/22/2020 | XRF | <368 | 2183 | -- | -- | <160 | 22 | <69 | 21 | 90 | <32 | 4 | 22 | <4 | <127 | -- | 162 | 167 |
| | Trail from flooplain to houses | BB-095 | 10/22/2020 | XRF | 69 | 1314 | -- | -- | <165 | <27 | <73 | 25 | 172 | <32 | 5 | 17 | <4 | <131 | -- | 204 | 154 |
| AOC 4 - Area Adjacent to Residence | Along property boundary | BB-108 | 10/23/2020 | XRF | <415 | 178 | -- | -- | <181 | <30 | <79 | 14 | 116 | 4 | 10 | 12 | <4 | <145 | -- | 224 | 124 |
| | Along property boundary | BB-075 | 10/23/2020 | XRF | <397 | 35 | -- | -- | <173 | 26 | <85 | 8 | 590 | 4 | 7 | 15 | <3 | <137 | -- | 207 | 100 |
| | Along property boundary | BB-077 | 10/23/2020 | XRF | <403 | 263 | -- | -- | <175 | 27 | <72 | 19 | 20 | 4 | 4 | 13 | <4 | <139 | -- | 241 | 112 |
| | Along property boundary | BB-079 | 10/23/2020 | XRF | 30 | 224 | -- | -- | <183 | <30 | <80 | 10 | 59 | 3 | 6 | 11 | <4 | <146 | -- | 198 | 82 |
| | Along property boundary | BB-055 | 10/23/2020 | XRF | 142 | 623 | -- | -- | <174 | <29 | <77 | 11 | 98 | 4 | 6 | 15 | <4 | <139 | -- | 174 | 116 |
| | Along property boundary | BB-060 | 10/23/2020 | XRF | <439 | 364 | -- | -- | <192 | <33 | <90 | 19 | 87 | 8 | 9 | 14 | <6 | <153 | -- | 249 | 209 |
| | Along property boundary above retaining wall | BB-058 | 10/23/2020 | XRF | 23 | 425 | -- | -- | <173 | <29 | <85 | 15 | 64 | <44 | 5 | 16 | <4 | <138 | -- | 172 | 245 |
| | Along property boundary. Reshoot BB-79. 2" offset. | BB-079B | 10/23/2020 | XRF | <392 | 160 | -- | -- | <169 | <28 | <78 | 11 | 12 | <27 | 3 | 15 | <3 | <134 | -- | 237 | 75 |
| | Bench near house | BB-025 | 10/20/2020 | XRF | 414 | 10929 | -- | -- | <147 | 38 | <82 | 20 | 891 | <52 | <26 | 11 | <7 | 26 | -- | 138 | 197 |
| | Offset 3 feet east of BB-25 | BB-025-SO-01 | 10/22/2020 | XRF | 224 | 4678 | -- | -- | <155 | 28 | <79 | 29 | 461 | 7 | 5 | 24 | <5 | <123 | -- | 187 | 185 |
| | | BB-106 | 10/22/2020 | XRF | 1172 | 8226 | -- | -- | <151 | 25 | <79 | 7 | 590 | <47 | 5 | 7 | <6 | 13 | -- | 196 | 82 |
| | Bench near house | BB-016 | 10/20/2020 | XRF | <373 | 250 | -- | -- | <161 | 50 | <104 | 32 | 31 | 16 | 9 | 37 | 2 | <128 | -- | 247 | 444 |
| | Below rock foundation (possible furnace) | BB-097 | 10/22/2020 | XRF | <429 | 104 | -- | -- | <185 | <29 | <67 | 13 | 10 | 9 | 4 | 21 | <4 | <146 | -- | 264 | 81 |
| | Bench near house | BB-031 | 10/20/2020 | XRF | <381 | 590 | -- | -- | <164 | 27 | <71 | 16 | 99 | 5 | 4 | 21 | <4 | <131 | -- | 288 | 169 |
| | Bench near house | BB-020 | 10/20/2020 | XRF | 8764 | 2997 | -- | -- | <118 | <22 | <61 | 17 | 249 | <27 | <21 | 20 | <4 | 12 | -- | 247 | 172 |
| AOC 5 - Cemented Tailings | Above trail | BB-012 | 10/20/2020 | XRF | <408 | 1045 | -- | -- | <176 | <28 | <66 | 13 | 61 | 8 | 3 | 23 | <4 | <139 | -- | 261 | 86 |
| | Above trail and cemented tailings | BB-131 | 10/20/2020 | XRF | <390 | 183 | -- | -- | <170 | <29 | <81 | 21 | 79 | 7 | 8 | 20 | <4 | <136 | -- | 250 | 106 |
| | Above trail and cemented tailings | BB-133 | 10/20/2020 | XRF | <388 | 132 | -- | -- | <168 | <29 | <79 | 25 | 38 | 6 | 4 | 20 | <3 | <133 | -- | 257 | 87 |
| | Below trail | BB-015 | 10/20/2020 | XRF | <387 | 1273 | -- | -- | 14 | <26 | <65 | 44 | 412 | 16 | <29 | 23 | 2 | <133 | -- | 186 | 550 |
| | Just above water level | BB-019 | 10/20/2020 | XRF | <396 | 65 | -- | -- | <172 | <28 | <67 | 11 | 8 | <26 | <31 | 16 | <3 | <136 | -- | 192 | 47 |
| | Below mill foundations | BB-023 | 10/20/2020 | XRF | 79 | 31092 | -- | -- | <125 | 29 | <74 | <11 | 3162 | 108 | <23 | <11 | 4 | 68 | -- | <49 | 98 |
| | Inside lower foundation at mill | BB-116 | 10/20/2020 | XRF | 28 | 1833 | -- | -- | <160 | <28 | <79 | 33 | 1002 | 19 | 18 | 16 | 2 | <127 | -- | 216 | 189 |
| | 11 feet south of BB-116, outside foundation | BB-116-SO-01 | 10/22/2020 | XRF | 95 | 9270 | -- | -- | <153 | <28 | <83 | 15 | 1229 | 11 | 12 | 10 | <1 | 34 | -- | 144 | 101 |
| | Between house and beach | BB-018 | 10/20/2020 | XRF | <333 | 1488 | -- | -- | <143 | 23 | <74 | 76 | 6956 | 10 | 5 | 11 | <9 | <114 | -- | 189 | 164 |
| | Cemented mine waste surface, collecting side wall sample from eroded features | BB-123 | 10/20/2020 | XRF | <272 | 27168 | -- | -- | <116 | 33 | <96 | <9 | 1801 | 693 | <21 | <11 | <9 | 39 | -- | 98 | 59 |
| | Cemented tailings above boulder beach | BB-135 | 10/20/2020 | XRF | 32 | 10745 | -- | -- | <149 | 41 | <83 | 7 | 445 | <51 | <26 | 8 | <7 | 15 | -- | <51 | 82 |
| | Cemented tailings near river | BB-129 | 10/20/2020 | XRF | <306 | 19793 | -- | -- | <132 | 37 | <92 | <9 | 874 | 21 | <23 | <11 | <8 | 17 | -- | 114 | 23 |
| | Trail above cemented mine waste | BB-009 | 10/20/2020 | XRF | <401 | 1171 | -- | -- | <174 | <25 | <42 | 7 | 306 | 39 | <30 | 14 | 2 | 10 | -- | 140 | 38 |
| | White tailings on trail | BB-127 | 10/20/2020 | XRF | 91 | 90189 | -- | -- | <76 | 46 | <96 | <9 | 2340 | 1458 | <15 | <9 | <11 | 190 | -- | <42 | 151 |
| | Cemented tailings near river | BB-007 | 10/22/2020 | XRF | 27 | 11395 | -- | -- | <147 | 29 | <78 | <10 | 1685 | 275 | <26 | <11 | <8 | 19 | -- | 145 | 64 |
| AOC 6 - Downriver Distributed Mill Material | Above trail by rock | BB-125 | 10/20/2020 | XRF | <402 | 151 | -- | -- | <174 | <29 | <71 | 22 | 22 | 6 | 6 | 23 | <4 | <137 | -- | 287 | 70 |
| | Along property boundary | BB-044 | 10/23/2020 | XRF | <406 | 75 | -- | -- | <177 | <29 | <81 | 19 | 26 | <28 | 8 | 9 | <4 | <141 | -- | 190 | 125 |
| | Along property boundary | BB-046 | 10/23/2020 | XRF | <396 | 44 | -- | -- | <172 | <29 | <79 | 15 | 14 | 4 | 4 | 18 | <3 | <137 | -- | 243 | 75 |
| | Base of foundation | BB-112 | 10/20/2020 | XRF | <409 | 60 | -- | -- | <176 | <31 | <86 | 72 | 56 | 17 | 15 | 15 | 2 | <140 | -- | 254 | 92 |
| | Bench near house | BB-002 | 10/20/2020 | XRF | <400 | 265 | -- | -- | <173 | <27 | <64 | 14 | 44 | 3 | 4 | 16 | <4 | <138 | -- | 249 | 86 |
| | Bench near house | BB-005 | 10/20/2020 | XRF | <402 | 369 | -- | -- | <174 | <26 | <57 | 24 | 33 | <28 | <31 | 21 | <4 | <138 | -- | 214 | 72 |
| | Bench near house | BB-008 | 10/20/2020 | XRF | <380 | 35 | -- | -- | <165 | <28 | <81 | 17 | 12 | 5 | 5 | 28 | <3 | <131 | -- | 223 | 73 |
| | Bench near house | BB-010 | 10/20/2020 | XRF | <394 | 84 | -- | -- | <170 | 27 | <68 | 18 | 15 | <26 | <30 | 18 | <3 | <135 | -- | 212 | 73 |
| | Bench near house | BB-013 | 10/20/2020 | XRF | <385 | 86 | -- | -- | <167 | 24 | <77 | 27 | 32 | 3 | <30 | 18 | <3 | <132 | -- | 190 | 183 |
| | Hill above trail near house | BB-011 | 10/20/2020 | XRF | <397 | 122 | -- | -- | <171 | 40 | <77 | 29 | 38 | 6 | <31 | 17 | <4 | <135 | -- | 233 | 72 |
| | Hill above trail near house | BB-014 | 10/20/2020 | XRF | <385 | 129 | -- | -- | <167 | <27 | <70 | 66 | 21 | 5 | <30 | 21 | <3 | <132 | -- | 269 | 98 |
| | Rock slab | BB-003 | 10/20/2020 | XRF | <402 | 63 | -- | -- | <174 | <26 | <58 | 12 | 15 | 3 | <30 | 20 | <3 | <138 | -- | 220 | 63 |
| | Overwash soil/sediment southwest of topographic high | BB-004 | 10/20/2020 | XRF | <388 | 43 | -- | -- | <168 | <29 | <82 | 26 | 19 | 4 | 8 | 28 | <3 | <133 | -- | 295 | 90 |
| | Southwest boundary | BB-001 | 10/20/2020 | XRF | <391 | 42 | -- | -- | <168 | 44 | <78 | 18 | 42 | 4 | 5 | 24 | <3 | <133 | -- | 284 | 87 |
| | Southwest boundary | BB-002-SO-01 | 10/20/2020 | XRF | <381 | 22 | -- | -- | <164 | 23 | <78 | 11 | 8 | 4 | <30 | 27 | <3 | <130 | -- | 235 | 72 |
| | Southwest boundary | BB-006 | 10/20/2020 | XRF | <381 | 22 | -- | -- | <165 | 40 | <73 | 17 | 6 | 3 | <29 | 28 | <3 | <130 | -- | 283 | 60 |
| AOC 7 - Downriver Sand Bar | Upstream soil sample for Mod-01 | BB-M1-01 | 10/22/2020 | XRF | <405 | 8 | -- | -- | <176 | <27 | <67 | 11 | 6 | 3 | 5 | 15 | <3 | <140 | -- | 289 | 46 |
| | Downstream soil sample for Mod-02 | BB-M1-02 | 10/22/2020 | XRF | <425 | 6 | -- | -- | <184 | <27 | <51 | 11 | 10 | 3 | <32 | 14 | <3 | <146 | -- | 259 | 33 |
| | On Mod Island | BB-M1-03 | 10/22/2020 | XRF | <409 | 4 | -- | -- | <178 | <27 | <57 | 23 | 8 | 3 | <31 | 17 | <3 | <141 | -- | 228 | 48 |
| | On Mod Island | BB-M1-04 | 10/22/2020 | XRF | <394 | 7 | -- | -- | <171 | <27 | <69 | 16 | 7 | 3 | 4 | 16 | <3 | <136 | -- | 254 | 58 |
| | On Mod Island | BB-M1-05 | 10/22/2020 | XRF | <387 | 16 | -- | -- | <167 | 38 | <78 | 20 | 6 | <26 | <29 | 30 | <3 | <132 | -- | 339 | 85 |
| | On Mod Island interior streambed | BB-M1-06 | 10/22/2020 | XRF | <392 | 22 | -- | -- | <170 | <28 | <76 | 11 | 9 | 4 | 6 | 20 | <3 | <135 | -- | 365 | 63 |

**Table 3A: Summary of Soil/Dry Sediment XRF and Laboratory Analytical Results for Surface Metals**



| AOC | Description/Location | Sample ID | Sample Date | Sample Method | Antimony | | Arsenic | | Barium | | Beryllium | | Cadmium | | Chromium | | Cobalt | | Copper | | Lead | | Mercury | | Molybdenum | | Nickel | | Selenium | | Silver | | Thallium | | Vanadium | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 7 - Downriver Sand Bar | On Mod Island near water | BB-M1-07 | 10/22/2020 | XRF | <365 | | 21 | | -- | | -- | | <157 | | 28 | | <92 | | 10 | | 7 | | <24 | | <28 | | 22 | | <3 | | <124 | | -- | | 325 | | 50 | |
| | On Mod Island | BB-M1-08 | 10/22/2020 | XRF | <399 | | 8 | | -- | | -- | | <172 | | 37 | | <68 | | 13 | | 7 | | 3 | | <29 | | 22 | | <3 | | <136 | | -- | | 268 | | 62 | |
| | On Mod Island | BB-M1-09 | 10/22/2020 | XRF | <397 | | 26 | | -- | | -- | | <171 | | <29 | | <77 | | 18 | | 9 | | <26 | | 4 | | 21 | | <3 | | <135 | | -- | | 293 | | 52 | |
| | On Mod Island | BB-M1-10 | 10/22/2020 | XRF | <384 | | 7 | | -- | | -- | | <165 | | 34 | | <80 | | 19 | | 8 | | <25 | | <30 | | 20 | | <3 | | <131 | | -- | | 323 | | 65 | |
| Boundary Delineation Samples | Step out for BB-102 | BB-102-SO-01 | 10/20/2020 | XRF | <380 | | 27 | | -- | | -- | | <164 | | <27 | | <75 | | 30 | | 49 | | 7 | | <29 | | 28 | | <3 | | <130 | | -- | | 246 | | 95 | |
| | Step out for BB-175 | BB-175-SO-01 | 10/20/2020 | XRF | <378 | | 31 | | -- | | -- | | <165 | | <28 | | <78 | | 23 | | 18 | | <26 | | 3 | | 29 | | <3 | | <132 | | -- | | 236 | | 121 | |
| | Step out for BB-175-SO-01 | BB-175-SO-02 | 10/20/2020 | XRF | <389 | | 29 | | -- | | -- | | <168 | | 40 | | <76 | | 20 | | 18 | | 4 | | 4 | | 20 | | <3 | | <134 | | -- | | 220 | | 88 | |
| AOC 4 - Area Adjacent to Residence | Bench near house | BB-020 | 10/20/2020 | Lab | **160** | A07 | **7400** | A07 | 98 | A07 | <0.47 | A07 | **60** | A07 | 10 | A07 | 6.7 | J,A07 | 15 | A07 | **520** | A07 | **2** | A07 | <0.5 | A07 | 8.1 | A07 | <1.1 | A07 | **8.5** | A07 | <0.49 | A07 | 28 | A07 | 150 | A07 |
| | Bench near house | BB-025 | 10/21/2020 | Lab | **120** | A07 | **7100** | A07 | 94 | A07 | <0.47 | A07 | **51** | A07 | 7.1 | A07 | 4.5 | J,A07 | 17 | A07 | **610** | A07 | **3** | A07 | <0.5 | A07 | 4.9 | J,A07 | <1.1 | A07 | **11** | A07 | <0.49 | A07 | 21 | A07 | **360** | A07 |
| AOC 5 - Cemented Tailings | Between house and beach | BB-018 | 10/20/2020 | Lab | **2.2** | J,A07 | **1900** | A07 | 54 | A07 | <0.47 | A07 | **14** | A07 | 8.6 | A07 | 4.8 | J,A07 | **87** | A07 | **13000** | A07 | **7.9** | A07 | **1.8** | J,A07 | 6.3 | A07 | <1.1 | A07 | **4.6** | J,A07 | <0.49 | A07 | 25 | A07 | 140 | A07 |
| | Associated with BB-018 | DUP-02 | 10/20/2020 | Lab | **1.6** | J,A07 | **1200** | A07 | 41 | A07 | <0.47 | A07 | **9.1** | A07 | 5.9 | A07 | 3.5 | J,A07 | **40** | A07 | **7100** | A07 | **5.7** | A07 | <0.5 | A07 | 4.5 | J,A07 | <1.1 | A07 | **4.7** | J,A07 | <0.49 | A07 | 17 | A07 | 110 | A07 |
| | Above trail | BB-012 | 10/20/2020 | Lab | **0.83** | J,A07 | **1100** | A07 | 57 | A07 | <0.47 | A07 | **8.5** | A07 | 6.8 | A07 | 5.1 | J,A07 | 7.4 | J,A07 | 66 | A07 | **7.1** | A07 | <0.5 | A07 | 4.7 | J,A07 | **1.6** | J,A07 | **0.85** | J,A07 | <0.49 | A07 | 28 | A07 | 64 | A07 |
| | Cemented mine waste surface, collecting side wall sample from eroded features | BB-123 | 10/20/2020 | Lab | **4.5** | J,A07 | **15000** | A07 | 41 | A07 | <0.47 | A07 | **110** | A07 | 3.7 | J,A07 | 2.2 | J,A07 | 4.6 | J,A07 | **1200** | A07 | **350** | A07 | <0.5 | A07 | 1.5 | J,A07 | <1.1 | A07 | **11** | A07 | <0.49 | A07 | 20 | A07 | 36 | A07 |
| | Cemented tailings near river | BB-129 | 10/20/2020 | Lab | **3.3** | J,A07 | **19000** | A07 | 47 | A07 | <0.47 | A07 | **140** | A07 | 4.4 | J,A07 | 2.3 | J,A07 | 3 | J,A07 | **990** | A07 | **20** | A07 | <0.5 | A07 | <1.5 | A07 | <1.1 | A07 | 2.2 | J,A07 | <0.49 | A07 | 24 | A07 | 19 | J,A07 |
| | White tailings on trail | BB-127 | 10/20/2020 | Lab | **74** | A07 | **88000** | | 18 | A07 | <0.47 | A07 | **630** | A07 | <0.5 | A07 | <0.98 | A07 | 7 | J,A07 | **2400** | A07 | **270** | A07 | <0.5 | A07 | <1.5 | A07 | <5.5 | A07 | **45** | A07 | <0.49 | A07 | 3.3 | J,A07 | 190 | A07 |
| | Below mill foundations | BB-023 | 10/20/2020 | Lab | **21** | A07 | **30000** | A07 | 45 | A07 | <0.47 | A07 | **210** | A07 | 4.4 | J,A07 | 1.4 | J,A07 | 28 | A07 | **2200** | A07 | **72** | A07 | <0.5 | A07 | 1.8 | J,A07 | <1.1 | A07 | **30** | A07 | <0.49 | A07 | 8.8 | A07 | 120 | A07 |
| | Step out from foundation | BB-116-SO-01 | 10/22/2020 | Lab | **23** | A07 | **13000** | A07 | 79 | A07 | <0.47 | A07 | **91** | A07 | 10 | A07 | 6.9 | J,A07 | 20 | A07 | **1300** | A07 | **8.8** | A07 | **4.3** | J,A07 | 7.1 | A07 | <1.1 | A07 | **24** | A07 | <0.49 | A07 | 28 | A07 | 110 | A07 |
| AOC 6 - Downriver Distributed Mill Material | Hill above trail near house | BB-011 | 10/20/2020 | Lab | <0.8 | A07 | **110** | A07 | 58 | A07 | <0.47 | A07 | **1.3** | J,A07 | 4.6 | J,A07 | 5.1 | J,A07 | 8.4 | J,A07 | 34 | A07 | 0.77 | | <0.5 | A07 | 3 | J,A07 | **3.9** | J,A07 | 2.3 | J,A07 | <0.49 | A07 | 21 | A07 | 44 | A07 |
| AOC 7 - Downriver Sand Bar | Upstream soil sample for Mod-01 | BB-M1-01 | 10/22/2020 | Lab | <0.8 | A07 | 8.8 | A07 | <1.8 | A07 | <0.47 | A07 | <0.52 | A07 | 9.1 | A07 | 5.2 | J,A07 | 6.1 | J,A07 | <4.1 | A07 | 0.022 | J | <0.5 | A07 | 4.4 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 32 | A07 | 24 | J,A07 |
| | Downstream soil sample for Mod-01 | BB-M1-02 | 10/22/2020 | Lab | <0.8 | A07 | 4.2 | J,A07 | 52 | A07 | <0.47 | A07 | <0.52 | A07 | 5.8 | A07 | 4.8 | J,A07 | 6.3 | J,A07 | <4.1 | A07 | 0.028 | J | <0.5 | A07 | 3.5 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 28 | A07 | 27 | A07 |
| | On Mod Island | BB-M1-03 | 10/22/2020 | Lab | <0.8 | A07 | 4.2 | J,A07 | 56 | A07 | <0.47 | A07 | <0.52 | A07 | 3.9 | J,A07 | 4.2 | J,A07 | 7.5 | J,A07 | <4.1 | A07 | **4.3** | A07 | <0.5 | A07 | 3.5 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 19 | A07 | 32 | A07 |
| | On Mod Island | BB-M1-04 | 10/22/2020 | Lab | <0.8 | A07 | 6.4 | A07 | 93 | A07 | 0.62 | J,A07 | <0.52 | A07 | 11 | A07 | 7.9 | J,A07 | 13 | A07 | <4.1 | A07 | 0.058 | J | <0.5 | A07 | 6.5 | A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 53 | A07 | 51 | A07 |
| | On Mod Island | BB-M1-05 | 10/22/2020 | Lab | <0.8 | A07 | 7.1 | A07 | 60 | A07 | <0.47 | A07 | <0.52 | A07 | 8.4 | A07 | 6 | J,A07 | 7.2 | J,A07 | <4.1 | A07 | 0.066 | J | <0.5 | A07 | 5.5 | A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 37 | A07 | 39 | A07 |
| | On Mod Island interior streambed | BB-M1-06 | 10/22/2020 | Lab | <0.8 | A07 | 13 | A07 | 68 | A07 | <0.47 | A07 | <0.52 | A07 | 12 | A07 | 7 | J,A07 | 7.8 | J,A07 | <4.1 | A07 | <0.016 | | <0.5 | A07 | 5.2 | A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 65 | A07 | 38 | A07 |
| | On Mod Island near water | BB-M1-07 | 10/22/2020 | Lab | <0.8 | A07 | 9.6 | A07 | 52 | A07 | <0.47 | A07 | <0.52 | A07 | 10 | A07 | 5.6 | J,A07 | 6.9 | J,A07 | <4.1 | A07 | <0.016 | | <0.5 | A07 | 9.5 | A07 | **1.8** | J,A07 | <0.67 | A07 | <0.49 | A07 | 28 | A07 | 26 | A07 |
| | On Mod Island | BB-M1-08 | 10/22/2020 | Lab | <0.8 | A07 | 7.1 | A07 | 53 | | <0.47 | A07 | <0.52 | A07 | 7.4 | A07 | 5.9 | J,A07 | 7 | J,A07 | <4.1 | A07 | <0.016 | | <0.5 | A07 | 4.2 | J,A07 | **1.6** | J,A07 | <0.67 | A07 | <0.49 | A07 | 32 | A07 | 35 | A07 |
| | On Mod Island | BB-M1-09 | 10/22/2020 | Lab | <0.8 | A07 | 17 | A07 | 36 | A07 | <0.47 | A07 | <0.52 | A07 | 9.3 | A07 | 5.3 | 0 | 13 | A07 | <4.1 | A07 | <0.016 | | <0.5 | A07 | 4.1 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 44 | A07 | 26 | A07 |
| | On Mod Island | BB-M1-10 | 10/22/2020 | Lab | <0.8 | A07 | <1.7 | A07 | 56 | A07 | <0.47 | A07 | <0.52 | A07 | 12 | A07 | 6.1 | J,A07 | 6.9 | J,A07 | <4.1 | A07 | 0.02 | J | <0.5 | A07 | 4.8 | J,A07 | **2.5** | J,A07 | <0.67 | A07 | <0.49 | A07 | 62 | A07 | 32 | A07 |
| **ARAR/TBC** | | | | **RECEPTOR** | **Soil and Dry Sediment Screening Criteria (mg/kg)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Background BB-B-COMP-01 (XRF) | | | | All | <376 | | 19 | | -- | | -- | | <164 | | 24 | | <80 | | 26 | | 59 | | 3 | | 6 | | 13 | | <3 | | <131 | | -- | | 209 | | 128 | |
| Three Times Background | | | | | **<376** | | **57** | | -- | | -- | | **<164** | | **72** | | **<80** | | **78** | | **177** | | **9** | | **18** | | **39** | | **<3** | | **<131** | | -- | | **627** | | **384** | |
| Background BB-B-COMP-01 (Laboratory) | | | | | <0.8 | A07 | 20 | A07 | 82 | A07 | <0.47 | A07 | <0.52 | A07 | 10 | A07 | 6.3 | J,A07 | 10 | A07 | 43 | A07 | 0.62 | | <0.5 | A07 | 4.9 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 30 | A07 | 78 | A07 |
| Three Times Background | | | | | **<0.8** | | **60** | | **246** | | **<0.47** | | **<0.52** | | **30** | | **18.9** | | **30** | | **129** | | **1.86** | | **<0.5** | | **14.7** | | **<1.1** | | **<0.67** | | **<0.49** | | **90** | | **234** | |
| TTLC | | | | | **500** | | **500** | | **10000** | | **75** | | **100** | | **2500** | | **8000** | | **2500** | | **1000** | | **20** | | **3500** | | **2000** | | **100** | | **500** | | **700** | | **2400** | | **5000** | |
| Ecological Soil Screening Levels [a,b,c,d] | | | | Avian | NE | | 43 [a] | | 720 [c] | | NE | | 0.77 [a] | | 26 [a,1] | | 120 [a] | | 28 [a] | | 11 [a] | | 0.013 [c] | | 15 [c] | | 210 [a] | | 1.2 [a] | | 4.2 [a] | | 4.5 [c] | | 7.8 [a] | | 46 [a] | |
| | | | | Invertebrates | 78 [a] | | 60 [b] | | 330 [a] | | 40 [a] | | 140 [a] | | 0.4 [b,2] | | NE | | 80 [a] | | 1,700 [a] | | 0.1 [b] | | NE | | 280 [a] | | 4.1 [a] | | NE | | NE | | NE | | 120 [a] | |
| | | | | Mammals | 0.27 [a] | | 46 [a] | | 2,000 [a] | | 21 [a] | | 0.36 [a] | | 34 [a,1] | | 230 [a] | | 49 [a] | | 56 [a] | | 1.7 [c] | | 0.52 [d] | | 130 [a] | | 0.63 [a] | | 14 [a] | | 0.42 [c] | | 280 [a] | | 79 [a] | |
| | | | | Plants | 5 [b] | | 18 [a] | | 110 [c] | | 2.5 [c] | | 32 [a] | | 1 [b,2] | | 13 [a] | | 70 [a] | | 120 [a] | | 0.3 [b] | | 2 [b] | | 38 [a] | | 0.52 [a] | | 560 [a] | | 1 [b] | | 2 [b] | | 160 [a] | |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Ecological Receptors | | | | Ecological | 0.27 | | 18 | | 110 | | 2.5 | | 0.36 | | 0.4 | | 13 | | 28 | | 11 | | 0.013 | | 0.52 | | 38 | | 0.52 | | 4.2 | | 0.42 | | 2 | | 46 | |
| EPA Regional Screening Levels - Generic Tables [e] | | | | Residents | 31 | | 0.68 | | 15,000 | | 160 | | 71 | | 120,000 [1] | | 23 | | 3,100 | | 400 | | 11 | | 390 | | 1,500 | | 390 | | 390 | | 0.78 | | 390 | | 23,000 | |
| DTSC-Modified Screening Levels [f] | | | | | NE | | 0.11 | | NE | | 16 | | 71 | | NE | | NE | | NE | | 80 | | 1 | | NE | | 820 | | NE | | NE | | NE | | NE | | NE | |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Residential Human Receptors | | | | Residents | 31 | | 0.11 | | 15000 | | 16 | | 71 | | 120,000 | | 23 | | 3100 | | 80 | | 1 | | 390 | | 820 | | 390 | | 390 | | 0.78 | | 390 | | 23,000 | |
| BLM Child/Adult Recreational Visitors [g] | | | | Visitors | 782 | | 30.6 | | 390,000 | | 3,910 | | 1,780 | | 1,000,000 [1] | | 586 | | 78,200 | | 800 | | 271 | | 9,780 | | 39,000 | | 9,780 | | 9,780 | | 19.60 | | 9,850 | | 587,000 | |
| Bioavailability (Soil/Dry Sediment) | | | | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | | -- | |

**Notes:**

[1] Screening values are for chromium III.

[2] Screening values are for total chromium (underlying toxicity data are for chromium VI).

**Bold** Above Three-Times Background Concentrations (exceedance at background concentrations if below the laboratory MDL)

Blue Text Exceeds TTLC threshold

**Acronyms and Abbreviations:**

ARAR = Applicable or Relevant and Appropriate Requirement
BLM = Bureau of Land Management
DTSC = Department of Toxic Substances Control
EcoSSL = Ecological Soil Screening Levels
EPA = United States Environmental Protection Agency
mg/kg = Milligrams per Kilogram
NE = Not Established
TBC = To-Be-Considered Requirement
TTLC = Total Threshold Limit Concentration

**Sources:**

[a] EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https://cfpub.epa.gov/ecotox/
[b] Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. Https://rais.ornl.gov/tools/eco_search.php
[c] Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1), https://www.lanl.gov/envirohment/protection/eco-risk-assessment.php
[d] Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June.
[e] EPA. 2020. Regional Screening Levels (RSLs) - Generic Tables. May 2020.
[f] DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3. June.
[g] BLM. 2017. Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites.

| AOC | Description/Location | Sample ID | Sample Depth (feet) | Sample Date | Sample Method | Antimony | | Arsenic | | Barium | | Beryllium | | Cadmium | | Chromium | | Cobalt | | Copper | | Lead | | Mercury | | Molybdenum | | Nickel | | Selenium | | Silver | | Thallium | | Vanadium | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 4 - Area Adjacent to Residence | Bench near house | BB-025 | 0 | 10/20/2020 | XRF | 414 | | 10929 | | -- | | -- | | <147 | | 38 | | <82 | | 20 | | 891 | | <52 | | <26 | | 11 | | <7 | | 26 | | -- | | 138 | | 197 | |
| | BB-25 subsurface near house | BB-025-0.5 | 0.5 | 10/22/2020 | XRF | 157 | | 24390 | | -- | | -- | | <129 | | 45 | | <84 | | <9 | | 1757 | | <64 | | <22 | | 6 | | <9 | | 45 | | -- | | 144 | | 43 | |
| | Above mill foundations | BB-025-1 | 1 | 10/22/2020 | XRF | 27 | | 3179 | | -- | | -- | | <161 | | 22 | | <83 | | 24 | | 131 | | <34 | | <29 | | 15 | | <5 | | 10 | | -- | | 227 | | 118 | |
| | BB-25 subsurface near house | BB-025-1.5 | 1.5 | 10/22/2020 | XRF | <396 | | 546 | | -- | | -- | | 13 | | 45 | | <70 | | 24 | | 59 | | <30 | | <31 | | 26 | | <4 | | <136 | | -- | | 275 | | 377 | |
| | Offset 3 feet east of BB-25 | BB-025-SO-01 | 0 | 10/22/2020 | XRF | 224 | | 4678 | | -- | | -- | | <155 | | 28 | | <79 | | 29 | | 461 | | 7 | | 5 | | 24 | | <5 | | <123 | | -- | | 187 | | 185 | |
| | Offset 3 feet east of BB-25 | BB-025-SO-01-0.5 | 0.5 | 10/22/2020 | XRF | 111 | | 11422 | | -- | | -- | | <146 | | 29 | | <87 | | <10 | | 782 | | <50 | | <26 | | 17 | | <7 | | 18 | | -- | | 220 | | 103 | |
| | Offset 3 feet east of BB-25 | BB-025-SO-01-1 | 1 | 10/22/2020 | XRF | 40 | | 2483 | | -- | | -- | | <161 | | 28 | | <85 | | 31 | | 299 | | 15 | | 5 | | 23 | | <5 | | <128 | | -- | | 218 | | 538 | |
| AOC 5 - Cemented Tailings | Cemented mine waste surface, collecting side wall sample from eroded features | BB-123 | 0 | 10/20/2020 | XRF | <272 | | 27168 | | -- | | -- | | <116 | | 33 | | <96 | | <9 | | 1801 | | 693 | | <21 | | <11 | | <9 | | 39 | | -- | | 98 | | 59 | |
| | Cemented mine waste at river | BB-123-0.5 | 0.5 | 10/20/2020 | XRF | <343 | | 11670 | | -- | | -- | | <148 | | 29 | | <89 | | <10 | | 1276 | | 346 | | <26 | | <12 | | <8 | | 15 | | -- | | 170 | | 87 | |
| | Cemented mine waste at river | BB-123-1 | 1 | 10/20/2020 | XRF | <376 | | 5632 | | -- | | -- | | <163 | | 20 | | <74 | | 5 | | 313 | | 79 | | <28 | | 6 | | <6 | | 10 | | -- | | 151 | | 44 | |
| | Cemented mine waste at river | BB-123-2 | 2 | 10/20/2020 | XRF | <396 | | 1097 | | -- | | -- | | <171 | | <29 | | <77 | | 14 | | 38 | | 17 | | 4 | | 11 | | <4 | | <136 | | -- | | 254 | | 108 | |
| | Cemented mine waste at river | BB-123-3 | 3 | 10/20/2020 | XRF | <373 | | 1086 | | -- | | -- | | <161 | | 33 | | <86 | | 25 | | 59 | | 51 | | <29 | | 25 | | <4 | | <127 | | -- | | 272 | | 194 | |
| | Cemented mine waste at river | BB-123-4 | 4 | 10/20/2020 | XRF | <368 | | 3186 | | -- | | -- | | <159 | | <27 | | <80 | | 6 | | 62 | | 40 | | <27 | | 11 | | <4 | | <125 | | -- | | 184 | | 110 | |
| | Cemented tailings near river | BB-129 | 0 | 10/20/2020 | XRF | <306 | | 19793 | | -- | | -- | | <132 | | 37 | | <92 | | <9 | | 874 | | 21 | | <23 | | <11 | | <8 | | 17 | | -- | | 114 | | 23 | |
| | Cemented tailings near river | BB-129-0.5 | 0.5 | 10/20/2020 | XRF | <343 | | 13786 | | -- | | -- | | <148 | | 22 | | <86 | | <9 | | 237 | | 8 | | <26 | | <12 | | <7 | | 10 | | -- | | 161 | | 28 | |
| | Cemented tailings near river | BB-129-1 | 1 | 10/20/2020 | XRF | <368 | | 10103 | | -- | | -- | | <160 | | 20 | | <73 | | <9 | | 154 | | <52 | | <28 | | <12 | | <7 | | <127 | | -- | | 159 | | 24 | |
| | Cemented tailings near river | BB-129-2 | 2 | 10/20/2020 | XRF | <366 | | 9430 | | -- | | -- | | <157 | | 33 | | <72 | | <9 | | 50 | | <50 | | <27 | | 11 | | <6 | | 12 | | -- | | 218 | | 23 | |
| | Cemented tailings near river | BB-129-3 | 3 | 10/20/2020 | XRF | <372 | | 8493 | | -- | | -- | | <160 | | 30 | | <76 | | <10 | | 62 | | <47 | | <28 | | 13 | | <6 | | <127 | | -- | | 223 | | 40 | |
| | Cemented tailings near river | BB-129-4 | 4 | 10/20/2020 | XRF | <389 | | 4822 | | -- | | -- | | <168 | | 34 | | <66 | | 6 | | 22 | | <40 | | <28 | | 13 | | <5 | | <133 | | -- | | 192 | | 38 | |
| | Cemented tailings near river | BB-129-5 | 5 | 10/20/2020 | XRF | <343 | | 10622 | | -- | | -- | | <148 | | <29 | | <94 | | <9 | | 38 | | <47 | | 6 | | 11 | | <6 | | <118 | | -- | | 188 | | 61 | |
| | Inside lower foundation at mill | BB-116 | 0 | 5/21/2020 | XRF | 28 | | 1833 | | -- | | -- | | <160 | | <28 | | <79 | | 33 | | 1002 | | 19 | | 18 | | 16 | | 2 | | <127 | | -- | | 216 | | 189 | |
| | Refusal on concrete | BB-116-0.5 | 0.5 | 10/22/2020 | XRF | 367 | | 64693 | | -- | | -- | | 17 | | 53 | | <89 | | <10 | | 6211 | | <90 | | 6 | | <10 | | <2 | | 210 | | -- | | <44 | | 111 | |
| | 11 feet south of BB-116, outside foundation | BB-116-SO-01 | 0 | 10/22/2020 | XRF | 95 | | 9270 | | -- | | -- | | <153 | | <28 | | <83 | | 15 | | 1229 | | 11 | | 12 | | 10 | | <1 | | 34 | | -- | | 144 | | 101 | |
| | Subsurface at BB-116-SO-01 | BB-116-SO-01-0.5 | 0.5 | 10/22/2020 | XRF | 152 | | 33372 | | -- | | -- | | <112 | | 62 | | <90 | | 12 | | 2459 | | <71 | | <20 | | <10 | | <9 | | 71 | | -- | | 81 | | 90 | |
| | Subsurface at BB-116-SO-01 | BB-116-SO-01-1 | 1 | 10/22/2020 | XRF | 58 | | 15474 | | -- | | -- | | <143 | | 37 | | <86 | | 54 | | 1289 | | 12 | | 4 | | 14 | | <8 | | 30 | | -- | | 65 | | 475 | |
| | Subsurface at BB-116-SO-01 | BB-116-SO-01-1.5 | 1.5 | 10/22/2020 | XRF | 40 | | 6260 | | -- | | -- | | <149 | | 30 | | <88 | | 36 | | 566 | | 47 | | <26 | | 12 | | <6 | | 17 | | -- | | 162 | | 131 | |
| | Subsurface at BB-116-SO-01 | BB-116-SO-01-2 | 2 | 10/22/2020 | XRF | <367 | | 3997 | | -- | | -- | | <157 | | 32 | | <83 | | 27 | | 129 | | 8 | | <28 | | 24 | | <5 | | <124 | | -- | | 191 | | 211 | |
| | Subsurface at BB-116-SO-01 | BB-116-SO-01-2.5 | 2.5 | 10/22/2020 | XRF | <353 | | 5954 | | -- | | -- | | <152 | | 34 | | <88 | | 33 | | 298 | | 65 | | <27 | | 15 | | <5 | | <121 | | -- | | 161 | | 251 | |
| | Below mill foundations | BB-023 | 0 | 10/20/2020 | XRF | 79 | | 31092 | | -- | | -- | | <125 | | 29 | | <74 | | <11 | | 3162 | | 108 | | <23 | | <11 | | 4 | | 68 | | -- | | <49 | | 98 | |
| | Subsurface at BB-23 | BB-023-0.5 | 0.5 | 10/22/2020 | XRF | 42 | | 15526 | | -- | | -- | | <149 | | 25 | | <75 | | 27 | | 884 | | 72 | | <27 | | <12 | | <8 | | 24 | | -- | | 61 | | 99 | |
| | Subsurface at BB-23 | BB-023-1 | 1 | 10/22/2020 | XRF | <10 | | 40262 | | -- | | -- | | <110 | | <26 | | <99 | | 21 | | 2287 | | <79 | | <20 | | <11 | | <10 | | 68 | | -- | | <47 | | 350 | |
| | Subsurface at BB-23 | BB-023-2 | 2 | 10/22/2020 | XRF | <295 | | 25511 | | -- | | -- | | <126 | | 30 | | <90 | | <10 | | 902 | | 156 | | <23 | | <11 | | <9 | | 33 | | -- | | 114 | | 326 | |
| | Subsurface at BB-23 | BB-023-3 | 3 | 10/22/2020 | XRF | <307 | | 13761 | | -- | | -- | | <131 | | 62 | | <100 | | 14 | | 375 | | 40 | | <23 | | 10 | | <6 | | <103 | | -- | | 234 | | 222 | |
| | Subsurface at BB-23 | BB-023-4 | 4 | 10/22/2020 | XRF | <343 | | 4647 | | -- | | -- | | <146 | | 37 | | <89 | | 37 | | 172 | | 35 | | <26 | | 26 | | <5 | | <116 | | -- | | 225 | | 209 | |
| | Subsurface at BB-23 | BB-023-5 | 5 | 10/22/2020 | XRF | <375 | | 1105 | | -- | | -- | | <161 | | 42 | | <86 | | 46 | | 24 | | <29 | | <28 | | 14 | | <4 | | <128 | | -- | | 242 | | 219 | |
| AOC 4 - Area Adjacent to Residence | Bench near house | BB-025 | 0 | 10/21/2020 | Lab | 120 | A07 | 7100 | A07 | 94 | A07 | <0.47 | A07 | 51 | A07 | 7.1 | A07 | 4.5 | J,A07 | 17 | A07 | 610 | A07 | 3 | A07 | <0.5 | A07 | 4.9 | J,A07 | <1.1 | A07 | 11 | A07 | <0.49 | A07 | 21 | A07 | 360 | A07 |
| | BB-25 subsurface near house | BB-025-0.5 | 0.5 | 10/22/2020 | Lab | 58 | A07 | 26000 | A07 | 210 | A07 | <0.47 | A07 | 160 | A07 | 6.2 | A07 | 2.2 | J,A07 | 8.1 | J,A07 | 1800 | A07 | 7.5 | A07 | <0.5 | A07 | 2.7 | J,A07 | <1.1 | A07 | 36 | A07 | <0.49 | A07 | 14 | A07 | 51 | A07 |
| AOC 5 - Cemented Tailings | Cemented mine waste surface, collecting side wall sample from eroded features | BB-123-0.5 | 0.5 | 10/20/2020 | Lab | 3.1 | | 6300 | | 32 | | 0.19 | J | 84 | | 5.3 | | 1.8 | J | 8.1 | | 820 | | 0.064 | J | <0.05 | A07 | 1.7 | | <0.55 | | 7 | | <0.24 | | 18 | | 60 | |
| | Cemented tailings near river | BB-129 | 0 | 10/20/2020 | Lab | 3.3 | J,A07 | 19000 | A07 | 47 | A07 | <0.47 | A07 | 140 | A07 | 4.4 | J,A07 | 2.3 | J,A07 | 3 | J,A07 | 990 | A07 | 20 | A07 | <0.5 | A07 | <1.5 | A07 | <1.1 | A07 | 2.2 | J,A07 | <0.49 | A07 | 24 | A07 | 19 | J,A07 |
| | Cemented tailings near river | BB-129-0.5 | 0.5 | 10/20/2020 | Lab | 1 | J,A07 | 11000 | A07 | 59 | A07 | <0.47 | A07 | 86 | A07 | 3.7 | J,A07 | 3 | J,A07 | 3.9 | J,A07 | 210 | A07 | 3.8 | A07 | <0.5 | A07 | 2 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 18 | A07 | 26 | A07 |
| | Step out from foundation | BB-116-SO-01 | 0 | 10/22/2020 | Lab | 23 | A07 | 13000 | A07 | 79 | A07 | <0.47 | A07 | 91 | A07 | 10 | A07 | 6.9 | J,A07 | 20 | A07 | 1300 | A07 | 8.8 | A07 | 4.3 | J,A07 | 7.1 | A07 | <1.1 | A07 | 24 | A07 | <0.49 | A07 | 28 | A07 | 110 | A07 |
| | 11 feet south of BB-116, outside foundation | BB-116-SO-01-0.5 | 0.5 | 10/22/2020 | Lab | 78 | A07 | 30000 | A07 | 110 | A07 | <0.47 | A07 | 210 | A07 | 34 | A07 | 2.6 | J,A07 | 43 | A07 | 2300 | A07 | 40 | A07 | 0.67 | J,A07 | 10 | A07 | <1.1 | A07 | 69 | A07 | <0.49 | A07 | 11 | A07 | 130 | A07 |
| | Below mill foundations | BB-023 | 0 | 10/20/2020 | Lab | 21 | A07 | 30000 | A07 | 45 | A07 | <0.47 | A07 | 210 | A07 | 4.4 | J,A07 | 1.4 | J,A07 | 28 | A07 | 2200 | A07 | 72 | A07 | <0.5 | A07 | 1.8 | J,A07 | <1.1 | A07 | 30 | A07 | <0.49 | A07 | 8.8 | A07 | 120 | A07 |
| | Subsurface at BB-23 | BB-023-1 | 1 | 10/22/2020 | Lab | 38 | A07 | 52000 | A07 | 41 | A07 | <0.47 | A07 | 350 | A07 | 2.3 | J,A07 | 5.8 | J,A07 | 35 | A07 | 2300 | A07 | 21 | A07 | <0.5 | A07 | 4.8 | J,A07 | <1.1 | A07 | 18 | A07 | <0.49 | A07 | 6.7 | A07 | 480 | A07 |
| ARAR/TBC | | | | | RECEPTOR | Soil and Dry Sediment Screening Criteria (mg/kg) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Background BB-B-COMP-01 (XRF) | | | | | All | <376 | | 19 | | -- | | -- | | <164 | | 24 | | <80 | | 26 | | 59 | | 3 | | 6 | | 13 | | <3 | | <131 | | -- | | 209 | | 128 | |
| Three Times Background | | | | | All | **<376** | | **57** | | -- | | -- | | **<164** | | **72** | | **<80** | | **78** | | **177** | | **9** | | **18** | | **39** | | **<3** | | **<131** | | -- | | **627** | | **384** | |
| Background BB-B-COMP-01 (Laboratory) | | | | | All | <0.8 | A07 | 20 | A07 | 82 | A07 | <0.47 | A07 | <0.52 | A07 | 10 | A07 | 6.3 | J,A07 | 10 | A07 | 43 | A07 | 0.62 | | <0.5 | A07 | 4.9 | J,A07 | <1.1 | A07 | <0.67 | A07 | <0.49 | A07 | 30 | A07 | 78 | A07 |
| Three Times Background | | | | | All | **<0.8** | | **60** | | **246** | | **<0.47** | | **<0.52** | | **30** | | **18.9** | | **30** | | **129** | | **1.86** | | **<0.5** | | **14.7** | | **<1.1** | | **<0.67** | | **<0.49** | | **90** | | **234** | |
| TTLC | | | | | | **500** | | **500** | | **10000** | | **75** | | **100** | | **2500** | | **8000** | | **2500** | | **1000** | | **20** | | **3500** | | **2000** | | **100** | | **500** | | **700** | | **2400** | | **5000** | |
| Ecological Soil Screening Levels [a,b,c,d] | | | | | Avian | NE | | 43 [a] | | 720 [c] | | NE | | 0.77 [a] | | 26 [a,1] | | 120 [a] | | 28 [a] | | 11 [a] | | 0.013 [c] | | 15 [c] | | 210 [a] | | 1.2 [a] | | 4.2 [a] | | 4.5 [c] | | 7.8 [a] | | 46 [a] | |
| | | | | | Invertebrates | 78 [a] | | 60 [b] | | 330 [a] | | 40 [a] | | 140 [a] | | 0.4 [b,1] | | NE | | 80 [a] | | 1,700 [a] | | 0.1 [b] | | NE | | 280 [a] | | 4.1 [a] | | NE | | NE | | NE | | 120 [a] | |
| | | | | | Mammals | 0.27 [a] | | 46 [a] | | 2,000 [a] | | 21 [a] | | 0.36 [a] | | 34 [a,1] | | 230 [a] | | 49 [a] | | 56 [a] | | 1.7 [c] | | 0.52 [d] | | 130 [a] | | 0.63 [a] | | 14 [a] | | 0.42 [c] | | 280 [a] | | 79 [a] | |
| | | | | | Plants | 5 [b] | | 18 [a] | | 110 [c] | | 2.5 [c] | | 32 [a] | | 1 [b,2] | | 13 [a] | | 70 [a] | | 120 [a] | | 0.3 [b] | | 2 [b] | | 38 [a] | | 0.52 [a] | | 560 [a] | | 1 [b] | | 2 [b] | | 160 [a] | |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Ecological Receptors | | | | | Ecological | 0.27 | | 18 | | 110 | | 2.5 | | 0.36 | | 0.4 | | 13 | | 28 | | 11 | | 0.013 | | 0.52 | | 38 | | 0.52 | | 4.2 | | 0.42 | | 2 | | 46 | |
| EPA Regional Screening Levels - Generic Tables [e] | | | | | Residents | 31 | | 0.68 | | 15,000 | | 160 | | 71 | | 120,000 [1] | | 23 | | 3,100 | | 400 | | 11 | | 390 | | 1,500 | | 390 | | 390 | | 0.78 | | 390 | | 23,000 | |
| DTSC-Modified Screening Levels [f] | | | | | Residents | NE | | 0.11 | | NE | | 16 | | 71 | | NE | | NE | | NE | | 80 | | 1 | | NE | | 820 | | NE | | NE | | NE | | NE | | NE | |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Residential Human Receptors | | | | | Residents | 31 | | 0.11 | | 15000 | | 16 | | 71 | | 120,000 | | 23 | | 3100 | | 80 | | 1 | | 390 | | 820 | | 390 | | 390 | | 0.78 | | 390 | | 23,000 | |

**Table 3B**: **Summary of Soil/Dry Sediment XRF and Laboratory Analytical Results for Metals at Test Pit Locations**



| AOC | Description/Location | Sample ID | Sample Depth (feet) | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLM Child/Adult Recreational Visitors [g] | | | | | Visitors | 782 | 30.6 | 390,000 | 3,910 | 1,780 | 1,000,000 [1] | 586 | 78,200 | 800 | 271 | 9,780 | 39,000 | 9,780 | 9,780 | 19.60 | 9,850 | 587,000 |
| EPA Method | | | | | | 6020 | 6020 | 6010B | 6010B | 6010B | 6010B | 6010B | 6010B | 6010B | 7471A | 6010B | 6010B | 6020 | 6010B | 6020 | 6010B | 6010B |
| Laboratory Method Detection Limits (Soil/Dry Sediment) | | | | | | 0.08 | 0.17 | 0.18 | 0.05 | 0.052 | 0.05 | 0.098 | 0.05 | 0.28 | 0.016 | 0.05 | 0.15 | 0.11 | 0.067 | 0.49 | 0.11 | 0.087 |
| Laboratory Reporting Limits (Soil/Dry Sediment) | | | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 2.5 | 1 | 2.5 | 0.16 | 2.5 | 0.5 | 0.5 | 1 | 0.25 | 0.5 | 2.5 |
| Bioavailability (Soil/Dry Sediment) | | | | | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

**Notes:**
[1] Screening values are for chromium III.
[2] Screening values are for total chromium (underlying toxicity data are for chromium VI).
**Bold** Above Three-Times Background Concentrations (exceedance at background concentrations if below the laboratory MDL)

**Acronyms and Abbreviations:**
ARAR = Applicable or Relevant and Appropriate Requirement
BLM = Bureau of Land Management
DTSC = Department of Toxic Substances Control
EcoSSL = Ecological Soil Screening Levels
EPA = United States Environmental Protection Agency
mg/kg = Milligrams per Kilogram
NE = Not Established
TBC = To-Be-Considered Requirement
TTLC = Total Threshold Limit Concentration

**Sources:**
[a] EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https://cfpub.epa.gov/ecotox/
[b] Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. Https://rais.ornl.gov/tools/eco_search.php
[c] Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1), https://www.lanl.gov/envirohment/protection/eco-risk-assessment.php
[d] Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June.
[e] EPA. 2020. Regional Screening Levels (RSLs) - Generic Tables. May 2020.
[f] DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3. June.
[g] BLM. 2017. Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites.

**Table 3C: Summary of Soil/Dry Sediment Laboratory Analytical Results for PAHs**



| Sample Matrix | Target Compound | EPA Method | Reporting Limit | Method Detection Limit | ESVs (Plants) | ESVs (Invertebrates) | ESVs (Mammals) | ESVs (Birds) | Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Ecological Receptors | EPA Residential RSL Human Health Screening Level [1] | EPA Residential DTSC Note 3 Human Health Screening Level [2] | Most Stringent Residential Human Health Screening Level | BB-022 | BB-043 | BB-097 | BB-116-SO-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | milligrams per kilogram (mg/kg) | | | | | | | | | | | | | |
| Soil/Dry Sediment | Acenaphthene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | 0.25[b] | -- | 130[b] | -- | 0.25 | 3,600 | 3,300 | 3,300 | <0.00052 | <0.0026 A01 | <0.00052 | <0.00052 |
| | Acenaphthylene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | -- | 120[b] | -- | 120 | -- | -- | -- | 0.0012 J | <0.0024 A01 | <0.00047 | <0.00047 |
| | Anthracene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | 6.8[b] | -- | 210[b] | -- | 7 | 18,000 | 17,000 | 17,000 | 0.00077 J | <0.0036 A01 | <0.00073 | <0.00073 |
| | Benzo[a]anthracene | 8270C-SIM | 0.10 mg/kg | 0.0077 mg/kg | 18[b] | -- | 3.4[b] | 0.73[b] | 0.73 | 1.1 | 1.1 | 1.1 | 0.0056 | 0.0056 J,A01 | 0.0007 J | 0.0011 J |
| | Benzo[a]pyrene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | -- | 62[b] | -- | 62 | 0.11 | 0.11 | 0.11 | 0.0087 | 0.0210 A01 | 0.0033 | 0.0051 |
| | Benzo[b]fluoranthene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | 18[b] | -- | 44[b] | -- | 18 | 1.1 | 1.1 | 1.1 | 0.0037 | 0.0130 J,A01 | 0.0023 J | 0.0028 J |
| | Benzo[g,h,i]perylene | 8270C-SIM | 0.10 mg/kg | 0.013 mg/kg | -- | -- | 25[b] | -- | 25 | -- | -- | -- | 0.0085 | 0.0250 A01 | 0.0042 | 0.0053 |
| | Benzo[k]fluoranthene | 8270C-SIM | 0.10 mg/kg | 0.0082 mg/kg | -- | -- | 71[b] | -- | 71 | 11 | 11 | 11 | 0.0026 J | <0.0034 A01 | <0.00068 | 0.0015 J |
| | Chrysene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | -- | 3.1[b] | -- | 3.1 | 110 | 110 | 110 | 0.0064 | 0.0042 J,A01 | 0.00042 J | 0.002 J |
| | Dibenz(a,h)anthracene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | -- | -- | -- | -- | 0.11 | 0.028 | 0.028 | 0.0049 | <0.0028 A01 | <0.00057 | 0.0046 |
| | Fluoranthene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 10[a] | 22[b] | -- | 10 | 2,400 | 2,400 | 2,400 | 0.0097 | 0.0056 J,A01 | 0.00061 J | 0.0024 J |
| | Fluorene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 3.7[b] | 250[b] | -- | 30 | 2,400 | 2,300 | 2,300 | <0.00037 | <0.0018 A01 | <0.00037 | <0.00037 |
| | Indeno[1,2,3-cd]pyrene | 8270C-SIM | 0.10 mg/kg | 0.0069 mg/kg | -- | -- | 71[b] | -- | 71 | 1.1 | 1.1 | 1.1 | 0.0055 | <0.0028 A01 | <0.00055 | 0.0045 |
| | Naphthalene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | 1[b] | -- | 9.6[b] | 3.4[b] | 1.0 | 2.0 | 2.0 | 2.0 | <0.00049 | <0.0024 A01 | <0.00049 | <0.00049 |
| | Phenanthrene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 5.5[b] | 11[b] | -- | 6 | -- | -- | -- | 0.0013 J | <0.0024 A01 | <0.00049 | 0.0011 J |
| | Pyrene | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 10[b] | 23[b] | 33[b] | 10 | 1,800 | 1,800 | 1,800 | 0.0082 | 0.0046 J,A01 | 0.00061 J | 0.002 J |
| | Total LMW PAHs | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 29[a] | 100[a] | -- | 29 | -- | -- | -- | 0.01297 | 0.0056 | 0.00061 | 0.0035 |
| | Total HMW PAHs | 8270C-SIM | 0.10 mg/kg | 0.0067 mg/kg | -- | 18[a] | 1.1[a] | -- | 1.1 | -- | -- | -- | 0.0492 | 0.0734 | 0.0111 | 0.0243 |

**Notes:**

DTSC = Department of Toxic Substances Control

Eco-SSL = Ecological Soil Screening Level

EPA = United States Environmental Protection Agency

ESV = Ecological Screening Value

HMW = High Molecular Weight PAHs (benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, pyrene)

LANL = Los Alamos National Laboratory

LMW = Low Molecular Weight PAHs (acenaphthene, acenapthylene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene)

mg/kg = Milligrams per Kilogram

"--" = Not Established

PAH = Polycyclic Aromatic Hydrocarbon

SIM = Selected Ion Monitoring

**Sources:**

[a] EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https://cfpub.epa.gov/ecotox/

[b] Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1), https://www.lanl.gov/envirohment/protection/eco-risk-assessment.php

[1] EPA. Regional Screening Levels (RSLs) - Generic Tables (Residential Soil). November 2020.

[2] DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3. June.

**Table 3D**: **Summary of Soil/Dry Sediment Laboratory Analytical Results for VOCs**



| Sample Matrix | Target Compound | EPA Method | Reporting Limit | Method Detection Limit | ESVs (Plants) | ESVs (Invertebrates) | ESVs (Mammals) | ESVs (Birds) | Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Ecological Receptors | EPA Residential RSL Human Health Screening Level[1] | EPA Residential DTSC Note 3 Human Health Screening Level[2] | Most Stringent Residential Human Health Screening Level | BB-022 | | BB-043 | | BB-097 | BB-116-SO-1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | milligrams per kilogram (mg/kg) | | | | | | | | | | | | | | | | |
| Dry Soil/Sediment | 1,1,1-Trichloroethane | 8260B | 0.005 | 0.002 | -- | -- | 260[b] | -- | 260 | 8,100 | 1700 | 1700 | <0.00074 | S08,Z1 | <0.00067 | | <0.00067 | <0.00086 | S08,Z1 |
| | 1,1,2,2-Tetrachloroethane | 8260B | 0.005 | 0.0022 | -- | -- | -- | -- | -- | 0.6 | 0.6 | 0.6 | <0.00074 | S08,Z1 | <0.00084 | | <0.00084 | <0.0011 | S08,Z1 |
| | 1,1,1,2-Tetrachloroethane | 8260B | 0.005 | 0.002 | -- | -- | -- | -- | -- | 2 | 2 | 2 | <0.001 | S08,Z1 | <0.00095 | | <0.00095 | <0.0012 | S08,Z1 |
| | 1,1,2-Trichloroethane | 8260B | 0.005 | 0.0019 | -- | -- | -- | -- | -- | 1.1 | NE | 1,1 | <0.001 | S08,Z1 | <0.00094 | | <0.00094 | <0.0012 | S08,Z1 |
| | 1,1-Dichloroethane | 8260B | 0.005 | 0.0019 | -- | -- | 210[b] | -- | 210 | 3.6 | 3.6 | 3.6 | <0.0007 | S08,Z1 | <0.00064 | | <0.00064 | <0.00082 | S08,Z1 |
| | 1,1-Dichloroethene | 8260B | 0.005 | 0.0021 | -- | -- | 11[b] | -- | 11 | 230 | 83 | 83 | <0.0012 | S08,Z1 | <0.0011 | | <0.0011 | <0.0014 | S08,Z1 |
| | 1,2,3-Trichloropropane | 8260B | 0.005 | 0.0023 | -- | -- | | -- | -- | 0.0051 | 0.0015 | 0.0015 | <0.0021 | S08,Z1 | <0.0019 | | <0.0019 | <0.0024 | S08,Z1 |
| | 1,2,4-Trichlorobenzene | 8260B | 0.005 | 0.0027 | -- | 20[a] | 0.27[b] | -- | 0.27 | 24 | 7.8 | 7.8 | <0.0015 | S08,Z1 | <0.0014 | | <0.0014 | <0.0018 | S08,Z1 |
| | 1,2-Dibromo-3-Chloropropane | 8260B | 0.005 | 0.0023 | -- | -- | -- | -- | -- | 0.0053 | 0.0043 | 0.0043 | <0.0011 | S08,Z1 | <0.00096 | | <0.00096 | <0.0012 | S08,Z1 |
| | 1,2-Dibromoethane | 8260B | 0.005 | 0.0019 | -- | -- | -- | -- | -- | 0.036 | NE | 0.036 | <0.0009 | S08,Z1 | <0.00082 | | <0.00082 | <0.0011 | S08,Z1 |
| | 1,2-Dichlorobenzene | 8260B | 0.005 | 0.0023 | -- | 20[a] | 0.92[b] | -- | 0.92 | 1,800 | NE | 1800 | <0.00087 | S08,Z1 | <0.00073 | | <0.00079 | <0.001 | S08,Z1 |
| | 1,2-Dichloroethane | 8260B | 0.005 | 0.0017 | -- | | 27[b] | 0.85[b] | 0.85 | 0.46 | NE | 0.46 | <0.0008 | S08,Z1 | <0.00073 | | <0.00073 | <0.00094 | S08,Z1 |
| | 1,2-Dichloropropane | 8260B | 0.005 | 0.0019 | -- | 700[a] | -- | -- | 700 | 2.5 | NE | 2.5 | <0.00088 | S08,Z1 | <0.0008 | | <0.0008 | <0.001 | S08,Z1 |
| | 1,3-Dichlorobenzene | 8260B | 0.005 | 0.0020 | -- | 20[a] | 0.74[b] | -- | 0.74 | NE' | NE | NE | <0.0008 | S08,Z1 | <0.00073 | | <0.00073 | <0.00094 | S08,Z1 |
| | 1,4-Dichlorobenzene | 8260B | 0.005 | 0.0023 | -- | 20[a] | 0.89[b] | -- | 0.89 | 2.6 | NE | 2.6 | <0.0008 | S08,Z1 | <0.00079 | | <0.00073 | <0.00094 | S08,Z1 |
| | Acetone | 8260B | 0.020 | 0.0068 | -- | -- | 1.2[b] | 7.5[b] | 1.2 | 61,000 | NE | 61,000 | -- | -- | -- | -- | -- | -- | -- |
| | Benzene | 8260B | 0.005 | 0.0018 | -- | -- | 24[b] | -- | 24 | 1.2 | 0.33 | 0.33 | 0.0011 | J,S08,Z1 | <0.00067 | | <0.00067 | <0.00086 | S08,Z1 |
| | Bromodichloromethane | 8260B | 0.005 | 0.0020 | -- | -- | -- | -- | -- | 0.29 | 0.29 | 0.29 | <0.00086 | S08,Z1 | <0.00078 | | <0.00078 | <0.001 | S08,Z1 |
| | Bromoform | 8260B | 0.005 | 0.0023 | -- | -- | -- | -- | -- | 19 | 19 | 19 | <0.00077 | S08,Z1 | <0.0007 | | <0.0007 | <0.0009 | S08,Z1 |
| | Bromomethane | 8260B | 0.005 | 0.0024 | -- | -- | -- | -- | -- | 6.8 | NE | 6.8 | <0.0019 | S08,Z1 | <0.0017 | | <0.0017 | <0.0022 | S08,Z1 |
| | Carbon tetrachloride | 8260B | 0.005 | 0.0019 | -- | -- | 58.6[c] | -- | 58.6 | 0.65 | 0.65 | 0.65 | <0.00086 | S08,Z1 | <0.00078 | | <0.00078 | <0.001 | S08,Z1 |
| | Chlorobenzene | 8260B | 0.005 | 0.0020 | -- | 40[a] | 43[b] | -- | 40 | 280 | NE | 280 | <0.00085 | S08,Z1 | <0.00077 | | <0.00077 | <0.00099 | S08,Z1 |
| | Chloroethane | 8260B | 0.005 | 0.0019 | -- | -- | -- | -- | | 14,000 | NE | 14000 | <0.0012 | S08,Z1 | <0.0011 | | <0.0011 | <0.0014 | S08,Z1 |
| | Chloroform | 8260B | 0.005 | 0.0017 | -- | -- | 8[b] | -- | 8 | 0.32 | NE | 0.32 | <0.00099 | S08,Z1 | <0.0009 | | <0.0009 | <0.0012 | S08,Z1 |
| | Chloromethane | 8260B | 0.005 | 0.0017 | -- | -- | -- | -- | | 110 | NE | 110 | <0.0012 | S08,Z1 | <0.0011 | | <0.0011 | <0.0014 | S08,Z1 |
| | cis-1,2-Dichloroethene | 8260B | 0.005 | 0.0018 | -- | -- | 89.6[c] | -- | 89.6 | 160 | 18 | 18 | <0.00059 | S08,Z1 | <0.00054 | | <0.00054 | <0.00069 | S08,Z1 |
| | cis-1,3-Dichloropropene | 8260B | 0.005 | 0.0017 | -- | -- | -- | -- | -- | NE | NE | NE | <0.00064 | S08,Z1 | <0.00058 | | <0.00058 | <0.00074 | S08,Z1 |
| | n-Butylbenzene | 8260B | 0.005 | 0.0021 | -- | -- | -- | -- | -- | 3,900 | NE | 3900 | <0.00084 | S08,Z1 | <0.00076 | | <0.00076 | <0.00097 | S08,Z1 |
| | Diisopropyl ether | 8260B | 0.005 | 0.0043 | -- | -- | -- | -- | -- | 2,200 | NE | 2200 | -- | -- | -- | -- | -- | -- | -- |
| | Dibromomethane | 8260B | 0.005 | 0.0016 | -- | -- | -- | -- | -- | 24 | NE | 24 | <0.0015 | S08,Z1 | <0.0014 | | <0.0014 | <0.0018 | S08,Z1 |
| | Dichlorodifluoromethane | 8260B | 0.005 | 0.0020 | -- | -- | -- | -- | -- | 87 | NE | 87 | <0.00087 | S08,Z1 | <0.00079 | | <0.00079 | <0.001 | S08,Z1 |
| | Ethylbenzene | 8260B | 0.005 | 0.0022 | -- | -- | -- | -- | -- | 5.8 | NE | 5.8 | <0.00076 | S08,Z1 | <0.00069 | | <0.00069 | <0.00088 | S08,Z1 |
| Soil/Dry Sediment | Sec-Butylbenzene | 8260B | 0.005 | 0.0021 | -- | -- | -- | -- | -- | 7,800 | NE | 7800 | <0.00078 | S08,Z1 | <0.00071 | | <0.00071 | <0.00091 | S08,Z1 |
| | Methyl tert-butyl ether | 8260B | 0.005 | 0.0017 | -- | -- | -- | -- | -- | 47 | NE | 47 | <0.00062 | S08,Z1 | <0.00056 | | <0.00056 | <0.00072 | S08,Z1 |
| | Methylene Chloride | 8260B | 0.005 | 0.0015 | 1,600[b] | -- | 2.6[b] | -- | 2.6 | 57 | 2.2 | 2.2 | <0.0012 | S08,Z1 | <0.0011 | | <0.0011 | <0.0014 | S08,Z1 |
| | Styrene | 8260B | 0.005 | 0.0020 | 300[a] | 1.2[b] | -- | -- | 1.2 | 6,000 | 5600 | 5600 | <0.00068 | S08,Z1 | <0.00062 | | <0.00062 | <0.00079 | S08,Z1 |
| | Tetrachloroethylene | 8260B | 0.005 | 0.0022 | 10[b] | -- | 0.18[b] | -- | 0.18 | 24 | 0.59 | 0.59 | <0.0011 | S08,Z1 | <0.00097 | | <0.00097 | <0.0012 | S08,Z1 |
| | Toluene | 8260B | 0.005 | 0.0020 | 200[a] | -- | 23[b] | -- | 23 | 4,900 | 1100 | 1100 | 0.0012 | J,S08,Z1 | 0.0014 | J | <0.00069 | <0.00088 | S08,Z1 |
| | trans-1,2-Dichloroethene | 8260B | 0.005 | 0.0019 | -- | -- | 89.6[c] | -- | 89.6 | 70 | 130 | 130 | <0.0041 | S08,Z1 | <0.0037 | | <0.0037 | <0.0047 | S08,Z1 |
| | trans-1,3-Dichloropropene | 8260B | 0.005 | 0.0018 | -- | -- | -- | -- | -- | NE | NE | NE | <0.00073 | S08,Z1 | <0.00066 | | <0.00066 | <0.00085 | S08,Z1 |
| | Trichloroethene | 8260B | 0.005 | 0.0022 | -- | -- | 42[b] | -- | 42 | 0.94 | NE | 0.94 | <0.00081 | S08,Z1 | <0.00074 | | <0.00074 | <0.00095 | S08,Z1 |
| | Vinyl chloride | 8260B | 0.005 | 0.0019 | -- | -- | 0.12[b] | -- | 0.12 | 0.059 | 0.0082 | 0.0082 | <0.00065 | S08,Z1 | <0.00059 | | <0.00059 | <0.00076 | S08,Z1 |
| | Xylenes (total) | 8260B | 0.01 | 0.0034 | 100[b] | -- | 1.4[b] | 41[b] | 1.4 | 580 | NE | 580.0 | <0.0028 | S08,Z1 | <0.0025 | | <0.0025 | <0.0032 | S08,Z1 |

**Table 3D**: **Summary of Soil/Dry Sediment Laboratory Analytical Results for VOCs**



**Notes:**

EPA - United States Environmental Protection Agency
ESV - Ecological Screening Value
LANL - Los Alamos National Laboratory
"--" - Not Established
mg/kg - Milligrams per Kilogram
NE - Not Established
ORNL - Oak Ridge National Laboratory
VOC = Volatile Organic Compound

**Sources:**

[a] ORNL Ecological Screening Values, 1997. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants, Oak Ridge National Laboratory.
[b] LANL Ecological Screening Values, 2017. ECORISK Database (Release 4.1). LA-UR-12-24548, Los Alamos National Laboratory
[c] Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June.
[1] EPA Regional Screening Levels (RSLs) - Generic Tables. May 2020.

**Table 4: Summary of Submerged Sediment Laboratory Analytical Results for Metals**



| Description/ Location | Sample ID | Sample Date | Sample Method | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upriver of Site | BB-SW-01-SED | 10/22/2020 | XRF | <581 | <10 | -- | -- | <278 | <31 | <16 | <13 | <43 | <38 | 23 | <18 | <5 | <227 | 51 | <59 | 8 |
| Upriver of Site | BB-SW-01-SED | 10/22/2020 | Lab | <0.8 A07 | 2.7 J,A07 | 52 A07 | <0.47 A07 | <0.52 A07 | 9.2 A07 | 5.3 J,A07 | 5.4 J,A07 | <4.1 A07 | <0.016 | <0.5 A07 | 3.9 J,A07 | <1.1 A07 | <0.67 A07 | <0.49 A07 | 57 A07 | 30 A07 |
| Adjacent to Site | BB-SW-02-SED | 10/22/2020 | Lab | <0.8 A07 | 32 A07 | 31 A07 | <0.47 A07 | <0.52 A07 | 5.8 A07 | 3.4 J,A07 | 3.8 J,A07 | <4.1 A07 | 0.55 | <0.5 A07 | 2.8 J,A07 | 1.8 J,A07 | <0.67 A07 | <0.49 A07 | 31 A07 | 24 J,A07 |
| Downriver of Site in sandy deposits (Mod area) | BB-SW-03-SED | 10/22/2020 | Lab | <0.8 A07 | 13 A07 | 24 A07 | <0.47 A07 | <0.52 A07 | 4.4 J,A07 | 2.3 J,A07 | 2.8 J,A07 | <4.1 A07 | 0.17 | <0.5 A07 | 3.3 J,A07 | 1.2 J,A07 | <0.67 A07 | <0.49 A07 | 17 A07 | 15 J,A07 |
| Downriver of MOD area | BB-M1-SED-01 | 10/22/2020 | Lab | 0.13 J | 22 | 21 | 0.22 J | 0.31 J | 7.2 | 3 | 3 | 2.6 | 0.08 J | <0.05 | 2.2 | <0.11 | <0.067 | 0.1 J | 35 | 16 |
| **Submerged Sediment Screening Criteria (mg/kg) [2]** | | | | | | | | | | | | | | | | | | | | |
| No-Effect Ecological Screening Values [a,b,c] | | Aquatic Invertebrates | | NE | 9.79 [a] | NE | NE | 0.99 [a] | 43.4 [a] | NE | 31.6 [a] | 35.8 [a] | 0.18 [a] | NE | 22.7 [a] | 0.9 [b] | 1 [c] | NE | NE | 121 [a] |
| EPA Regional Screening Levels - Generic Tables [d] | | Residents | | 31 | 0.68 | 15,000 | 160 | 71 | 120,000 [1] | 23 | 3,100 | 400 | 11 | 390 | 1,500 | 390 | 390 | 0.78 | 390 | 23,000 |
| DTSC-Modified Screening Levels [e] | | Residents | | NE | 0.11 | NE | 16 | 71 | NE | NE | NE | 80 | 1 | NE | 820 | NE | NE | NE | NE | NE |
| Preliminary Site Screening Criteria (Most Stringent and Applicable Values) for Residential Human Receptors | | | | 31 | 0.11 | 15000 | 16 | 71 | 120000 | 23 | 3100 | 80 | 1 | 390 | 820 | 390 | 390 | 0.78 | 390 | 23,000 |
| BLM Child/Adult Recreational Visitors [f] | | Visitors | | 782 | 30.6 | 390,000 | 3,910 | 1,780 | 1,000,000 | 586 | 78,200 | 800 | 271 | 9,780 | 39,000 | 9,780 | 9,780 | 19.60 | 9,850 | 587,000 |

**Notes:**

1 No screening level value established for total chromium, value shown is chromium III.

2 Screening levels established for aquatic invertebrates for streambed sediment.

**Acronyms and Abbreviations:**

ARAR = Applicable or Relevant and Appropriate Requirement
DTSC = Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
mg/kg = Milligrams per Kilogram
NE = Not Established
TBC = To-Be-Considered Requirement

**Sources:**

a D.D. MacDonald, C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31 (2000).

b Thompson, P.A., J. Kurias, and S. Mihok. 2005. Derivation and use of sediment guidelines for ecological risk assessment of metals and radionuclides released to the environment from uranium mining and milling activities in Canada. Environ. Monit. Assess. 110:71-85.

c Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ. Manag. 19:81-97.

d EPA. 2018. Regional Screening Levels

e DTSC. 2020. DTSC-modified

f BLM. 2017. Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites.

**Table 5**: **Summary of Surface Water Laboratory Analytical Results For Metals**



| Sample ID | Sample Date | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BB-SW-01 - Total | 10/22/2020 | 0.30 | 5.7 | 18 | <0.14 | <0.11 | 0.55 | <0.1 | 0.62 | <0.1 | 0.21 | 7.3 | 0.44 | <0.19 | <0.1 | <0.1 | <0.78 | <1.7 |
| BB-SW-01 - Dissolved | 10/22/2020 | <0.23 | 6.4 | 18 | <0.05 | <0.034 | <0.15 | 0.059 | <0.32 | <0.021 | 0.12 | 6.5 | 0.48 | <0.25 | <0.015 | <0.025 | 0.67 | <2.2 |
| BB-SW-02 - Total | 10/22/2020 | 0.19 | 6 | 17 | <0.14 | <0.11 | <0.5 | 0.1 | 0.62 | <0.1 | 0.39 | 7.5 | 0.44 | <0.19 | <0.1 | <0.1 | <0.78 | 1.9 |
| BB-SW-02 - Dissolved | 10/22/2020 | <0.23 | 5.9 | 18 | <0.05 | <0.034 | <0.15 | 0.051 | <0.32 | 0.024 | 0.25 | 6.6 | 0.45 | <0.25 | <0.015 | <0.025 | 0.66 | <2.2 |
| BB-SW-03 - Total | 10/22/2020 | 0.13 | 6.7 | 18 | <0.14 | <0.11 | <0.5 | <0.1 | 0.53 | <0.1 | 0.16 | 7.9 | 0.46 | <0.19 | <0.1 | <0.1 | <0.78 | <1.7 |
| BB-SW-03 - Dissolved | 10/22/2020 | <0.23 | 7.3 | 18 | <0.05 | 0.050 | <0.15 | 0.046 | 0.34 | 0.059 | 0.25 | 6.8 | 0.40 | <0.25 | <0.015 | <0.025 | 0.66 | <2.2 |
| Dup-01 - Total (BB-SW-02) | 10/22/2020 | 0.11 | 5.9 | 18 | <0.14 | <0.11 | <0.5 | <0.1 | 0.66 | <0.1 | 0.22 | 7.8 | 0.48 | <0.19 | <0.1 | <0.1 | <0.78 | <1.7 |
| Dup-01 - Dissolved (BB-SW-02) | 10/22/2020 | <0.23 | 6.5 | 18 | <0.05 | 0.034 | <0.15 | 0.047 | <0.32 | <0.021 | 0.24 | 6.6 | 0.35 | <0.25 | <0.015 | <0.025 | 0.56 | <2.2 |
| **ARAR/TBC** | **RECEPTOR** | **Surface Water Screening Criteria (µg/L)** | | | | | | | | | | | | | | | | |
| California Toxics Rule | Human Health (Inland Waters) [a] | 14 | NE | NE | NE | NE | NE | NE | 1,300 | NE | 0.05 | NE | 610 | NE | NE | 1.7 | NE | 120 |
| | Ecological (Freshwater Criteria Continuous Concentration, Inland Waters) [a] | NE | 150 | NE | NE | NE | 180 [1,*] | NE | 9 | 2.5[*] | NE | NE | 52[*] | 5 | NE | NE | NE | 120 [a] |
| | Ecological (Freshwater Criteria Maximum Concentration, Inland Waters) [a] | NE | 340 [a] | NE | NE | 3.9 [a,*] | 550 [1,a,*] | NE | 13 [a] | 65 [a,*] | NE | NE | 470 [a,*] | NE | 3.4 [a] | NE | NE | 120 [a] |
| EPA National Water Quality Criteria | Human (Surface Water) [b] | 5.6 | 0.018 | 1,000 | NE | NE | NE | NE | NE | NE | NE | NE | 610 | 170 | NE | 0.24 | NE | 7,400 |
| | Ecological (Freshwater Criterion Continuous Concentration) [b] | 30 | 150 | NE | NE | 0.25[*] | 74 [1,*] | NE | 9 | 2.5[*] | 0.77 | NE | 52[*] | 5 | NE | NE | NE | 120 |
| | Ecological (Freshwater Criteria Maximum Concentration) [b] | 88 | 340 | NE | NE | 2* | 570[1,*] | NE | 13 | 65* | 1.40 | NE | 470* | NE | 3.2 | NE | NE | 120 |
| Preliminary Human Health Site Screening Criteria (Most Stringent and Applicable Values) | | 5.6 | 0.018 | 1,000 | NE | NE | NE | NE | 1,300 | NE | 0.05 | NE | 610 | 170 | NE | 0.2 | NE | 120 |
| Preliminary Ecological Site Screening Criteria (Most Stringent and Applicable Values) | | 30 | 150 | NE | NE | 0.25 | 74 | NE | 9 | 2.5 | 0.77 | NE | 52 | 5 | 3.2 | NE | NE | 120 |

**Notes:**

* Freshwater aquatic life criteria for metals are expressed as a function of total hardness in the water body. Values presented correspond to a total hardness of 100 milligrams per liter.

[1] Screening level value established for chromium III.

[2] Screening level value established for total chromium.

**Acronyms and Abbreviations:**

µg/L = Micrograms per Liter
ARAR = Applicable or Relevant and Appropriate Requirement
CalEPA = California Environmental Protection Agency
CCC = Criteria Continuous Concentration (water quality criteria to protect against chronic effects in aquatic life and is the highest instream concentration of a priority toxic pollutant metal consisting of a 4-day average not to be exceeded more than once every 3 years on average).
CMC = Criteria Maximum Concentration (water quality criteria to protect against acute effects in aquatic life and is the highest instream concentration of a priority pollutant metal consisting of a short-term average not to be exceeded more than once every 3 years on average).
NE = Not Established
RSL = Regional Screening Level
TBC = To-Be-Considered Requirement

**Sources:**

[a] EPA. 2000. 40 Code of Federal Regulations Part 131, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

[b] EPA. 2020a. National Recommended Water Quality Criteria - Human Health Criteria Table Consumption of Water and Organisms and Aquatic Life Criteria Tables. February.

**Table 6: Summary of Particulate Laboratory Analytical Results For Metals**



| Sample ID | Sample Date | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc | Respirable Dust | Total Dust |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Particulate Screening Criteria (ug/m$^3$) | | | | | | | | | | | | | | | | | mg/m$^3$ | |
| BB-D-1.1 | 10/21/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | <0.11 | <0.11 |
| BB-D-1.2 | 10/21/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | -- | -- |
| BB-D-1.3 | 10/21/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | <0.056 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| BB-D-2.1 | 10/21/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | <0.11 | <0.11 |
| BB-D-2.2 | 10/21/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | -- | -- |
| BB-D-2.3 | 10/22/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | <0.056 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| BB-D-3.1 | 10/22/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | <0.11 | 0.15 |
| BB-D-3.2 | 10/22/2020 | <2.2 | <2.2 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | -- | -- |
| BB-D-3.3 | 10/22/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | <0.056 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| BB-D-4.1 | 10/22/2020 | <2.2 | 3.7 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | <1.1 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | 0.22 | 0.85 |
| BB-D-4.2 | 10/22/2020 | <2.2 | 23 | <11 | <0.22 | <0.44 | <2.2 | <1.1 | <2.2 | 1.7 | -- | <1.1 | <2.2 | <2.2 | <2.2 | <2.2 | <1.1 | <2.2 | -- | -- |
| BB-D-4.3 | 10/22/2020 | -- | -- | -- | -- | -- | -- | -- | -- | -- | <0.056 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **ARAR/TBC** | **RECEPTOR** | Particulate Screening Criteria (ug/m$^3$) | | | | | | | | | | | | | | | | | mg/m$^3$ | |
| EPA Regional Screening Levels - Generic Tables [d] | Residents | 0.31 | 0.00065 | 0.52 | 0.0012 | -- | 0.000012 | 0.00031 | -- | 0.15 | 0.31 | -- | 0.011 | 21 | -- | -- | 0.10 | -- | -- | -- |
| DTSC Modified[e] | | -- | | | | | | | | | 0.031 | | 0.011 | | | | | | -- | -- |
| EPA Regional Screening Levels - Generic Tables [d] | Industrial | 1.3 | 0.0029 | 2.2 | 0.0051 | -- | 0.00015 | 0.0014 | -- | -- | 1.3 | -- | 0.047 | 88 | -- | -- | 0.44 | -- | -- | -- |
| DTSC Modified[g] | | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.13 | -- | 0.047 | -- | -- | -- | -- | -- | -- | -- |
| DIR Permissible Exposure Limits[h] | | 500 | 10 | 500 | 2 | 5 | 500 | 20 | 1000 | 50 | 25/100C | 3000* | 500 | 200 | 10 | 100 | 50 | -- | 5 | 10 |

**Notes:**

[1] No screening level value established for total chromium, value shown is chromium III.

[2] Screening levels established for aquatic invertebrates for streambed sediment.

* Respirable fraction

**Acronyms and Abbreviations:**

DTSC = Department of Toxic Substances Control
EPA = United States Environmental Protection Agency
µg/m$^3$ = micrograms per cubic meter
mg/m$^3$ = milligrams per cubic meter
-- = Not sampled
C = ceiling value

**Sources:**

[a] D.D. MacDonald, C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31 (2000).

[b] Thompson, P.A., J. Kurias, and S. Mihok. 2005. Derivation and use of sediment guidelines for ecological risk assessment of metals and radionuclides released to the environment from uranium mining and milling activities in Canada. Environ. Monit. Assess. 110:71-85.

[c] Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ. Manag. 19:81-97.

[d] EPA. 2018. Regional Screening Levels (RSLs) - Generic Tables. November 2018.

[e] DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number

[f] BLM. 2017. Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites.

[g] DTSC Note 3 Table 3, June 2020 (nickel is cancer endpoint)

[h] Table AC-1 Permissible Exposure Limits for Chemical Contaminants, Particulates not otherwise regulated. California Department of Industrial Relations (PEL is 8-Hr TWA average for 40-hour work week)

**Table 7**
**Summary of Human Health and Ecological Risks For Surface Soil (XRF)**



| AOC/Table Number | Resident | | | Recreational Visitor | | | Plant | | Invertebrate | | Mammal | | Avian | | Total Ecological HI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cancer Risk - As | HI | HQs (Sb, As, Pb, Hg) | Cancer Risk - As | HI | HQs (Sb, As, Pb, Hg) | HI | HQs (Sb, As, Cu, Pb, Hg, Ag, Zn) | HI | HQs (Sb, As, Cu, Pb, Hg, Ag, Zn) | HI | HQs (Sb, As, Cu, Pb, Hg, Ag, Zn) | HI | HQs (Sb, As, Cu, Pb, Hg, Ag, Zn) | |
| **Background** | | | | | | | | | | | | | | | |
| Table H2-1 | **2E-04** | **50** | **As(46)**, Pb(1), **Hg(3)** | 6E-07 | <1 | <1 | **13** | As(1), **Hg(10),** Zn(1) | **32** | **Hg(30)**, Zn(1) | **5** | Cu(1), Pb(1), **Hg(2), Zn(2)** | **240** | Cu(1), Pb (5), Hg**(231), Zn(3)** | 290 |
| **AOC 1** | | | | | | | | | | | | | | | |
| Table H2-2 | **1E-04** | **35** | **As(31), Hg(4)** | 4E-07 | <1 | <1 | **15** | As(1), **Hg(13),** Zn(1) | **40** | **Hg(39)**, Zn(1) | **4** | **Hg(2),** Zn(1) | **304** | Cu(1), Pb(1), **Hg(300)**, **Zn(2)** | 363 |
| **AOC 2** | | | | | | | | | | | | | | | |
| Table H2-3 | **7E-04** | **200** | **As(189),** Pb(1), **Hg(10)** | **3E-06** | <1 | <1 | **39** | **As(4),** Pb(1), **Hg(33),** Zn(1) | **101** | As(1), **Hg(98)**, Zn(1) | **12** | **As(2)**, Cu(1), **Pb(2), Hg(6), Zn(2)** | **766** | **As(2)**, Cu(1), **Pb(9), Hg(751), Zn(3)** | 918 |
| **AOC 3** | | | | | | | | | | | | | | | |
| Table H2-4 | **6E-03** | **1615** | **As(1579), Pb(2), Hg(34)** | **2E-05** | 1 | As(1) | **151** | **As(36),** Cu(1), Pb(1), **Hg(113),** Zn(1) | **351** | **As(11), Hg(338)**, Zn(1) | **39** | **As(14)**, Cu(1), **Pb(3), Hg(20), Zn(2)** | **2,634** | **As(15)**, Cu(1), **Pb(14), Hg(2600), Zn(3)** | 3175 |
| **AOC 4** | | | | | | | | | | | | | | | |
| Table H2-5 | **1E-01** | **26304** | **Sb(283), As(26007), Pb(6), Hg(8)** | **3E-04** | **24** | **Sb(11), As(12)**, Pb(1) | **2,378** | **Sb(1753), As(592), Pb(4), Hg(27),** Zn(1) | **373** | **Sb(112), As(178), Hg(81), Zn(2)** | **32,708** | **Sb(32459), As(232), Pb(8), Hg(5),** Ag(1), **Zn(3)** | **922** | **As(248)**, Cu(1), **Pb(42), Hg(624), Ag(4), Zn(4)** | 36381 |
| **AOC 5** | | | | | | | | | | | | | | | |
| Table H2-6 | **3E-01** | **89748** | **Sb(3), As(88334), Pb(38), Hg(1373)** | **1E-03** | **50** | **As(41), Pb(4), Hg(5)** | **6,633** | **Sb(17), As(2012), Cu(1), Pb(25), Hg(4577),** Zn(1) | **14,339** | Sb(1), **As(604), Pb(2), Hg(13730), Zn(2)** | **1,980** | **Sb(318), As(787),** Cu(1), **Pb(54), Hg(808), Ag(9)**, **Zn(2)** | **106,771** | **As(842),** Cu(1), **Pb(277), Hg(105615), Ag(31), Zn(4)** | 129723 |
| **AOC 6** | | | | | | | | | | | | | | | |
| Table H2-7 | **1E-03** | **384** | **As(377), Hg(7)** | **5E-06** | <1 | <1 | **33** | **As(9), Hg(23),** Zn(1) | **74** | **As(3), Hg(70)**, Zn(1) | **10** | **As(3)**, Cu(1), Pb(1), **Hg(4),** Zn(1) | **548** | **As(4),** Cu(1), **Pb(3), Hg(538)**, **Zn(2)** | 665 |
| **AOC 7** | | | | | | | | | | | | | | | |
| Table H2-8 | **2E-04** | **45** | **As(42), Hg(4)** | 6E-07 | <1 | <1 | **13** | As(1), **Hg(12)** | **36** | **Hg(35)**, Zn(1) | **4** | **Hg(2)**, Zn(1) | **273** | Cu(1), Pb(1), **Hg(269),** Zn(1) | 326 |

Notes:

| | | |
|---|---|---|
| As = Arsenic | HI = Hazard Index | Sb = Antimony |
| Ag = Silver | HQ = Hazard Quotient | Zn = Zinc |
| Cu = Copper | Pb = Lead | |
| Hg = Mercury | | |

**Table 8**
**Summary of Human Health and Ecological Risks For Surface Soil (Laboratory)**

| AOC/Table Number | Resident | | | Recreational Visitor | | | Plant | | Invertebrate | | Mammal | | Avian | | Total Ecological HI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cancer Risk - As | HI | HQs (Sb, As, Cd, Pb, Hg) | Cancer Risk - As | HI | HQs (Sb, As, Cd, Pb, Hg) | HI | HQs (Sb, As, Cd, Cr, Cu, Pb, Hg, Mo, Se, Ag, Zn) | HI | HQs (Sb, As, Cd, Cr, Cu, Pb, Hg, Mo, Se, Ag, Zn) | HI | HQs (Sb, As, Cd, Cr, Cu, Pb, Hg, Mo, Se, Ag, Zn) | HI | HQs (Sb, As, Cd, Cr, Cu, Pb, Hg, Mo, Se, Ag, Zn) | |
| **Background** | | | | | | | | | | | | | | | |
| Table H2-1 | 2E-04 | 50 | As(49), Pb(1), Hg(1) | 7E-07 | <1 | <1 | 14 | As(1), Cr(10), Hg(2) | 32 | Cr(25), Hg(6), Zn(1) | 3 | Pb(1), Zn(1) | 55 | Pb(4), Hg(48), Zn(2) | 104 |
| **AOC 4** | | | | | | | | | | | | | | | |
| Table H2-5 | 7E-02 | 18065 | Sb(5), As(18049), Cd(1), Pb(8), Hg(3) | 2E-04 | 9 | As(8), Pb(1) | 473 | Sb(32), As(411), Cd(2), Cr(10), Pb(5), Hg(10), Zn(2) | 184 | Sb(2), As(123), Cr(25), Hg(30), Zn(3) | 939 | Sb(593), As(161), Cd(167), Pb(11), Hg(2), Ag(1), Zn(5) | 548 | As(172), Cd(78), Cu(1), Pb(55), Hg(231), Ag(3), Zn(8) | 2144 |
| **AOC 5** | | | | | | | | | | | | | | | |
| Table H2-6 | 4E-01 | 99233 | Sb(2), As(98720), Cd(4), Pb(157), Hg(350) | 1E-03 | 64 | As(46), Pb(16), Hg(1) | 3,555 | Sb(14), As(2249), Cd(9), Cr(8), Cu(1), Pb(105), Mo(2), Hg(1167), Zn(1) | 4,207 | Sb(1), As(675), Cd(2), Cr(20), Cu(1), Pb(7), Hg(3500), Zn(1) | 2,384 | Sb(256), As(880), Cd(805), Cu(1), Pb(225), Hg(206), Ag(2), Mo(8), Zn(2) | 29,396 | As(941), Cd(376), Cu(2), Pb(1144), Hg(26923), Ag(6), Zn(3) | 39542 |
| **AOC 6** | | | | | | | | | | | | | | | |
| Table H2-7 | 1E-03 | 270 | As(268), Hg(1) | 4E-06 | <1 | <1 | 22 | As(6), Cr(5), Hg(3), Se(8) | 22 | As(2), Cr(12), Hg(8), Se(1) | 14 | As(2), Cd(4), Pb(1), Se(6), Zn(1) | 72 | As(3), Cd(2), Pb(3), Hg(59), Se(3), Ag(1), Zn(1) | 130 |
| **AOC 7** | | | | | | | | | | | | | | | |
| Table H2-8 | 1E-04 | 106 | As(27), Hg(4) | 4E-07 | <1 | <1 | 26 | As(1), Cr(10), Hg(14) | 70 | Cr(26), Hg(43) | 4 | Hg(3) | 333 | Hg(331), Zn(1) | 433 |

Notes:
As = Arsenic
Ag =Silver
Cd = Cadmium
Cr = Chromium
Cu = Copper
Hg = Mercury
HI = Hazard Index
HQ = Hazard Quotient
Mo = Molybdenum
Pb = Lead
Sb = Antimony
Se = Selenium
Zn = Zinc

**Table 9**
**Summary of Human Health and Ecological Risks For Subsurface Soil (XRF)**
**AOC 4 and AOC 5**

| AOC/Table Number | Resident | | | Recreational Visitor | | | Plant | | Invertebrate | | Mammal | | Avian | | Total Ecological HI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cancer Risk - As | HI | HQs (As, Pb, Hg, Sb) | Cancer Risk - As | HI | HQs (As, Pb, Hg, Sb) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | |
| **Surface Soil Sample from AOC 4** | | | | | | | | | | | | | | | |
| Table H2-9 | 7E-02 | 19059 | Sb(10), As(19033), Pb(8), Hg(7) | 3E-04 | 10 | As(9), Pb(1) | 529 | Sb(64), As(434), Cd(2), Pb(6), Hg(23), Zn(1) | 207 | Sb(4), As(130), Hg(70), Zn(2) | 1,514 | Sb(1181), As(170), Cd(142), Cu(1), Pb(12), Hg(4), Ag(2), Zn(2) | 859 | As(181), Cd(66), Cu(1), Pb(61), Hg(538), Ag(6), Zn(4) | 3109 |
| **AOC 4 Depth (0-1 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 9E-02 | 25316 | Sb(3), As(25289), Pb(9), Hg(15) | 3E-04 | 13 | As(12), Pb(1) | 656 | Sb(17), As(576), Cd(5), Pb(6), Hg(50), Zn(1) | 327 | Sb(1), As(173), Cd(1), Hg(150), Zn(2) | 1,007 | Sb(310), As(225), Cd(444), Cu(1), Pb(13), Hg(9), Ag(2), Zn(3) | 1,681 | As(241), Cd(208), Cu(1), Pb(67), Hg(1154), Ag(6), Zn(4) | 3671 |
| **AOC 4 (1-2 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 5E-03 | 1332 | As(1332), Pb(1) | 2E-05 | 1 | As(1) | 34 | As(30), Zn(2) | 13 | As(9), Zn(3) | 54 | As(12), Cd(36), Pb(1), Zn(5) | 44 | As(13), Cd(17), Cu(1), Pb(5), Zn(8) | 145 |
| **Surface Soil Sample from AOC 5** | | | | | | | | | | | | | | | |
| Table H2-9 | 2E-01 | 43683 | Sb(2), As(43491), Pb(20), Hg(170) | 6E-04 | 23 | As(20), Pb(2), Hg(1) | 1591 | Sb(13), As(991), Cd(5), Pb(13), Hg(568), Zn(1) | 2005 | Sb(1), As(297), Cd(1), Pb(1), Hg(1704), Zn(1) | 1,179 | Sb(249), As(388), Cd(408), Pb(29), Hg(100), Ag(3), Zn(1) | 13,872 | As(415), Cd(191), Cu(1), Pb(147), Hg(13108), Ag(9), Zn(2) | 18647 |
| **AOC 5 Depth (0-1 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 2E-01 | 57180 | Sb(5), As(57051), Pb(21), Hg(103) | 8E-04 | 29 | As(27), Pb(2) | 1696 | Sb(31), As(1299), Cd(6), Pb(14), Hg(345), Zn(1) | 1430 | Sb(2), As(390), Cd(1), Pb(1), Hg(1034), Zn(1) | 1,686 | Sb(573), As(508), Cd(507), Pb(30), Hg(61), Ag(4), Zn(2) | 8,905 | As(544), Cd(237), Cu(1), Pb(153), Hg(7954), Ag(13), Zn(3) | 13717 |
| **AOC 5 Depth (1-2 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 8E-02 | 22645 | Sb(1), As(22583), Pb(4), Hg(57) | 3E-04 | 11 | As(11) | 717 | Sb(8), As(514), Pb(3), Hg(190), Zn(1) | 727 | Sb(1), As(154), Hg(570), Zn(1) | 393 | Sb(148), As(201), Cu(1), Pb(6), Hg(34), Ag(1), Zn(2) | 4,640 | As(215), Cu(1), Pb(31), Hg(4385), Ag(5), Zn(3) | 6477 |
| **AOC 5 Depth (2-3 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 7E-02 | 17917 | As(17862), Pb(2), Hg(52) | 2E-04 | 9 | As(8) | 583 | As(407), Pb(2), Hg(173), Zn(1) | 644 | As(122), Hg(520), Zn(1) | 196 | As(159), Pb(4), Hg(31), Zn(2) | 4,193 | As(170), Cu(1), Pb(18), Hg(4000), Zn(4) | 5616 |
| **AOC 5 Depth (3-4 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | 4E-02 | 10327 | As(10289), Pb(1), Hg(38) | 1E-04 | 5 | As(5) | 361 | As(234), Pb(1), Hg(125), Zn(1) | 447 | As(70), Hg(375), Zn(1) | 117 | As(92), Pb(2), Hg(22), Zn(2) | 2,994 | As(98), Cu(1), Pb(8), Hg(2885), Zn(3) | 3919 |

**Table 9**
**Summary of Human Health and Ecological Risks For Subsurface Soil (XRF)**
**AOC 4 and AOC 5**



| AOC/Table Number | Resident | | | Recreational Visitor | | | Plant | | Invertebrate | | Mammal | | Avian | | Total Ecological HI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cancer Risk - As | HI | HQs (As, Pb, Hg, Sb) | Cancer Risk - As | HI | HQs (As, Pb, Hg, Sb) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | HI | HQs (Ag, As, Cd, Cu, Hg, Pb, Sb, Zn) | |
| **AOC 5 Depth (4-5 feet bgs)** | | | | | | | | | | | | | | | |
| Table H2-9 | **5E-02** | **14302** | **As(14301)** | **2E-04** | **7** | **As(7)** | **328** | **As(326),** Cu(1), Zn(1) | **99** | **As(98),** Cu(1), Zn(1) | **131** | **As(127)**, Cu(1), Pb(1), **Zn(2)** | **144** | **As(136), Cu(2), Pb(3), Zn(3)** | 702 |

Notes:
Cadmium concentrations represent laboratory results where present (see Appendix H, Table H2-9)

| | |
|---|---|
| As = Arsenic | HI = Hazard Index |
| Ag = Silver | HQ = Hazard Quotient |
| Cd = Cadmium | Pb = Lead |
| Cu = Copper | Sb = Antimony |
| Hg = Mercury | Zn = Zinc |

**Table 10**
**Summary of Human Health and Ecological Risks for Sediment (River)**

| Sample ID/ AOC | Table | Resident | | | Recreational Visitor | | | Aquatic Invertebrate | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cancer Risk - As | HI | HQs (As) | Cancer Risk - As | HI | HQs (As) | HI | HQs (As, Hg, Se) |
| **Sediment in Kern River upriver of site** | | | | | | | | | |
| BB-SW-01-SED | H2-10 | **2E-05** | **7** | **As(7)** | 9E-08 | <1 | <1 | <1 | <1 |
| **Sediment Sample Adjacent to Site** | | | | | | | | | |
| BB-SW-02-SED | H2-10 | **3E-04** | **78** | **As(78)** | 1E-06 | <1 | <1 | **8** | **As(3)**, **Hg(3)**, **Se(2)** |
| **Sediment Sample Downriver of Site (AOC 7 Area)** | | | | | | | | | |
| BB-SW-03-SED | H2-10 | **1E-04** | **32** | **As(32)** | 4E-07 | <1 | <1 | **4** | As(1), Hg(1), Se(1) |
| **Sediment Sample Downriver of AOC 7 Area** | | | | | | | | | |
| BB-M1-SED-01 | H2-10 | **2E-04** | **54** | **As(54)** | 7E-07 | <1 | <1 | **3** | **As(2)** |

Notes:
As = Arsenic
Pb = Lead
Se = Selenium
HI = Hazard Index
HQ = Hazard Quotient

**Table 11**
**Summary of Human Health and Ecological Risks**
**for Surface Water**

| Sample ID | Date | Maximum Concentration | | |
|---|---|---|---|---|
| | | EPA National Water Quality Criteria | California Toxics Rule Criteria | |
| | | Cancer Risk - As | HI (As, Hg) | HQs |
| **Surface Water Sample in Kern River Upriver of Site** | | | | |
| BB-SW-01 - Total | 10/22/2020 | **3E-04** | **4** | **Hg(4)** |
| **Surface Water Sample Adjacent to Site** | | | | |
| BB-SW-02 - Total | 10/22/2020 | **3E-04** | **8** | **Hg(8)** |
| **Surface Water Sample Downriver of Site - AOC 7 area** | | | | |
| BB-SW-03 - Total | 10/22/2020 | **4E-04** | **3** | **Hg(3)** |

**Notes:**
As = arsenic
Hg = mercury
HI = Hazard Index
HQ = Hazard Quotient

# Appendix A
# Previous USFS Investigation Results

# Removal Preliminary Assessment

# For The

# Big Blue Mill Site

Kernville Ranger District
Sequoia National Forest

February 10, 2020

Prepared by:
Noelle Graham-Wakoski, P.E.
On-Scene Coordinator
Pacific Southwest Region
USDA Forest Service

# Removal Preliminary Assessment
# For the Big Blue Mill Site

Kernville Ranger District
Sequoia National Forest

February 10, 2020

Prepared by:

Noelle Graham-Wakoski, P.E.
On-Scene Coordinator

## 1.0 LOCATION

The Big Blue Mill Site (Site) is a former gold ore processing facility dating back to the 1860s that was associated with the nearby historic Big Blue and Summer group of mines. The Site is located in Section 27, Township 25 South, Range 33 East, Mount Diablo Meridian, on the western bank of the North Fork of the Kern River (River) – a tributary feeding into Lake Isabella within Kern County, California (see Figure 1). The Site is located on both private and national forest system land under the jurisdiction, custody and control of the U.S. Department of Agriculture Forest Service (Forest Service), within the Sequoia National Forest, Kern River Ranger District.

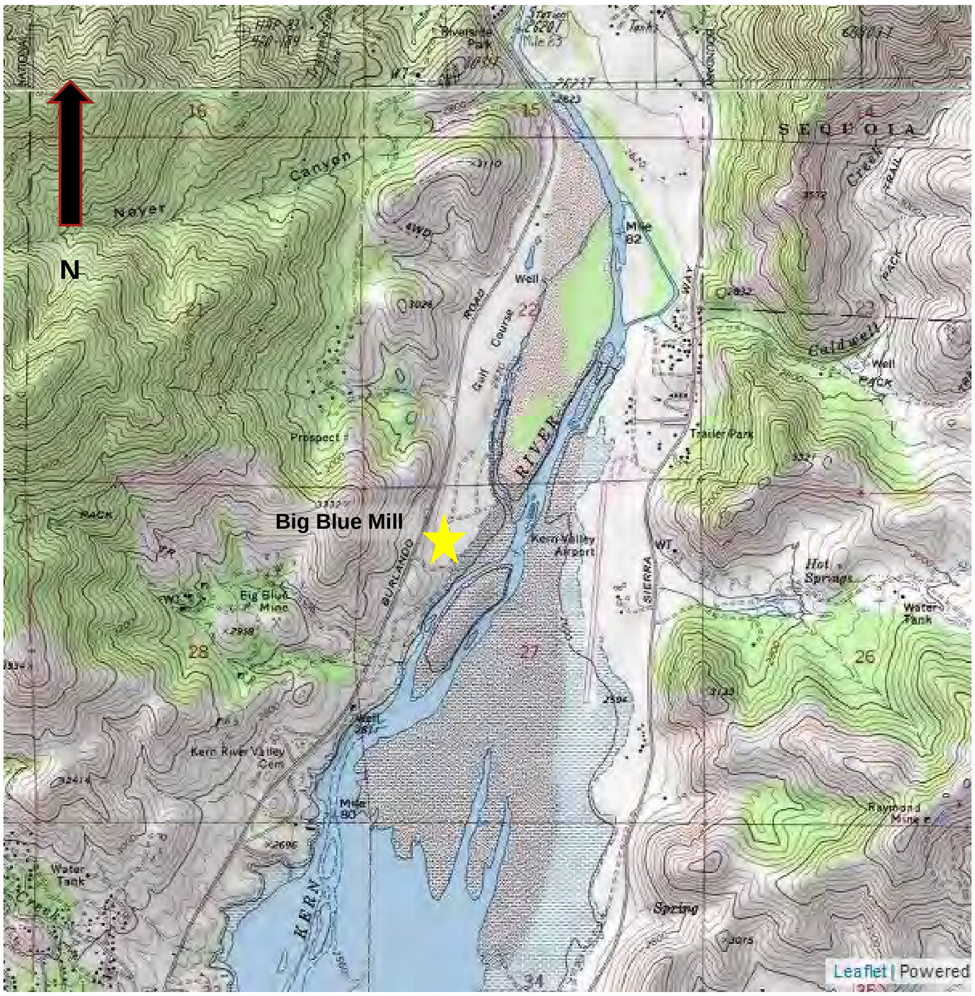



**Figure 1: Location of the Big Blue Mill Site on the western bank of the Kern River above Lake Isabella, Kern County**

The Site is located approximately 2 miles south of Kernville, California and can be accessed by taking California State Highway 178 east from Bakersfield toward Lake Isabella, California. Then turn left and head north on Highway 155 toward Wofford Heights. Continue north on Highway 495 (Burlando Road) toward Kernville for approximately three miles to the Site on the right side, which is approximately 800 feet east of the road toward the Kern River. The preferred access to the Site within Forest Service land is via the abandoned golf course just south of downtown Kernville. This path entails a one-mile travel on single lane track. The north end of the Site is the northern portion of the mill building foundations and the south end of the Site is just beyond the ragged peak along the shoreline of the Kern River.

## 2.0 BACKGROUND

### 2.1 Site History

The Big Blue Mill Site, also referred to as the "Sumner Mill" in some historic reports, is a former gold ore processing facility dating back to the 1860s that was associated with the nearby historic Big Blue and Summer group of mines. The Big Blue and Sumner group of mines are located southwest of the Site (see Figure 1) and were part of the historic Cove Mining District on the west side of the Kern River Valley. The September 15, 1896, Thirteenth Report of the State Mineralogist, for the California State Mining Bureau, indicates that there were multiple mining claims associated with mill site, these being the Big Blue, Commonwealth, Content, Nelly Dent, Nelly Dent Extension, Sumner, and Summer 5 Extensions (Beauregard, Bull Run, Frank, Jeff Davis, Lady Bell, and Urbana). According to the January 1940 "Volume 36 California Journal of Mines and Geology", the gold vein mined by these mines was first discovered in 1860.

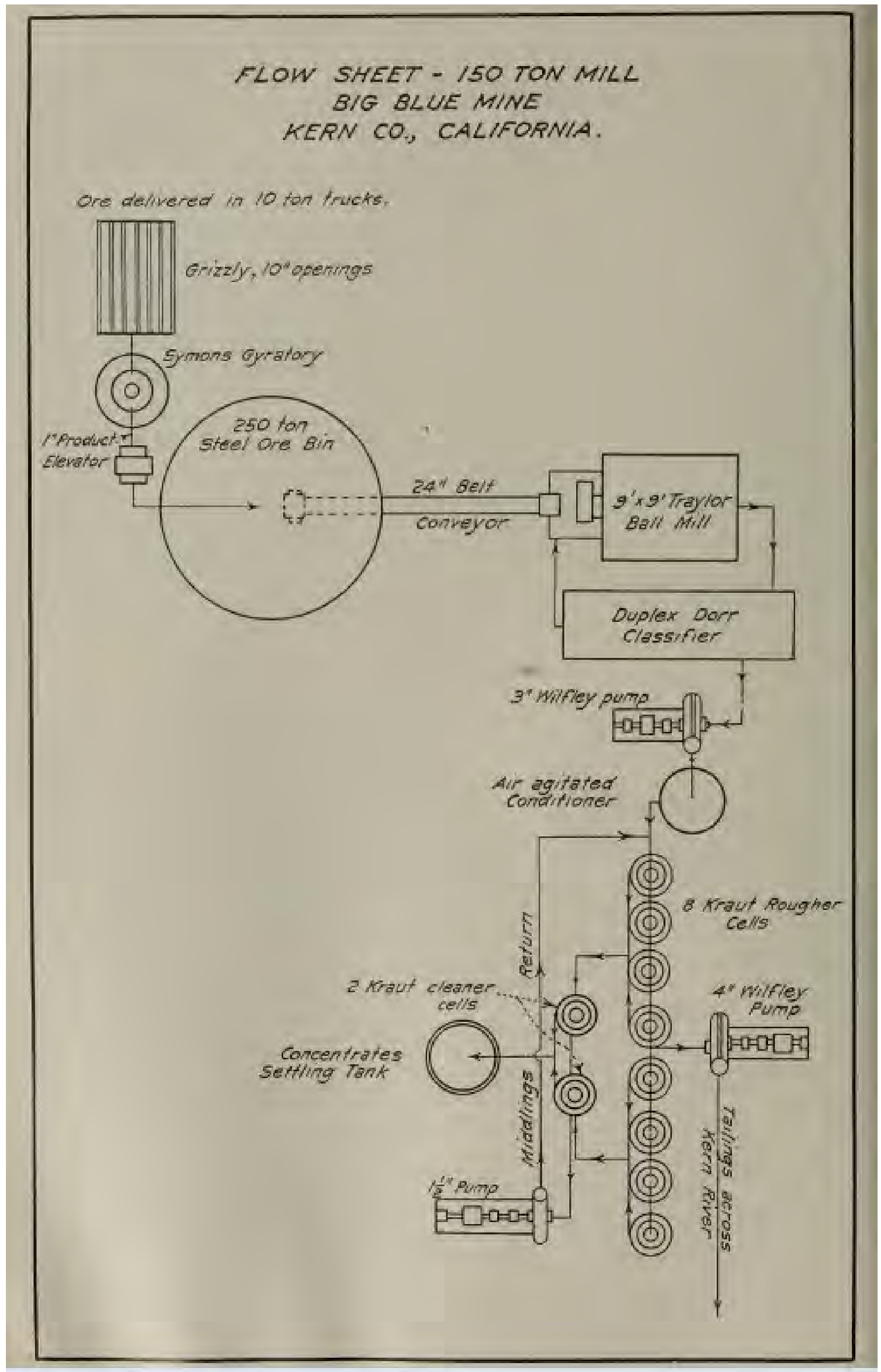
Historic records from the California State Division of Mines indicate that mineral processing operations were conducted at the site dating back to the 1860s. At least four different mineral processing operations occurred at the Site, including: a 16-stamp mill from approximately 1867 through the mid-1870s, an 80-stamp mill from 1875 through 1883, a 10-stamp mill from approximately 1901 through 1932, and floatation plant and ball mill from 1934 – 1943. Records stated that the 80-stamp mill was the largest of its kind at the time.

The 1888 "Eighth Annual Report of the State Mineralogist" described the 80-stamp mill as follows: “It is an eighty-stamp mill. Built in 1874 and 1875 and was run by a 56-inch turbine water wheel. The ore from the mine was dumped from five-ton cars into a 60-ton bin, or bunker, whence it fell and went through a 15 by nine jaw-crusher of peculiar lever construction and thence dropped into small cars running on a tramway the whole length of the building. From these cars it was dumped by hand into the separate hoppers of the automatic feeders, one to each battery of five stamps. From the batteries the pulp went to Hendy concentrators, one to each battery. Later on, two of the Hendy concentrators were replaced by four Frue vanners. Below the concentrators and vanners, there are six pans and three large settlers. Tailings were allowed to run into the river. The whole eighty stamps are said to have been run continuously for some two years, after first starting up in the spring of 1875. After that, the mill ran spasmodically, with more or less stamps at a time, up to the date of its final substantial stoppage in November, 1883."

**Figure 2: Big Blue Mill Site on the west bank of the Kern River (date is unknown but thought to be from the 1870s era)**

According to several Annual Reports of the State Mineralogist, up until the 1930s, tailings and other materials from the mill operations were dumped into the Kern River and most washed down stream. In the early 1930s, the flotation plant and ball mill was installed at the site (1934 30th Annual Report of the State Mineralogist) from which point tailings from the processing operations were pumped across the Kern River and deposited into a tailings pond. The 1934 30th Annual Report of the State Mineralogist for the California Division of Mines lists the size of the floatation plant at 150 -ton.

**Figure 3: Floatation Plant Flow Sheet for the Big Blue Mill (source 1934 30th Annual Report of the State Mineralogist)**



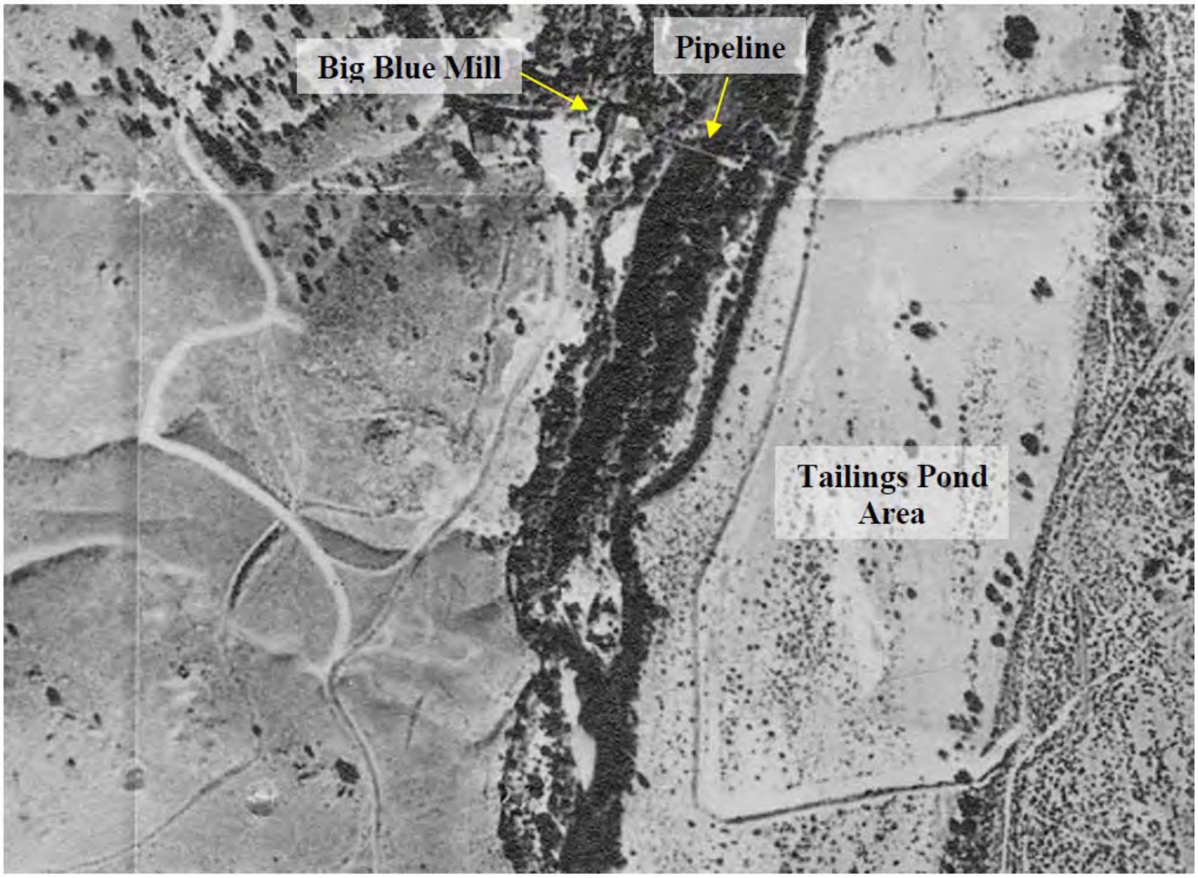



**Figure 4: October 20, 1938 Aerial photo showing Big Blue Mill, pipeline, and tailings pond area**

**Figure 5: Big Blue Mill Circa pre-1940 (source January 1940, Vol 36 California Journal of Mines and Geology)**

The Big Blue Mill operated up until 1943 when it was shut down during World War II as a result of Order L 208 of the War Production Board. Order L 208, issued by the War Production Board gave priority to copper mining, which had useful military implications, and labeled gold mines as “nonessential” for purposes of the war effort. As such, Order L-208 prohibited mining of “nonessential” materials. The 1962 report "Mines and Mineral Resources of Kern County, California" by the California Division of Mines and Geology states that Order L208 caused the mine to be shut down permanently.

## 2.2 Current Land Status

In 1948, US Army Corps of Engineers (USACE) began construction of the Lake Isabella Dam and reservoir project. In 1954, to complete the reservoir project, the USACE acquired all land below elevation 2617 feet. This included Big Blue Mill site which was at a lower elevation than the spillway of Lake Isabella dam. In 1957, the mill was sold at auction, and removed to New Mexico (California Division of Mines and Geology, 1962)

In 1991, in order to ensure ongoing public access to recreational activities along the river, this USACE floodplain land area was exchanged, from the USACE to the USDA Forest Service.

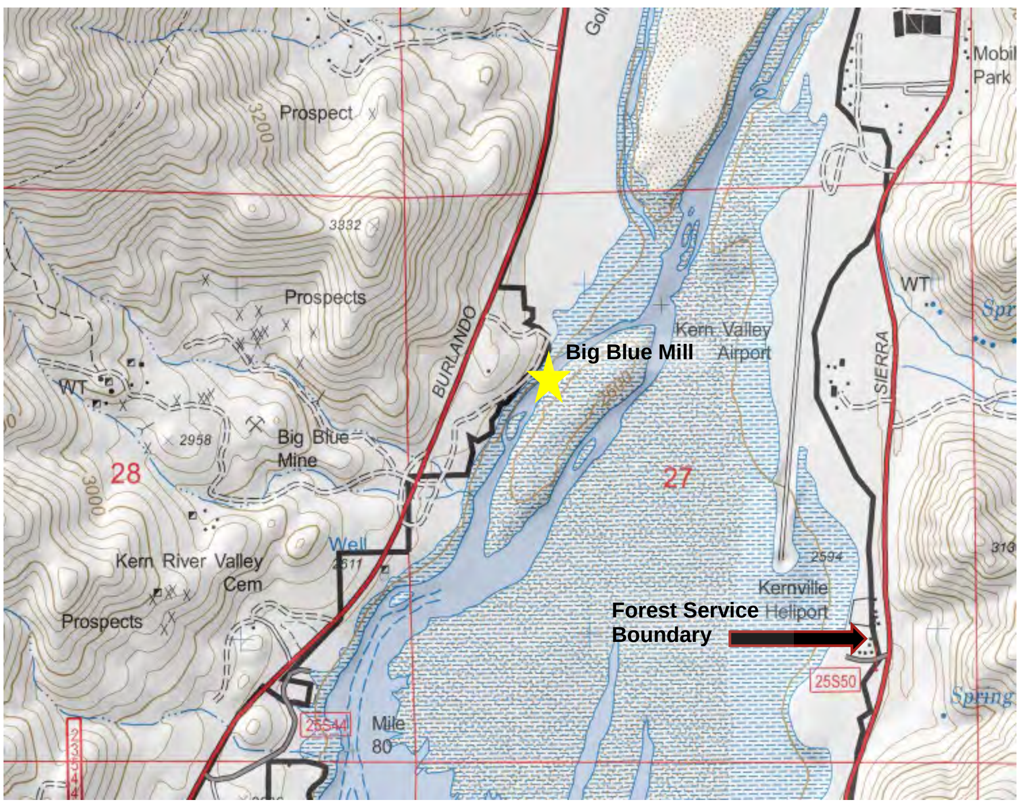



**Figure 6: Current Forest Service land boundary**

## 2.3 Current Land Use

The site is immediately adjacent to the Kern River which is a popular recreation area for fishing and water sports. The banks of the Kern River are reportedly popular fishing locations and some of the tailing materials encompass a common fishing platform and are bisected by a user created, well developed ‘fishermen’s trail’ leading up from the south. There are also permitted commercial rafting corridors along the Kern River allowing access whereby recreational rafters may readily climb up on the shoreline in this location. There is an occupied single-family private residence within 100 feet of the Site. The home sits immediately adjacent to the posted private property-National Forest land boundary. There are two other parcels with homes at an approximate distance of 500 feet and 1,000 feet respectively from the Site. It is unknown at this time whether there are children living in these homes. This portion of the River has been determined to be eligible as a Wild & Scenic river byway for permitted, non-permitted and commercial recreational use. The Kern River Valley Chamber of Commerce holds an annual Lake Isabella Fishing Derby for the public every April. This event likely draws huge crowds along the north fork of the Kern River and south/downriver to Lake Isabella.

## 3.0 PREVIOUS INVESTIGATIONS

No previous investigations have been performed at the location of the former Big Blue Mill. The Forest Service has conducted several investigations of the former tailings pond area which is located across the Kern River from the former mill site (see Figure 4 above). The former tailings pond area is referred to as the "Kern Floodplain Site". Previous investigations associated with the Kern Floodplain Site include the following:

- February 2011, Investigation Results for Suspected Big Blue Mine Tailings between the Kern Valley Airport Campground and the Kern River by Jerome DeGraff, Forest Service
- January 2013, Kern Floodplain Site Sequoia National Forest, Site Inspection Summary Report, Weston Solutions
- October 2016, Final Engineering Evaluation and Cost Analysis, Kern Floodplain Site, ECM Consultants
- May 2018, Potentially Responsible Party Search Final Report, Kern Floodplain Site, ECM Consultants

### 3.1 Kern Floodplain Site Investigation Summary

The Kern Floodplain Site is the location of the former tailings pond area for the Big Blue Mill. Historic records indicate that tailings from the Big Blue Mill were deposited at the Kern Floodplain Site from approximately 1934 through 1943. The Kern Floodplain site is approximately 4.1 acres in size and is located directly across the Kern River from the Big Blue Mill Site.

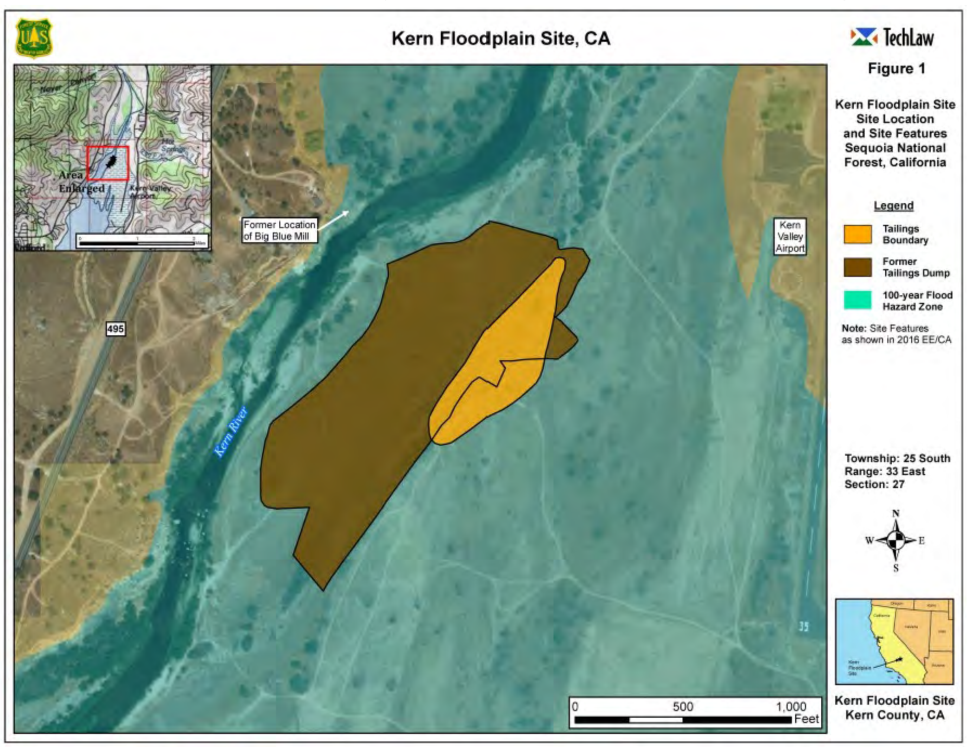



**Figure 7: Kern Floodplain Site Tailings Delineation**

Forest Service site investigation efforts at the Kern Floodplain site found elevated levels of arsenic, cadmium and lead present in the mill tailings. With arsenic concentrations peaking at 4,200 mg/kg, lead at 220 mg/kg and cadmium at 4.7 mg/kg.

**Table 9: Summary of Analytical Results by Sample Location**

| Sample Location | Sample Depth | Arsenic (mg/kg) | Cadmium (mg/kg) | Lead (mg/kg) |
|---|---|---|---|---|
| Trench 1 | 0.5 | ***640*** | *1.6* | 0.12 |
| Trench 1 | 2 | ***1,500*** | *3.3* | 0.1 |
| Trench 1 | 1 | ***2,300*** | *4* | 0.56 |
| Pothole 11 | 1 | ***1,300*** | *1.6* | *46* |
| Trench 2 | 3 | *120* | *3.3* | 15 |
| Trench 2 | 4 | *100* | *4* | 3.4 |
| Trench 2 | 1.5 | ***2,800*** | *2.8* | *61* |
| Trench 2 | 8 | *37* | *0.29* | 2.6 |
| Trench 2 | 8 | *190* | 0.072 | 7.4 |
| Trench 2 | 4 | *130* | *3.3* | 7.2 |
| Trench 2 | 0.5 | *160* | 0.088 | 14 |
| Trench 3 | 3 | ***3,900*** | *0.34* | *190* |
| Trench 3 | 3 | ***3,700*** | *0.25* | *180* |
| Trench 3 | 4 | *240* | *0.94* | 11 |
| Trench 3 | 7 | *190* | *3.5* | 6.6 |
| Trench 5 | 4 | *130* | *3.3* | 3.1 |
| Trench 5 | 4 | *120* | *0.22* | 3.2 |
| Pothole 15 | 0.5 | 4.5 | 0.11 | 2.7 |
| Pothole 15 | 3 | 4.3 | 0.091 | 2.2 |
| Pothole 16 | 0.8 | ***940*** | *3.6* | *46* |
| Pothole 16 | 2 | *6.6* | 0.079 | 2.2 |
| Pothole 18 | 0.8 | *14* | 0.14 | 3 |
| Pothole 18 | 2.5 | 4.4 | 0.091 | 2.4 |
| Pothole 20 | 0.25 | *17* | *0.46* | 5.2 |
| Pothole 20 | 2.5 | 3.2 | 0.063 | 3.3 |
| Pothole 21 | 1.5 | ***4,200*** | *4.7* | *220* |
| Pothole 21 | 4 | *62* | *0.16* | 4.4 |
| Pothole 22 | 0.5 | *15* | *0.26* | 4.5 |
| Pothole 22 | 1.5 | 5.5 | *0.17* | 3.4 |
| Pothole 23 | 0.6 | *22* | *0.82* | 6.2 |
| Pothole 23 | 3 | *6.2* | *0.16* | 2 |
| Background | -- | 5.64 | 0.15 | 16.24 |
| TTLC | | 500 | 100 | 1,000 |

*Notes:*

*Italicized* text denotes concentration exceeds site-specific background.
Bold text denotes concentration exceeds the Total Threshold Limit Concentration (TTLC).

**Figure 8: Summary of arsenic, lead and cadmium levels present in tailings at the Kern Floodplain Site (source October 2016 Final Engineering Evaluation and Cost Analysis Report, Kern Floodplain Site)**

## 4.0 BIG BLUE MILL SITE INVESTIGATION

On October 17, 2019, an initial site visit was made to the former Big Blue Mill Site to assess whether there was a tailings deposit near the former mill site. The site was chosen because of its historical connection to the tailing materials discovered in 2011 in the floodplain on the east side of the Kern River. Initial screening with a field X Ray Fluorescence (XRF) revealed elevated arsenic and lead levels in deposits along the bank. Arsenic levels ranged from 95 milligrams per kilogram (mg/kg) to 97,592 mg/kg and lead levels ranged from 35 mg/kg to 7,539 mg/kg. Based on these initial results a follow-up assessment was planned to further assess site contamination and potential risks.

The follow-up site assessment was conducted on January 14, 2020 by Forest Service On-Scene Coordinators (OSCs), Rick Weaver and Noelle Graham-Wakoski using two separate field XRF field instruments to better delineate the full range of contaminants at the Site.

During the October 2019 visit, the Big Blue Mill site was accessed by foot from the abandoned golf course on National Forest land north of the private property from Burlando Road. For the January site visit, Forest Service employees were accompanied by a Law Enforcement officer, who had previously contacted the occupant of the northern parcel residence. Permission was granted to the Forest Service to park vehicles along the private driveway and to walk down toward the former mill site from above.

### 4.1 Current Site Conditions

The only physical evidence remaining at the site of the former mill structures are concrete foundations and dilapidated retaining walls. The area is strewn with driftwood and other river debris and indicates that the site has been subject to periodic flooding.


**Figure 9: Concrete foundations that once supported structures and processing equipment at the Big Blue Mill. Photo taken from across the Kern River shows the proximity of nearby residences to the foundations that once supported site structures and processing equipment.**

The mill foundation and tailings materials are located within 100 feet of the northern parcel single-story residence that was constructed up to the public/private property boundary in the early 2000s (Figures 9 and 10). Given the large footprint of the former Mill structures, there is the potential that the home foundation is immediately adjacent, if not on top of the footprint of the former mill structures. Two other residential dwellings are located within 500 and 1,000 feet of the site. Trash and other evidence of human visitation to the Site is present throughout the area.


**Figure 10: Approximate location of the former mill relative to nearby residences and the Kern Floodplain Site**

Fishing is very popular along the Kern River from the shoreline. A well-used 'Fishermen's Trail' exists through the Site and a fishing platform was observed on the heavy metal impacted tailing materials at the shoreline. The west bank of the Kern River near the former site is heavily eroded although pockets of tailing deposits remain. The east side of the river is lined with cottonwoods, locust and willow trees. Along the shoreline there is clear evidence of tailings depicted by very fine brown materials, rust colored formations, white powdery and chunked deposits, likely to be mineral processing wastes from the former mill operations. (Figures 11, 12).



**Figure 11: Rust colored tailings and mineral processing deposits along the Kern riverbank below the former mill.**

**Figure 12: Deposits of very fine white powdery material along the riverbank (left) and brown silty materials below the former mill foundation (right) where elevated arsenic, lead and mercury were found.**


**Figure 13: Fishing platform on river bank comprised of mill tailing deposits below the former mill site.**

### 4.2 Site Sampling

Field screening was conducted using a Thermo Scientific Niton Model XL3t-600 and an Olympus Delta Model DS-4000 handheld X-Ray Fluorescence analyzer. XRF sampling was performed by Forest Service OSCs along the areas with visible evidence of tailings along the streambank and near foundation of the former mill. A total of 31 locations throughout the former mill site were sampled, including one (1) up gradient location for site background (Figure 14).


**Figure 14: January 14, 2020, XRF (sample Locations 429-445 taken by the Thermo Scientific Niton Model XL3t-600 and sample numbers 3-22 by the Olympus Delta XRF Model DS-4000).**

Prior to conducting sampling, both XRFs were field calibrated in accordance with manufacturer specifications and checked to ensure they were set to the same analysis mode. XRF readings were taken using a 60 second acquisition time period. Materials in several locations were also analyzed by both instruments in order to assess the variability between the two XRF devices.

Nine (9) soil samples were taken around the site in locations with the highest XRF reading for laboratory confirmation sampling. Samples were drawn using a steel hand shovel and placed into new sample bags and immediately labelled with a sharpie pen with the corresponding XRF instrument auto numbered identifier shot on that sample bag. Full sample description labels were created with sampler name, sample date, sample identifier, and project information following the field visit. Samples were sent to Babcock Laboratories in Riverside, California - a California and National ELAP accredited laboratory for analysis.

### 4.3 Site Sampling Results

XRF values obtained during this assessment indicate that contamination is present at the Site as a result of historic mineral processing activities. XRF results are provided below in Table 1. Inital screeing results point to arsenic, lead, mercury and zinc initial constituents of concern.

## Table 1: Summary of XRF Data

| Big Blue Mill | Arsenic, mg/kg | | Antimony, mg/kg | | Barium, mg/kg | | Cadmium, mg/kg | | Chromium, mg/kg | | Cobalt, mg/kg | | Copper, mg/kg | | Lead, mg/kg | | Mercury, mg/kg | | Molybdenum, mg/kg | | Nickel, mg/kg | | Selenium, mg/kg | | Silver, mg/kg | | Zinc, mg/kg | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample number/description | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var | XRF | +/- Var |
| **Thermo Scientific Niton Model XL3t-600** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 429 - white tailings on top, brown silty at 0.5", powdery | 405 | 35 | | | | | ND | 117 | 289 | 30 | ND | 331 | 62 | 31 | 506 | 39 | ND | 17 | | | ND | 66 | 477 | 26 | | | 72 | 20 |
| 430 -white tailings - center of site | ND | 6 | ND | 207 | ND | 616 | ND | 326 | 29 | 8 | ND | 28 | ND | 23 | ND | 7 | ND | 9 | | | ND | 38 | ND | 5 | | | ND | 12 |
| 431 -fine, silty, brown-center of site[3] | 143,314 | 864 | ND | 494 | ND | 1,468 | ND | 176 | 58 | 24 | 2,208 | 870 | ND | 141 | 3,356 | 170 | 1,183 | 117 | | | ND | 221 | ND | 80 | | | 311 | 97 |
| 432-center of site | 116,272 | 4,338 | 455 | 83 | | | | | ND | 1,270 | 371 | 231 | ND | 59 | 3,326 | 190 | ND | 300,000 | | | ND | 88 | ND | 32 | | | 75 | 40 |
| 434-rust colored, clumpy, easily breakable | 138,125 | 832 | | | | | ND | 41 | 72 | 38 | ND | 1,275 | ND | 134 | 3,144 | 161 | 743 | 102 | | | ND | 212 | ND | 78 | | | 311 | 92 |
| 437-rust colored | 8,503 | 104 | ND | 69 | 937 | 141 | ND | 279 | 58 | 26 | ND | 338 | ND | 35 | 723 | 38 | 53 | 16 | | | ND | 58 | ND | 12 | | | 88 | 22 |
| 438 - fine silty, brown | 249 | 25 | ND | 401 | ND | 1,257 | ND | 331 | 44 | 11 | ND | 287 | ND | 57 | 83 | 18 | ND | 22 | | | ND | 79 | ND | 10 | | | 115 | 28 |
| 439-fine, silty, brown-mid bank on South end | 11,518 | 123 | ND | 724 | ND | 2,075 | | | 43 | 20 | ND | 296 | ND | 39 | 972 | 45 | 122 | 20 | | | ND | 62 | ND | 14 | | | 70 | 21 |
| 440-south end | 8,946 | 108 | | | | | | | 78 | 24 | ND | 334 | 53 | 30 | 420 | 31 | 26 | 15 | | | ND | 66 | ND | 13 | | | 153 | 26 |
| 441-fine, silty, brown-bank area on south end | 953 | 32 | | | | | | | | | ND | 280 | ND | 34 | 90 | 14 | ND | 13 | | | ND | 50 | ND | 6 | | | 155 | 22 |
| 443-fine, silty, brown-below mill foundation, north end[3] | 41,099 | 304 | | | | | | | | | ND | 528 | ND | 68 | 766 | 55 | 1,240 | 67 | | | ND | 118 | ND | 34 | | | 113 | 45 |
| 445-rust colored, clumpy, hardened-below main foundation-North end | 22,579 | 185 | | | | | | | 40 | 21 | ND | 289 | ND | 46 | 1,592 | 62 | 149 | 25 | | | ND | 69 | ND | 19 | | | 194 | 33 |
| **Olympus Delta XRF Model DS-4000** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-North White Tailings | 217,719 | 1,637 | 695 | 54 | ND | 342 | 9 | 11 | ND | 97 | 1,331 | 92 | 0 | 34 | 12,513 | 131 | ND | | 0 | 31 | 0 | 27 | | | 0 | 159 | 120 | 10 |
| 4-North White Tailings | 103,772 | 1,707 | 140 | 16 | ND | 187 | 11 | 8 | ND | 49 | | | ND | 36 | 3,520 | 65 | 3,653 | 85 | 18 | 2 | ND | 21 | ND | 12 | 169 | 8 | 393 | 23 |
| 5-North White Tailings | 172,971 | 3,667 | 147 | 21 | ND | 321 | ND | 10 | ND | 86 | | | ND | 49 | 2,129 | 55 | 3,694 | 115 | 29 | 3 | ND | 31 | ND | 17 | 219 | 11 | 648 | 35 |
| 6-white Tailings | 83,419 | 1,276 | 65 | 15 | ND | 295 | 14 | 10 | ND | 79 | | | ND | 32 | 2,229 | 41 | 1,673 | 50 | 14 | 2 | ND | 19 | ND | 10 | 131 | 8 | 369 | 20 |
| 7-Sample Bag | 159,533 | 3,240 | 139 | 20 | 424 | 113 | 6 | 5 | 38 | 27 | | | ND | 45 | 2,336 | 57 | 3,570 | 107 | 33 | 3 | ND | 28 | ND | 16 | 210 | 11 | 624 | 33 |
| 8-Sample Bag[3] | 152,928 | 2,985 | 143 | 20 | 305 | 91 | 5 | 5 | 8 | 22 | | | ND | 44 | 2,733 | 62 | 3,016 | 94 | 20 | 3 | ND | 27 | ND | 16 | 226 | 11 | 593 | 31 |
| 9-Red Conglomerate | 10,924 | 118 | 5 | 11 | 217 | 119 | 0 | 6 | 45 | 30 | | | 23 | 16 | 650 | 11 | 188 | 11 | 4 | 1 | ND | 10 | ND | 3 | 11 | 5 | 51 | 7 |
| 10-South White Tailings | 5,710 | 62 | 23 | 10 | | | 334 | 28 | 120 | 37 | | | 33 | 15 | 4,954 | 54 | 2,642 | 36 | 3 | 1 | 3 | 8 | 29 | 3 | 167 | 5 | 126 | 8 |
| 11-Red Conglomerate | 16,461 | 184 | 14 | 11 | 370 | 118 | 1 | 6 | ND | 31 | | | 16 | 18 | 1,857 | 25 | 1,330 | 26 | 3 | 1 | ND | 10 | ND | 4 | 26 | 5 | 173 | 10 |
| 12-Red Conglomerate | 54,136 | 371 | 1,136 | 41 | ND | 419 | 31 | 11 | ND | 111 | 0 | 168 | 0 | 29 | 6,328 | 65 | ND | | 0 | 40 | 0 | 25 | | | 0 | 218 | 119 | 7 |
| 13-Red Conglomerate | 8,774 | 97 | ND | 11 | ND | 364 | 43 | 11 | ND | 104 | | | ND | 16 | 540 | 10 | 607 | 16 | 21 | 1 | ND | 10 | ND | 3 | 8 | 5 | 293 | 10 |
| 14-South Rocky Point[4] | 207,984 | 4,720 | 182 | 22 | ND | 139 | 11 | 6 | 10 | 35 | | | ND | 56 | 3,761 | 96 | 3,896 | 132 | 32 | 4 | ND | 36 | ND | 21 | 295 | 13 | 1,041 | 47 |
| 15-White Chunks, Bagged | 181,752 | 3,890 | 122 | 21 | 491 | 108 | 6 | 5 | ND | 26 | | | ND | 52 | 8,257 | 186 | 846 | 73 | 36 | 3 | ND | 32 | ND | 19 | 299 | 13 | 437 | 33 |
| 16-Riverbank, Mill Bldg. | 46,355 | 581 | 81 | 13 | 363 | 101 | ND | 5 | ND | 24 | | | ND | 22 | 1,877 | 29 | 156 | 21 | 9 | 2 | ND | 13 | 11 | 6 | 86 | 6 | 239 | 13 |
| 17-Yellow Chunk | 18,749 | 200 | 47 | 11 | 544 | 85 | 6 | 4 | 75 | 20 | | | ND | 17 | 1,356 | 19 | 220 | 14 | 6 | 1 | ND | 9 | 1 | 4 | 47 | 5 | 279 | 10 |
| 18-NW Mill Bldg./Riverbank | 9,303 | 96 | 33 | 10 | ND | 463 | 14 | 13 | ND | 131 | | | 61 | 16 | 910 | 13 | 287 | 12 | 3 | 1 | 32 | 9 | ND | 3 | 15 | 5 | 137 | 8 |
| 19-Floodplain North Side | 133 | 4 | ND | 9 | 270 | 70 | 9 | 4 | 43 | 18 | | | 68 | 12 | 124 | 4 | 53 | 4 | 5 | 1 | 43 | 7 | 7 | 1 | ND | 4 | 89 | 6 |
| 20-East Mill Bldg. Foundation | 239,639 | 6,021 | 727 | 34 | 854 | 86 | ND | 5 | 67 | 20 | | | ND | 64 | 2,479 | 74 | ND | 78 | 41 | 4 | ND | 40 | ND | 23 | 292 | 15 | 296 | 38 |
| 21-East Mill Bldg. Foundation | 2,484 | 24 | 20 | 9 | | | | | | | | | 78 | 13 | 91 | 3 | 10 | 4 | 1 | 1 | 15 | 7 | 1 | 1 | 6 | 4 | 151 | 6 |
| 22-Background | 15 | 2 | 10 | 9 | | | | | | | | | ND | 12 | 21 | 2 | 8 | 3 | 0 | 1 | 28 | 7 | 3 | 1 | ND | 4 | 42 | 5 |

Levels of arsenic, lead, mercury, and zinc (CERCLA hazardous substances) greatly exceed site background levels, as shown in Table 2 below and indicates that a release of hazardous substances to the environment has occurred as a result of historic mineral processing operations.

**Table 2: Summary of XRF Arsenic, Lead, Mercury, and Zinc Concentrations Compared to Site Background Levels**

| | Arsenic (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|
| **XRF Detection Range** | ND - 239,639 | ND - 12,513 | ND - 3,896 | ND - 1,047 |
| **Site Background (sample 22)** | 15 | 21 | 8 | 42 |
| **Site Background Exceedance** | 0x - 15,975.9x | 0x - 595.9x | 0x - 487x | 0x - 24.9x |

To assess field instrument consistency, soil sample 8 was analyzed by both XRF devices. The readings of the two machines are compared below in Table 3.

**Table 3: Field XRF Consistency Samples**

| XRF Device | Arsenic mg/kg | Lead mg/kg | Mercury mg/kg | Zinc mg/kg |
|---|---|---|---|---|
| Olympus Delta Model DS-4000 | 152,928 | 2,733 | 3,016 | 593 |
| Thermo Scientific Niton Model XL3t-600 | 143,314 | 3,356 | 1,183 | 311 |
| **Relative percent difference** | 6.5 | 20.5 | 174.6 | 62.4 |

The variation between the two separate XRF instruments range from 6.5 percent for arsenic to 174.6 percent for mercury and 62.4 for zinc. While the variance results seems to vary greatly between the two instruments, both results confirm the trend of elevated metals. The low relative percent difference for arsenic between the two instruments demonstrates a higher confidence of an elevated concentrations detected at the Site.

Laboratory results for the ten (10) samples sent off for laboratory analysis are provided in Appendix A. It is believed that the sample preparation method utilized by the laboratory did not provide for a full extraction of the metals from the samples. Resulting in lower reporting and not providing a correct correlation with the XRF data. The laboratory results, summarized in Table 3, do confirm that arsenic, lead and mercury are present in concentrations significantly above background levels and that a release of hazardous substances has occurred as a result of historic mineral processing operations.

**Table 3: Summary of Laboratory Arsenic, Lead, Mercury, and Zinc Concentrations Compared to Site Background Levels**

| | Arsenic (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|
| **Laboratory Analytical Results** | 400 - 60,000 | 50 - 8,300 | 5 - 1,500 | 25 - 180 |
| **Site Background (sample 22)** | 15 | 21 | 8 | 42 |
| **Site Background Exceedance** | 26.7x - 4,000x | 2.4x - 395.2x | 0.6x - 187.5x | 0.6x - 4.3x |

### 4.4 Human Health Risk Screening Assessment

Exposure pathways of concern for the Big Blue Mill Site are through inhalation, dermal exposure and ingestion by site visitors. Contamination is present within 100 feet from an occupied residence on private land and within 500 feet and 1,000 feet of two other residences on separate private parcels. Mill waste and tailings are present in powdery surface deposits and soils and there is a high likelihood of transferring contamination to clothing, equipment and vehicles that would result in contaminated material being transported and deposited at off-site locations such as residences and offices. Fishing is very popular along the Kern River from the shoreline. A well-used 'Fishermen's Trail' exists through the Site and a fishing platform was observed on the heavy metal impacted tailing materials at the shoreline (Figure 13). The close proximity of occupied residences to the site and the high recreational usage of the area increase the likelihood of exposure of children to contaminants. Children are considered a sensitive group upon which exposures to heavy metals could interfere with neurological development.

Arsenic, lead, and mercury concentrations at the Site greatly exceed established human health risk screening levels (SLs). Screening levels are concentrations of chemicals in soil intended to be protective of human health and/or the environment under a defined exposure setting (Cox, 2017 Update). They represent heavy metal concentrations thresholds at which people, under varying exposure levels, will not experience adverse health effects during their lifetimes.

The most widely used human health screening values are the Regional Screening Level (RSLs) developed by the US EPA for residential and industrial populations (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables). EPA RSLs are based on a residential exposure frequency of 350 days/year for 26 years and the industrial RSLs assume worker exposure frequency of 225 days/year for 25 years. These residential and industrial exposure frequencies are very conservative for many abandoned mine land (AML) sites. Recreational visitors are the most common group of human receptors to AML sites. This is a broad category that can cover a range of possible recreational activities, including camping, hiking, hunting, biking, ATV riding, horseback riding, etc.

To address recreational visitation at AML sites, the Bureau of Land Management (BLM) developed recreational exposure SLs for metals found in soils at AML sites. BLM's recreational SLs take into account the reduced exposures associated with most recreational activities and are based on a recreational exposure frequency of 14 days/year for 26 years (Cox, September 2017 update).

Although highly conservative for most AML sites, EPA's RSLs provide a useful benchmark in gaining an initial understanding of the magnitude of potential risk and at sites where off-site residents live in immediate proximity of the contamination. In the case of the Big Blue Mill site, residential property is immediately adjacent to the former mill site and an occupied residential home is located within 100 feet of identified site contamination. Two other occupied residences are located within 500 and 1,000 feet of site contamination (see Figures 9, 10 and 14). Given the close proximity of occupied residences to the site, the use of EPA residential RSLs is warranted in assessing potential site risks.

A summary of arsenic, lead, and mercury concentrations compared to EPA residential RSLs and BLM recreational SLs is provided in Table 4 below and a comparison to the laboratory results is provided in Table 5.

**Table 4: Summary of XRF Arsenic, Lead, and Mercury Concentrations Compared To Human Health Screening Levels**

| | Arsenic (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) |
|---|---|---|---|
| **XRF Concentration Range** | ND - 239,639 | ND -12,513 | ND - 3,896 |
| **EPA Residential RSL[1]** | 0.68[2] | 400 | 11 |
| **EPA Residential RSL Exceedance** | 0x - 352,410.3x | 0x - 31.3x | 0x - 354.2x |
| **BLM Recreation SL[3]** | 30.6 | 800 | 271 |
| **BLM Recreation SL Exceedance** | 0x - 7,831.3x | 0x - 15.6x | 0x - 14.4x |

[1] (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
[2] Arsenic detected in background sample at 15 mg/kg.
[3] September 2017 Update, BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

**Table 5: Summary of Laboratory Arsenic, Lead, and Mercury Concentrations Compared To Human Health Screening Levels**

| | Arsenic (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) |
|---|---|---|---|
| **Laboratory Concentration Range** | 400 - 60,000 | 50 - 8,300 | 5 - 1,500 |
| **EPA Residential RSL[1]** | 0.68 | 400 | 11 |
| **EPA Residential RSL Exceedance** | 588.2x - 88,235.3x | 0.1x - 20.8x | 0.5x - 136.4x |
| **BLM Recreation SL[2]** | 30.6 | 800 | 271 |
| **BLM Recreation SL Exceedance** | 13.1x - 1,960.8x | 0.06x - 10.4x | 0.0x - 5.5x |

[1] (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
[2] September 2017 Update, BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

Arsenic, lead, and mercury concentrations greatly exceed residential and recreational exposure screening levels. Exceedances of the SLs can be interpreted as follows in order to provide a means for assessing the hazard posed by the presence of heavy metals:

- Less than the criteria: low risk
- 1-10 times the criteria: moderate risk
- 10-100 times the criteria: high risk
- >100 times the criteria: extremely high risk

The range of detected arsenic concentrations indicate the Site poses a potential extremely high risk for arsenic under recreational and residential exposure scenarios. XRF screening found arsenic concentrations in surface materials ranging from 133 to 239,639 mg/kg. Greatly exceeding residential and recreational exposure SLs (Table 4). Laboratory results, provided in Table 5, confirm that arsenic concentrations exceed EPA residential RSLs and BLM recreational SLs and that the Site poses potential extremely high risk for arsenic under recreational and residential exposure scenarios. The exposure routes of concern for arsenic would primarily be through the inhalation, ingestion, and dermal pathways.

XRF lead concentrations ranged from 83 to 12,513 mg/kg, indicating the Site poses a potential high risk for lead under recreational and residential exposure scenarios. Laboratory results, provided in Table 5, confirm that lead concentrations exceed EPA residential RSLs and BLM recreational SLs and that the Site poses a potential exposure high risk to recreational and residential visitors for lead. The exposure routes of concern for lead would primarily be through the ingestion and inhalation pathways.

XRF mercury concentrations ranged from 26 to 3,896 mg/kg, indicating the Site poses a potential extremely high risk for mercury under the residential exposure scenarios and a high exposure risk under the recreational exposure scenario. Laboratory results, provided in Table 5 confirm that lead concentrations exceed EPA residential RSLs and BLM recreational SLs and that the Site poses a potential extremely high risk for mercury under the residential exposure scenarios and a moderate exposure risk under the recreational exposure scenario. The exposure routes of concern for mercury would be the inhalation, ingestion, and dermal pathways.

### 4.5 Ecological Risk Screening Assessment

To assess potential risks to wildlife posed by contamination present at the site, XRF and laboratory data was compared to EPA Ecological Soil Screening Levels (Eco-SSLs). Eco-SSLs are concentrations of contaminants in soil that are protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil. Although Eco-SSLs were developed specifically to be used during Step 2 of the Superfund ecological risk assessment process (Screening-Level Exposure Estimate and Risk Calculation), they can be used during the site screening process to screen soil contaminants in order to determine if additional ecological site studies are warranted.

Tables 6 and 7 below list the primary constituents of concern from the site XRF and laboratory data which exceed EPA Eco-SSLs.

**Table 6: Summary of XRF Concentrations for Constituents Exceeding Ecological Screening Levels**

| | Antimony (mg/kg) | Arsenic (mg/kg) | Barium (mg/kg) | Cadmium (mg/kg) | Chromium (mg/kg) | Copper (mg/kg) | Lead (mg/kg) | Selenium (mg/kg) | Silver (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| **XRF Concentration Range** | ND - 1,136 | 133 - 239,639 | ND - 937 | ND - 334 | 8 - 289 | ND - 78 | 83 -12,513 | ND - 477 | ND - 295 | 51 - 1,047 |
| **Plant ECO-SSL[1]** | NA[2] | 18 | NA[2] | 32 | NA[2] | 70 | 120 | 0.52[3] | 560 | 160 |
| **Plant ECO-SSL Exceedance** | -- | 6.3x - 13,313.3x | -- | 0x - 10.4x | -- | 0x - 1.1x | 0.7x - 104.3x | 0x - 917.3x | 0x - 0.5x | 0.3x - 6.5x |
| **Soil Invertebrates ECO-SSL** | 78 | NA[2] | 330[3] | 140 | NA[2] | 80 | 1700 | 4.1 | NA[2] | 120 |
| **Soil Invertebrates ECO-SSL Exceedance** | 0x - 14.6x | - | 0x - 2.8x | 0x - 2.4x | -- | 0x - 1x | 0.0x - 7.4x | 0x - 116.3x | -- | 0.4x - 8.7x |
| **Avian Wildlife ECO-SSL** | NA[2] | 43 | NA[2] | 0.77 | 26[3] | 28 | 11[3] | 1.2[3] | 4.2 | 46 |
| **Avian Wildlife ECO-SSL Exceedance** | -- | 3.1x - 5,573x | -- | 0x - 433.7x | 0.3x - 11.1x | 0x - 2.8x | 7.5x - 1,137.5x | 0x - 397.5x | 0x - 70.2x | 1.1x 22.8x- |
| **Mammalian Wildlife ECO-SSL** | 0.27[3] | 46 | 2000 | 0.36 | 34[3] | 49 | 56 | 0.63[3] | 14 | 79 |
| **Mammalian Wildlife ECO-SSL Exceedance** | 0x- 4,207.4x | 2.9x - 5,209.5x | 0x - 0.5x | 0x - 927.8x | 0.2x - 8.5x | 0x - 1.6x | 1.5x - 223.4x | 0x - 757.1x | 0x - 21.1x | 0.6x - 13.3x |

[1] EPA Ecological Soil Screening Levels (ECO-SSLs) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents)

[2] NA = Not Available

[3] ECO-SSL Below Site XRF Background Concentrations

**Table 7: Summary of Laboratory for Constituents Exceeding Ecological Screening Levels**

| | Antimony (mg/kg) | Arsenic (mg/kg) | Cadmium (mg/kg) | Lead (mg/kg) | Selenium (mg/kg) | Silver (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|---|---|---|
| **Laboratory Concentration Range** | ND - 38 | 400 - 60,000 | ND - 334 | 50 - 8,300 | ND - 5.5 | ND - 82 | 51 - 1,047 |
| **Plant ECO-SSL[1]** | NA[2] | 18 | 32 | 120 | 0.52[3] | 560 | 160 |
| **Plant ECO-SSL Exceedance** | -- | 6.3x - 13,313.3 x | 0x - 10.4x | 0.7x - 104.3x | 0x -10.6x | 0x - 0.1x | 0.3x - 6.5x |
| **Soil Invertebrates ECO-SSL** | 78 | NA[2] | 140 | 1700 | 4.1 | NA[2] | 120 |
| **Soil Invertebrates ECO-SSL Exceedance** | 0x - 14.6x | - | 0x - 2.4x | 0.0x - 7.4x | 0x - 1.3x | -- | 0.4x - 8.7x |
| **Avian Wildlife ECO-SSL** | NA[2] | 43 | 0.77 | 11[3] | 1.2[3] | 4.2 | 46 |
| **Avian Wildlife ECO-SSL Exceedance** | -- | 3.1x - 5,573x | 0x - 433.7x | 7.5x - 1,137.5x | 0x - 4.6x | 0x - 19.5x | 1.1x 22.8x- |
| **Mammalian Wildlife ECO-SSL** | 0.27[3] | 46 | 0.36 | 56 | 0.63[3] | 14 | 79 |
| **Mammalian Wildlife ECO-SSL Exceedance** | 0x- 4,207.4x | 2.9x - 5,209.5x | 0x - 927.8x | 1.5x - 223.4x | 0x - 8.7x | 0x -5.9x | 0.6x - 13.3x |

[1] EPA Ecological Soil Screening Levels (ECO-SSLs) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents)
[2] NA = Not Available
[3]ECO-SSL Below Site XRF Background Concentrations

Initial site screening indicates that levels of antimony, arsenic, lead and zinc greatly exceed both site background levels and EPA Eco-SSLs. Mill waste and tailings are present in powdery surface deposits and soils and are readily accessible to wildlife. Some of the contaminated materials are un-vegetated and exposed on the banks of the Kern River and there is evidence of on-going erosion into the river. Additional ecological risk evaluation is warranted in order to fully assess the risks to wildlife posed by the Site.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

XRF values obtained during the Removal PA indicate that contamination is present as a result of historic mineral processing activities at the Site. Elevated concentrations of arsenic is present in mill tailings exceed site background levels (up to 13,866x for arsenic, 393x for lead, and 487x for mercury) and indicates that a release of hazardous substances to the environment has occurred. The tailings are susceptible to migration because of water- and wind-borne influences. Mill waste and tailings are present in surface deposits and soils and are susceptible to migration because of water- and wind-borne influences. Some of the contaminated materials are un-vegetated and exposed on the banks of the Kern River and there is evidence of on-going erosion into the river.

Concentrations of arsenic, lead, and mercury in the mill tailings greatly exceed established human health risk screening thresholds for residential and recreational exposure scenarios and indicate that the site poses an exposure hazard to nearby populations. Contamination is present within 100 feet from an adjacent occupied residence on private land and within 500 feet and 1,000 feet of two other residences on separate private parcels. There is evidence of public visitation to the site and the area along the river bank where tailings are present is used by the public for fishing. Mill waste and tailings are present in powdery surface deposits and soils and there is a high likelihood of transferring contamination to clothing, equipment and vehicles that would result in contaminated material being transported and deposited at off-site locations such as residences and offices. Mill tailings are also readily accessible to wildlife.

A full CERCLA Site Inspection (SI) is recommended in order to delineate the full nature and extent of contamination and human health and ecological risks posed by the Site.

Conditions represent a threat of release of CERCLA hazardous substances, threatening to public health, or welfare, or the environment based on the factors set forth in the NCP, 40 CFR § 300.415(b)(2). A Time-Critical Removal Action (TCRA) is recommended to implement institutional controls to restrict all public access to the Site and the area of contamination. It is recommended that these controls include a prohibition on all public entry to the Site. Based on available data, the recommended initial closure area includes former mill area east and northeast of the adjacent private Parcel APN 296-110-11-00-1 and the area between the Kern River and private Parcels APN 296-110-11-00-1 and 296-110-12-00-4 (see Figure 15 below).


**Figure 15: Recommended Closure Area**

## References Cited


September 15, 1896, Thirteenth Report (Third Biennial) of the State Mineralogist For The Two Years Ending September 15, 1896, California State Mining Bureau

January 1934, Volume 30 California Journal of Mines and Geology Quarterly Chapter of State Mineralogist's Report XXX, State Division of Mines

January 1940, Volume 36 California Journal of Mines and Geology Quarterly Chapter of State Mineralogist's Report XXXVI, State Division of Mines

1962, Mines and Mineral Resources of Kern County, California, California Division of Mines and Geology, County Report 1

October 2004, Technical Note 390, “Risk Management Criteria for Metals at BLM Mining Sites”, Karl L. Ford, Ph.D., Bureau of Land Management, National Science and Technology Center

September 2017 Update, BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

# APPENDIX A

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

| | | | |
|---|---|---|---|
| Client Name: | USDA Forest Service-Region 5 Office | Analytical Report: | Page 1 of 11 |
| Contact: | Noelle Graham-Wakoski | Project Name: | CAM 17 Metals - Solid |
| Address: | 10845 Rancho Bernardo Rd<br>San Diego, CA 92127 | Project Number: | Big Blue Mill - Sequoia NF |
| Report Date: | 29-Jan-2020 | **Work Order Number:** | **C0A1592** |

Received on Ice (Y/N): Yes Temp: °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

## Sample Identification

| Lab Sample # | Client Sample ID | Matrix | Date Sampled | By | Date Submitted | By |
|---|---|---|---|---|---|---|
| C0A1592-01 | 444 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-02 | R-15 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-03 | 441 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-04 | 439 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-05 | 431 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-06 | 435 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-07 | 442 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-08 | 434 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |
| C0A1592-09 | 445 | Solid | 01/14/20 00:00 | Noelle Graham-Wako | 01/15/20 14:04 | Noelle Graham-Wakowski |

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-01**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 444 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 13 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Arsenic | 31000 | 50 | mg/kg | EPA 6020 | 01/24/20 14:06 | MEL | |
| Barium | 36 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Cadmium | 3.9 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Total Chromium | 2.4 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Copper | 31 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Lead | 1600 | 100 | mg/kg | EPA 6020 | 01/24/20 14:06 | MEL | |
| Mercury | 100 | 100 | mg/kg | EPA 7471A | 01/22/20 14:03 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Nickel | 1.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Silver | 33 | 10 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Vanadium | 7.0 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |
| Zinc | 100 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:04 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-02**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| R-15 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 11 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Arsenic | 55000 | 50 | mg/kg | EPA 6020 | 01/24/20 14:08 | MEL | |
| Barium | 20 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Cadmium | 6.7 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Total Chromium | 1.8 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Copper | 39 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Lead | 8300 | 100 | mg/kg | EPA 6020 | 01/24/20 14:08 | MEL | |
| Mercury | 470 | 250 | mg/kg | EPA 7471A | 01/22/20 14:05 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Nickel | 1.3 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Selenium | 5.5 | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Silver | 82 | 10 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Vanadium | 2.3 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |
| Zinc | 110 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:06 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-03**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 441 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Arsenic | 400 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Barium | 75 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Cadmium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Total Chromium | 7.5 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Cobalt | 5.3 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Copper | 8.9 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Lead | 50 | 2.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Mercury | 4.6 | 2.5 | mg/kg | EPA 7471A | 01/24/20 15:06 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Nickel | 5.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Silver | ND | 10 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Vanadium | 28 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |
| Zinc | 52 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:09 | MEL | |

BABCOCK Laboratories, Inc.
The Standard of Excellence for Over 100 Years

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-04**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 439 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 2.2 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Arsenic | 7200 | 5.0 | mg/kg | EPA 6020 | 01/24/20 14:11 | MEL | |
| Barium | 39 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Cadmium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Total Chromium | 3.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Cobalt | 1.6 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Copper | 5.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Lead | 710 | 2.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Mercury | 160 | 120 | mg/kg | EPA 7471A | 01/22/20 14:09 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Nickel | 2.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Silver | 10 | 10 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Vanadium | 13 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |
| Zinc | 25 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:11 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

| | | | |
|---|---|---|---|
| Client Name: | USDA Forest Service-Region 5 Office | Analytical Report: | Page 6 of 11 |
| Contact: | Noelle Graham-Wakoski | Project Name: | CAM 17 Metals - Solid |
| Address: | 10845 Rancho Bernardo Rd<br>San Diego, CA 92127 | Project Number: | Big Blue Mill - Sequoia NF |
| Report Date: | 29-Jan-2020 | **Work Order Number:** | **C0A1592** |

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-05**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 431 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 35 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:19 | MEL | |
| Arsenic | 60000 | 50 | mg/kg | EPA 6020 | 01/24/20 14:13 | MEL | |
| Barium | 7.8 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Cadmium | 4.1 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Total Chromium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Copper | 3.6 | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Lead | 2600 | 100 | mg/kg | EPA 6020 | 01/24/20 14:13 | MEL | |
| Mercury | 1500 | 250 | mg/kg | EPA 7471A | 01/22/20 14:11 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Nickel | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Silver | 41 | 10 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Vanadium | ND | 1.0 | mg/kg | EPA 6020 | 01/21/20 18:14 | MEL | |
| Zinc | 110 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:19 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

| | | | |
|---|---|---|---|
| Client Name: | USDA Forest Service-Region 5 Office | Analytical Report: | Page 7 of 11 |
| Contact: | Noelle Graham-Wakoski | Project Name: | CAM 17 Metals - Solid |
| Address: | 10845 Rancho Bernardo Rd<br>San Diego, CA 92127 | Project Number: | Big Blue Mill - Sequoia NF |
| Report Date: | 29-Jan-2020 | **Work Order Number:** | **C0A1592** |

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-06**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 435 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 24 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Arsenic | 53000 | 100 | mg/kg | EPA 6020 | 01/24/20 16:31 | MEL | |
| Barium | 12 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Cadmium | 3.5 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Total Chromium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Copper | 8.0 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Lead | 3200 | 200 | mg/kg | EPA 6020 | 01/24/20 16:31 | MEL | |
| Mercury | 420 | 250 | mg/kg | EPA 7471A | 01/22/20 14:13 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Nickel | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Silver | 53 | 10 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Vanadium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |
| Zinc | 120 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:32 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-07**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 442 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 38 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Arsenic | 49000 | 100 | mg/kg | EPA 6020 | 01/24/20 16:43 | MEL | |
| Barium | 32 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Cadmium | 5.4 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Total Chromium | 2.5 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Copper | 14 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Lead | 2400 | 200 | mg/kg | EPA 6020 | 01/24/20 16:43 | MEL | |
| Mercury | 870 | 250 | mg/kg | EPA 7471A | 01/22/20 14:15 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Nickel | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Selenium | 5.4 | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Silver | 69 | 10 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Vanadium | 4.8 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |
| Zinc | 170 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:34 | MEL | |

BABCOCK Laboratories, Inc.
The Standard of Excellence for Over 100 Years

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid
Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-08**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 434 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 7.3 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Arsenic | 16000 | 100 | mg/kg | EPA 6020 | 01/24/20 16:45 | MEL | |
| Barium | 190 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Cadmium | 8.4 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Total Chromium | 1.8 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Copper | 13 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Lead | 1300 | 200 | mg/kg | EPA 6020 | 01/24/20 16:45 | MEL | |
| Mercury | 190 | 50 | mg/kg | EPA 7471A | 01/24/20 16:24 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Nickel | 3.1 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Silver | 20 | 10 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Vanadium | 4.5 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |
| Zinc | 140 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:36 | MEL | |

BABCOCK Laboratories, Inc.
*The Standard of Excellence for Over 100 Years*

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid

Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

Laboratory Reference Number

**C0A1592-09**

| Sample Description | Matrix | Sampled Date/Time | Received Date/Time |
|---|---|---|---|
| 445 | Solid | 01/14/20 00:00 | 01/15/20 14:04 |

| Analyte(s) | Result | RDL | Units | Method | Analysis Date | Analyst | Flag |
|---|---|---|---|---|---|---|---|
| Metals and Metalloids; EPA SW846 Series | | | | | | | |
| Antimony | 8.4 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Arsenic | 21000 | 100 | mg/kg | EPA 6020 | 01/24/20 16:48 | MEL | |
| Barium | 270 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Beryllium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Cadmium | 12 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Total Chromium | 2.2 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Cobalt | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Copper | 15 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Lead | 1700 | 200 | mg/kg | EPA 6020 | 01/24/20 16:48 | MEL | |
| Mercury | 240 | 50 | mg/kg | EPA 7471A | 01/24/20 16:26 | KSL | |
| Molybdenum | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Nickel | 4.1 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Selenium | ND | 5.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Silver | 24 | 10 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Thallium | ND | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Vanadium | 5.9 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |
| Zinc | 180 | 1.0 | mg/kg | EPA 6020 | 01/24/20 13:39 | MEL | |

Client Name: USDA Forest Service-Region 5 Office
Contact: Noelle Graham-Wakoski
Address: 10845 Rancho Bernardo Rd
San Diego, CA 92127

Report Date: 29-Jan-2020


Project Name: CAM 17 Metals - Solid
Project Number: Big Blue Mill - Sequoia NF

**Work Order Number: C0A1592**

Received on Ice (Y/N): Yes Temp: °C

## Notes and Definitions

| | |
|---|---|
| ND: | Analyte NOT DETECTED at or above the Method Detection Limit **(if MDL is reported)**, otherwise at or above the Reportable Detection Limit (RDL) |
| NR: | Not Reported |
| RDL: | Reportable Detection Limit |
| MDL: | Method Detection Limit |
| * / ''' : | NELAP does not offer accreditation for this analyte/method/matrix combination |

## Approval

Enclosed are the analytical results for the submitted sample(s). Babcock Laboratories certify the data presented as part of this report meet the minimum quality standards in the referenced analytical methods. Any exceptions have been noted.

Angela Brown

**Angela E. Brown For KayeLani A. Marshall**

cc:

e-Short_No Alias.rpt

**BABCOCK Laboratories, Inc.**
*The Standard of Excellence for Over 100 Years*

| | | | |
|---|---|---|---|
| Client Name: | USDA Forest Service-Region 5 Office | Analytical Report: | Page 1 of 1 |
| Contact: | Noelle Graham-Wakoski | Project Name: | CAM 17 Metals - Solid |
| Address: | 10845 Rancho Bernardo Rd<br>San Diego, CA 92127 | Project Number: | Big Blue Mill - Sequoia NF |
| Report Date: | 29-Jan-2020 | **Work Order Number:** | **C0A1592** |

Received on Ice (Y/N): Yes Temp: °C

BABCOCK Laboratories, Inc.
6100 Quail Valley Court Riverside, CA 92507
(951) 653-3351 • FAX (951) 653-1662
www.babcocklabs.com

## Chain of Custody & Sample Information Record

Client: US Forest Service
Contact: Noelle Graham-Wakoski Fax No. 858 673-6192
Phone No. (858) 735-7728
email: noelle.graham@usda.gov
Project Name: Big Blue Mill
Turn Around Time: ✓ Routine *72 Hour Rush *48 Hour Rush *24 Hour Rush
Project Location: Sequoia NF
*Lab TAT Approval: By: *Additional Charges Apply

Additional Reporting Requests: Include QC Data Package: ☐ Yes ☐ No; FAX Results: ☐ Yes ☐ No; Email Results: ☐ Yes ☐ No; State EDT: ☐ Yes ☐ No (Include Source Number in Notes)

Sampler Information
Name: Noelle Graham-Wakoski
Employer: US Forest Service
Signature: [signature]

Matrix: DW = Drinking Water; WW = Waste Water; GW = Ground Water; S = Source; SG = Sludge; L = Liquid; M = Miscellaneous

| Sample ID | Date | Time | # of Containers & Preservatives (Unpreserved, H2SO4, HCl, HNO3, Na2S2O3, NaOH, NaOH/Zn Acetate, NH4Cl, PDC) | Total # of Containers | Sample Type (Routine / Resample / Special) | Analysis Requested: CAM 17 Metals | Matrix | Notes |
|---|---|---|---|---|---|---|---|---|
| 444 | 1/14/20 | | | 1 | | ✓ | Soil | |
| R-15 | ↓ | | | 1 | | ✓ | ↓ | |
| 441 | ↓ | | | 1 | | ✓ | ↓ | |
| 439 | ↓ | | | 1 | | ✓ | ↓ | |
| 431 | ↓ | | | 1 | | ✓ | ↓ | |
| 435 | ↓ | | | 1 | | ✓ | ↓ | |
| 442 | ↓ | | | 1 | | ✓ | ↓ | |
| 434 | ↓ | | | 1 | | ✓ | ↓ | |
| 445 | ↓ | | | 1 | | ✓ | ↓ | |

| Relinquished By (sign) | Print Name / Company | Date / Time | Received By (sign) | Print Name / Company |
|---|---|---|---|---|
| Noelle Graham-Wakoski | [signature] US Forest Service | 1/15/2020 1404 | [signature] | [illegible] / ESB |

c/o Cleveland National Forest
10845 Rancho Bernardo Rd, San Diego 92127

By signing on behalf of your organization and relinquishing this chain of custody you agree to abide by the Babcock Laboratories, Inc. Terms and Conditions.

(For Lab Use Only) Sample Integrity Upon Receipt/Acceptance Criteria

| | | |
|---|---|---|
| Sample(s) Submitted on Ice? | Yes (No) | Sample meets laboratory acceptance criteria? (Yes) |
| Custody Seal(s) Intact? | Yes No (NA) | Permission to continue: Yes |
| Sample(s) Intact? | (Yes) No | Deviation/Notes: Per analysis no temp. req |
| Temperature: | ___ °C ☐ Cooler Blank | Signature/Date: [initials] 1/15/2020 |

**C0A1592**
Rc'd: 01/15/2020 14:04
JMG

Forest Service
Pacific Southwest Region
Regional Office, R5
1323 Club Drive
Vallejo, CA 94592
(707) 562-8737
TDD: (707) 562-9240

**File Code:** 2160 **Date:** February 26, 2020
**Route To:**

**Subject:** Time Critical Removal Action Memorandum for the Big Blue Mill Site, Sequoia National Forest

**To:** Forest Supervisor, Sequoia National Forest

Enclosed you will find the signed Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Action Memorandum for the time critical removal action at the Big Blue Mill Site on the Sequoia National Forest. The Action Memorandum describes the site investigation work conducted to date and identifies the site response action to be undertaken to address the site contamination concerns in accordance with the National Contingency Plan.

Upon completion of the removal action, Noelle Graham-Wakoski, the site On-Scene Coordinator, needs to provide the Regional Environmental Engineer with a copy of the removal action completion report and the CERCLA administrative record for the project. If you have any questions regarding this matter, please contact Dennis Geiser, Regional Environmental Engineer, at 707-562-8729.

TYRONE KELLEY
Director of Engineering

Enclosure: Big Blue Mill final TCRA 02-14-2020

cc: Noelle Graham-Wakowski, Belinda Walker, Dennis Geiser

# TIME CRITICAL REMOVAL ACTION MEMORANDUM
# BIG BLUE MILL SITE

## I. PURPOSE

The Big Blue Mill Site (Site) is a former gold processing facility dating back to the 1860s that was associated with the nearby historic Big Blue and Sumner Mines. It is located on the western bank of the north fork of the Kern River – a tributary feeding into Lake Isabella within Kern County, California. The Site sits easterly of the historic Big Blue Mine and directly across the river from the Kern Valley airport in Kernville. It is located on National Forest System Lands under the jurisdiction, custody and control of the U.S. Department of Agriculture, Forest Service ("Forest Service"), within the Sequoia National Forest, Kern River Ranger District, Kern County, California. This land on the periphery of Lake Isabella Reservoir was acquired through a land exchange with the U.S. Army Corps of Engineers (USACE). The Forest Service is conducting response actions at the Site pursuant to its lead agency authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended under the Superfund Amendments and Reauthorization Act (SARA), 42 U.S.C. 9601 et seq., and Executive Order 12580.

The purpose of this memorandum is to select the time-critical removal action to implement institutional controls that will prevent public exposure to arsenic, lead and mercury contaminated tailings at the Big Blue Mill Site. This response action consists of area closure of this 4.1-acre Site to the public to prohibit public access and use of the Site by Forest Service issuance of a Forest Closure Order. These site access restrictions will prevent immediate on-site exposure while the Forest Service completes additional studies and related actions needed for implementing a response action to abate the release, or threat of a release of hazardous substances posed by the contaminated tailings at the Site.

The conditions at the Site meet the criteria for a removal action under Section 300.415 of the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). This decision document, called a Time-Critical Removal Action Memorandum (TCRAM), presents the Forest Service's selected removal response action for the Site, chosen in accordance with CERCLA and to the extent practicable, the NCP. This TCRAM is based upon the administrative record for the Site. No Federal, State or local permits are required for this on-site response actions, 42 USC 9621 (c) and 40 CFR 300.400 (e).

## II. SITE CONDITIONS AND BACKGROUND

### A. Site Location

The Big Blue Mill Site is located along the western shore of the Kern River, north east of the historic Big Blue and Sumner mines and across the Kern River from the Kern Valley airport. It is located on National Forest System Lands under the jurisdiction, custody and control of the Sequoia National Forest, Kern River Ranger District. The Site lies just south of Kernville, California within Section 27 of Township 25 South, Range 33 East of the Mt. Diablo Base Meridian at an elevation of approximately 2600 feet (Figure 1).

The Site lies on the western bank of the Kern River, approximately 2 miles upstream of Lake Isabella. The Site can be accessed by taking California State Highway 178 east from Bakersfield toward Lake Isabella, California. Then turn left and head north on Highway 155 toward Wofford Heights. Continue north on Highway 495 (Burlando Road) toward Kernville for approximately three miles to the Site on the right side, which is approximately 800 feet east of the road toward the Kern River. The preferred access to the Site within Forest Service land is via the abandoned golf course just south of downtown Kernville. This path entails one mile of travel on a single lane track. The north end of the Site is the northern portion of the mill building foundations and the south end of the Site is just beyond the ragged peak along the shoreline of the Kern River.

## B. Site Description

The Site is approximately 4.1 acres in size located on the western shoreline of the Kern River. The only physical evidence remaining at the Site of the former mill structures are concrete foundations and dilapidated retaining walls (Photographs 1 & 2). The Site is strewn with driftwood and other river debris and indicates that the site is subject to periodic flooding. Along the shoreline there is clear evidence of tailings and mineral processing wastes from the former mill operations. There is evidence of iron oxide suspected from roasting operations associated with former mineral processing activities at the Site.

The mill foundation and tailings materials are located within 100 feet of an occupied residence that was constructed up to the Forest Service property boundary in the early 2000s, and within 500 and 1000 feet of two additional occupied residences (Figure 4 and Photographs 3 & 4). Given the large footprint of the former mill and associated mineral processing operations, there is the potential likely that the nearest residence may have been constructed within the footprint of the former mill operation.

The Kern River area is a popular rafting and fishing corridor for locals and recreationists. There is a worn "Fisherman's trail" that runs parallel to the shoreline through the area (Photograph 5). The former mill site the area is also used as an area of rest for those rafting on the popular Kern River as there are permitted commercial rafting corridors along the Kern River in this area.

## C. Operational History

The Big Blue Mill Site, also referred to as the "Sumner Mill" in some historic reports, is a former gold ore processing facility dating back to the 1860s that was associated with the nearby historic Big Blue and Summer group of mines. The Big Blue and Sumner group of mines are located southwest of the Site (see Figure 1) and were part of the historic Cove Mining District on the west side of the Kern River Valley. The September 15, 1896, Thirteenth Report of the State Mineralogist, for the California State Mining Bureau, indicates that there were multiple mining claims associated with mill site, these being the Big Blue, Commonwealth, Content, Nelly Dent, Nelly Dent Extension, Sumner, and Summer 5 Extensions (Beauregard, Bull Run, Frank, Jeff Davis, Lady Bell, and Urbana). According to the January 1940 "Volume 36 California Journal of Mines and Geology", the gold vein mined by these mines was first discovered in 1860.

Historic records from the California State Division of Mines indicate that mineral processing operations were conducted at the site dating back to the 1860s. At least four different mineral processing operations occurred at the Site, including: a 16-stamp mill from approximately 1867 through the mid-1870s, an 80-stamp mill from 1875 through 1883, a 10-stamp mill from approximately 1901 through 1932 and floatation plant and ball mill from 1934 – 1943. Historic records state that the 80-stamp mill was the largest of its kind at the time.

According to several Annual Reports of the State Mineralogist, up until the 1930s, tailings and other materials from the mill operations were dumped into the Kern River and most washed down stream. In the early 1930s, the flotation plant and ball mill were installed at the Site (1934 30th Annual Report of the State Mineralogist) from which point tailings from the processing operations were pumped across the Kern River and deposited into a tailings pond.

During the 1930s and early 1940s tailings were pumped across the river to a "tailings pond" located on the eastern banks of the river (Figure 3). The Big Blue Mill ceased operations in 1943 when regulations were instituted by the U.S. Government limiting sale of mining supplies to producers of strategic metals needed in the war effort and gold was not one of the strategic metals (Powers, 1940). The 1962 report "Mines and Mineral Resources of Kern County, California" by the California Division of Mines and Geology states that Order L208 caused the mine to be shut down permanently.

In 1948, US Army Corps of Engineers (USACE) began construction of the Lake Isabella Dam and reservoir project. In 1954, to complete the reservoir project, the USACE acquired all land below elevation 2617 feet (California Division of Mines and Geology, 1962). This included Big Blue Mill site which was at a lower elevation than the spillway of Lake Isabella dam. In 1957, the mill was sold at auction, and removed to New Mexico (California Division of Mines and Geology, 1962). In 1991, in order to ensure ongoing public access to recreational activities along the river, this USACE floodplain land area was exchanged, from the USACE to the USDA Forest Service.

## D. Other Actions to Date

A Removal Preliminary Assessment (PA) report for the Big Blue Mill Site was completed February 14, 2020 (Graham-Wakoski, 2020). The investigation was initiated because of the Site's historical connection to the tailing materials discovered in 2011 in the floodplain on the east side of the Kern River. A site assessment of the Big Blue Mill Site was conducted on January 14, 2020 by Forest Service On-Scene Coordinators, Rick Weaver and Noelle Graham-Wakoski using two separate field X Ray Fluorescence (XRF) field instruments to assess whether contaminants from historic mineral processing operations are present. Field XRF screening found that elevated concentrations of arsenic, lead and mercury are present in the mill tailings present in the area.

Arsenic is present at concentrations ranging from non-detect to 239,639 mg/kg, with most readings exceeding the initial site background levels of 15 mg/kg.

Lead is present at concentrations ranging from range of non-detect to 12,513 mg/kg with most readings exceeding the initial background reading of 21 mg/kg.

Mercury is present at concentrations ranging from non-detect to 3,896 mg/kg with most readings exceeding the initial background reading of 8 mg/kg.

Table 1 below presents the XRF sampling results for arsenic, lead and mercury from the January 14, 2020, site visit. XRF sampling locations are show on Figure 4.

**Table 1: Big Blue Mill Site Removal Preliminary Assessment XRF Results**

| Big Blue Mill | Arsenic, mg/kg | | Mercury, mg/kg | | Lead, mg/kg | |
|---|---|---|---|---|---|---|
| **Sample number/description** | **XRF** | **+/- Var** | **XRF** | **+/- Var** | **XRF** | **+/- Var** |
| **Thermo Scientific Niton Model XL3t-600** | | | | | | |
| 429 - white tailings on top, brown silty at 0.5", powdery | 405 | 35 | ND | 17 | 506 | 39 |
| 430 -white tailings - center of site | ND | 6 | ND | 9 | ND | 7 |
| 431 -fine, silty, brown-center of site | 143,314 | 864 | 1,183 | 117 | 3,356 | 170 |
| 432-center of site | 116,272 | 4,338 | ND | 300,000 | 3,326 | 190 |
| 434-rust colored, clumpy, easily breakable | 138,125 | 832 | 743 | 102 | 3,144 | 161 |
| 437-rust colored | 8,503 | 104 | 53 | 16 | 723 | 38 |
| 438 - fine silty, brown | 249 | 25 | ND | 22 | 83 | 18 |
| 439-fine, silty, brown-mid bank on South end | 11,518 | 123 | 122 | 20 | 972 | 45 |
| 440-south end | 8,946 | 108 | 26 | 15 | 420 | 31 |
| 441-fine, silty, brown-bank area on south end | 953 | 32 | ND | 13 | 90 | 14 |
| 443-fine, silty, brown-below mill foundation, north end | 41,099 | 304 | 1,240 | 67 | 766 | 55 |
| 445-rust colored, clumpy, hardened-below main foundation-North end | 22,579 | 185 | 149 | 25 | 1,592 | 62 |
| **Olympus Delta XRF Model DS-4000** | | | | | | |
| 3-North White Tailings | 217,719 | 1,637 | ND | | 12,513 | 131 |
| 4-North White Tailings | 103,772 | 1,707 | 3,653 | 85 | 3,520 | 65 |
| 5-North White Tailings | 172,971 | 3,667 | 3,694 | 115 | 2,129 | 55 |
| 6-White Tailings | 83,419 | 1,276 | 1,673 | 50 | 2,229 | 41 |
| 7-Sample Bag | 159,533 | 3,240 | 3,570 | 107 | 2,336 | 57 |
| 8-Sample Bag | 152,928 | 2,985 | 3,016 | 94 | 2,733 | 62 |
| 9-Red Conglomerate | 10,924 | 118 | 188 | 11 | 650 | 11 |
| 10-South White Tailings | 5,710 | 62 | 2,642 | 36 | 4,954 | 54 |
| 11-Red Conglomerate | 16,461 | 184 | 1,330 | 26 | 1,857 | 25 |
| 12-Red Conglomerate | 54,136 | 371 | ND | | 6,328 | 65 |
| 13-Red Conglomerate | 8,774 | 97 | 607 | 16 | 540 | 10 |
| 14-South Rocky Point | 207,984 | 4,720 | 3,896 | 132 | 3,761 | 96 |
| 15-White Chunks, Bagged | 181,752 | 3,890 | 846 | 73 | 8,257 | 186 |
| 16-Riverbank, Mill Bldg. | 46,355 | 581 | 156 | 21 | 1,877 | 29 |
| 17-Yellow Chunk | 18,749 | 200 | 220 | 14 | 1,356 | 19 |
| 18-NW Mill Bldg./Riverbank | 9,303 | 96 | 287 | 12 | 910 | 13 |
| 19-Floodplain North Side | 133 | 4 | 53 | 4 | 124 | 4 |
| 20-East Mill Bldg. Foundation | 239,639 | 6,021 | ND | 78 | 2,479 | 74 |
| 21-East Mill Bldg. Foundation | 2,484 | 24 | 10 | 4 | 91 | 3 |
| 22-Background | 15 | 2 | 8 | 3 | 21 | 2 |

### E. State and Local Authorities Roles

The Forest Service has delegated CERCLA authority and is the lead agency for response actions where the release is on, or the sole source of the release is from, National Forest System Lands at non-National Priorities List sites. No other appropriate response mechanisms or authorities are currently available to address this site.

In compliance with the Forest Service's role in protecting the public health and welfare and the environment, and because the release or threatened releases are on NFS lands under the administration of the Sequoia National Forest, and pursuant to the authority found at 42 U.S.C. 9604(a), Executive Order 12580, and 7 CFR 2.60, the Forest Service issues this Action Memorandum. The response action will be not inconsistent with the NCP.

## III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

### A. Threats to Public Health, or Welfare or the Environment

The release of hazardous substances from the drainage emanating from the Site supports the determination that it poses threats to public health, welfare and the environment and that it is appropriate to implement the response actions described in this AM. In accordance with Title 40 Code of Federal Regulations, Part 300, Section 415 (40 CFR 300.415), the following conditions indicate that removal action is warranted for the Site:

#### i. § 300.415 (b) (2) (i) Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby human populations, animals, or the food chain;

Public Health and Welfare:

The contaminants of potential concern that have been identified to date are arsenic, lead, and mercury, and are hazardous substances or pollutants or contaminants as defined by sections 101 (14) and 101 (33) of CERCLA, as amended, 42 U.S.C. Section 9601(14) and (33).

The Removal PA for the Big Blue Mill Site compared site XRF data against established risk-based screening levels (SLs) to evaluate whether a release has occurred and to get an initial understanding of the potential risks. The Removal PA compared site data against the Regional Screening Level (RSLs) developed by the US EPA for residential and industrial populations (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables) and the recreational exposure SLs developed by the Bureau of Land Management (BLM) for metals in soils at AML sites.

Site XRF data regarding the nature and extent of mill-waste contamination compared to human health screening levels are summarized below in Table 2.

Table 2: Summary of Contaminant Concentrations Compared To Site Background and Human Health Screening Levels

| | Arsenic (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) |
|---|---|---|---|
| XRF Detection Range | ND - 239,639 | ND - 12,513 | ND - 3,896 |
| Site Background | 15 | 21 | 8 |
| Site Background Exceedance | 0 - 15,976 times | 0 - 596 times | 0 - 487 times |
| EPA Residential RSL[1] | 0.68 | 400 | 11 |
| EPA Residential RSL Exceedance | 0 - 352,410 times | 0 - 31 times | 0 - 354 times |
| EPA Industrial RSL[1] | 3 | 800 | 46 |
| EPA Industrial RSL Exceedance | 0 - 78,880 times | 0 - 16 times | 0 - 85 times |
| BLM Recreation SL[2] | 30.6 | 800 | 271 |
| BLM Recreation SL Exceedance | 0 - 7,831 times | 0 - 16 times | 0 - 14 times |

[1] (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)

[2] September 2017 Update, BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

Site exposure pathways of concern due to the presence of arsenic, mercury and lead are through inhalation, dermal exposure and ingestion. Contamination is present within 100 feet from an occupied residence on private land and within 500 feet and 1,000 feet of two other residences on separate private parcels. Mill waste and tailings are present in surface deposits and soils and are susceptible to migration because of water- and wind-borne influences. Some of the contaminated materials are un-vegetated and exposed on the banks of the Kern River and there is evidence of on-going erosion into the river. There is a high likelihood of transferring contamination to clothing, equipment and vehicles that would result in contaminated material being transported and deposited at off-site locations such as residences and offices.

Fishing is very popular along the Kern River from the shoreline. A well-used 'Fishermen's Trail' exists through the Site and a fishing platform was observed on the heavy metal impacted tailing materials at the shoreline.

The XRF values obtained during the Removal PA indicate that contamination is present as a result of historic mineral processing activities at the Site. Concentrations of arsenic, lead, and mercury greatly exceed site background levels and established human health risk screening thresholds and indicates that the site poses an exposure hazard to nearby populations.

ii. **§ 300.415 (b) (2) (iv): High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;**

Elevated concentrations of arsenic (239,639 mg/kg), lead (12,513 mg/kg) and mercury (3,896 mg/kg) in mill tailings exceed Site background levels (up to 15,976 times for arsenic, 596 times for lead, and 487 times for mercury) and indicates that a release of hazardous substances to the environment has occurred. These materials are un-vegetated and exposed on the banks of the Kern River and there is evidence of on-going erosion into the river. The Site is also subject to periodic flooding from the river and strong winds in the Kern river valley. The tailings are susceptible to migration because of water- and wind-borne influences

iii. **§ 300.415 (b) (2) (vii): Availability of Other Appropriate Federal or State Response Mechanisms to Respond to the Release;**

The Site is located on National Forest System lands under the jurisdiction, custody and control of the U.S.D.A. Forest Service, within the boundaries of the Sequoia National Forest. There are no other appropriate Federal or State response mechanisms to respond to the threat of release at this Site.

## IV. ENDANGERMENT DETERMINATION

Conditions represent a potential threat of release of a CERCLA hazardous substance threatening to public health, or welfare, or the environment based on the factors set forth in the NCP, 40 CFR § 300.415(b)(2). Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response actions selected in this Action Memorandum, will continue to present an imminent and substantial endangerment to public health, or welfare, or the environment

## V. PROPOSED ACTION AND ESTIMATED COSTS

### A. Proposed Actions

The scope and goal for this time-critical removal action is to prevent human exposure to elevated concentrations of arsenic, lead, and mercury at the Big Blue Mill Site. The concentration of arsenic, lead, and mercury present in the tailings are at the ground surface throughout the former mill site and pose an exposure threat to site visitors.

The proposed action would implement institutional controls to restrict all public access to the Site and the area of contamination. These controls include a prohibition on all public entry to the Site. Warning signs would be placed at the boundaries to identify the nature of the exposure hazard and would be placed in a manner that encompasses the contaminated area as presently known.

Figure 5 shows the approximate boundaries of the closed area. The closure area includes the former mill area east and northeast of the adjacent private residence (Parcel APN 296-110-11-00-1) and the area between the Kern River and private residences (Parcel APNs 296-110-11-00-1 and 296-110-12-00-4). This area may be expanded depending on the results of future site investigations.

Enforcement of the institutional controls and site access restrictions will be through the issuance of a Forest Closure Order by the Sequoia National Forest. The Forest Closure Order will contain the legal description of the area to be closed and will provide the mechanism for enforcement of the CERCLA site access restrictions.

The current assessment of the extent of elevated heavy metals present in the soil-like tailings is based on a preliminary field screening. There is a need for additional sampling to establish the vertical and lateral extent of the contamination present at the Site. The results of this additional investigation will determine future CERCLA response actions at the Site.

This proposed action shall, to the extent practicable, considering the exigencies of the situation, attain ARARs under federal or state environmental or facility siting laws. Other federal and state advisories, criteria or guidance may, as appropriate, be considered in formulating the removal action.

## VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

The risk of delay is the risk of arsenic, mercury, and lead exposure to human populations. Failure to restrict access to the Site will permit direct contact by individuals with arsenic, mercury, and lead contamination without realizing this hazard exists. It will permit exposure to soils contaminated with these heavy metals resulting in potential contamination of footwear and clothing and potential off-site contamination of vehicles and residences. Inhalation of dust contaminated with arsenic, mercury, and lead has the potential to occur by local residents and recreationalists fishing from the shoreline or exiting rafts or other water craft stepping onto the shore at the former Big Blue Mill Site.

## VII. OUTSTANDING POLICY ISSUES

None have been identified at this time.

## VIII. ENFORCEMENT

To date, the Forest Service has not completed its investigation of potentially responsible parties (PRPs) for the Site. PRP investigation efforts are on-going. Forest Service law enforcement personnel are expected to provide enforcement of this time critical removal action's Forest Closure Order.

## IX. DECISION

Conditions at the Site satisfy NCP Section 300.415 (b) (2) criteria for a removal action. The removal action for the Big Blue Mill Site was developed in accordance with CERCLA, as amended, and is not inconsistent with the NCP. The closure order and related actions address the immediate human health exposure concerns arising from the presence of hazardous substances in the tailings present at the ground surface at the former Big Blue Mill Site.

Approval is hereby given by the Forest Service to conduct a time-critical removal action to implement institutional controls to restrict public access to the former Big Blue Mill Site on the Sequoia National Forest.

Approval Signature

Tyrone Kelley 2/26/2020

Tyrone Kelley
Director of Engineering
USDA Forest Service Pacific Southwest Region

Date

## References Cited

September 15, 1896, Thirteenth Report (Third Biennial) of the State Mineralogist For The Two Years Ending September 15, 1896, California State Mining Bureau

January 1934, Volume 30 California Journal of Mines and Geology Quarterly Chapter of State Mineralogist's Report XXX, State Division of Mines

January 1940, Volume 36 California Journal of Mines and Geology Quarterly Chapter of State Mineralogist's Report XXXVI, State Division of Mines

1962, Mines and Mineral Resources of Kern County, California, California Division of Mines and Geology, County Report 1

September 2017 Update, BLM Technical Memorandum: Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

February 2020, Removal Preliminary Assessment Report for the Big Blue Mill Site, Sequoia National Forest. Noelle Graham-Wakoski, USDA Forest Service (Pacific Southwest Region)

# FIGURES

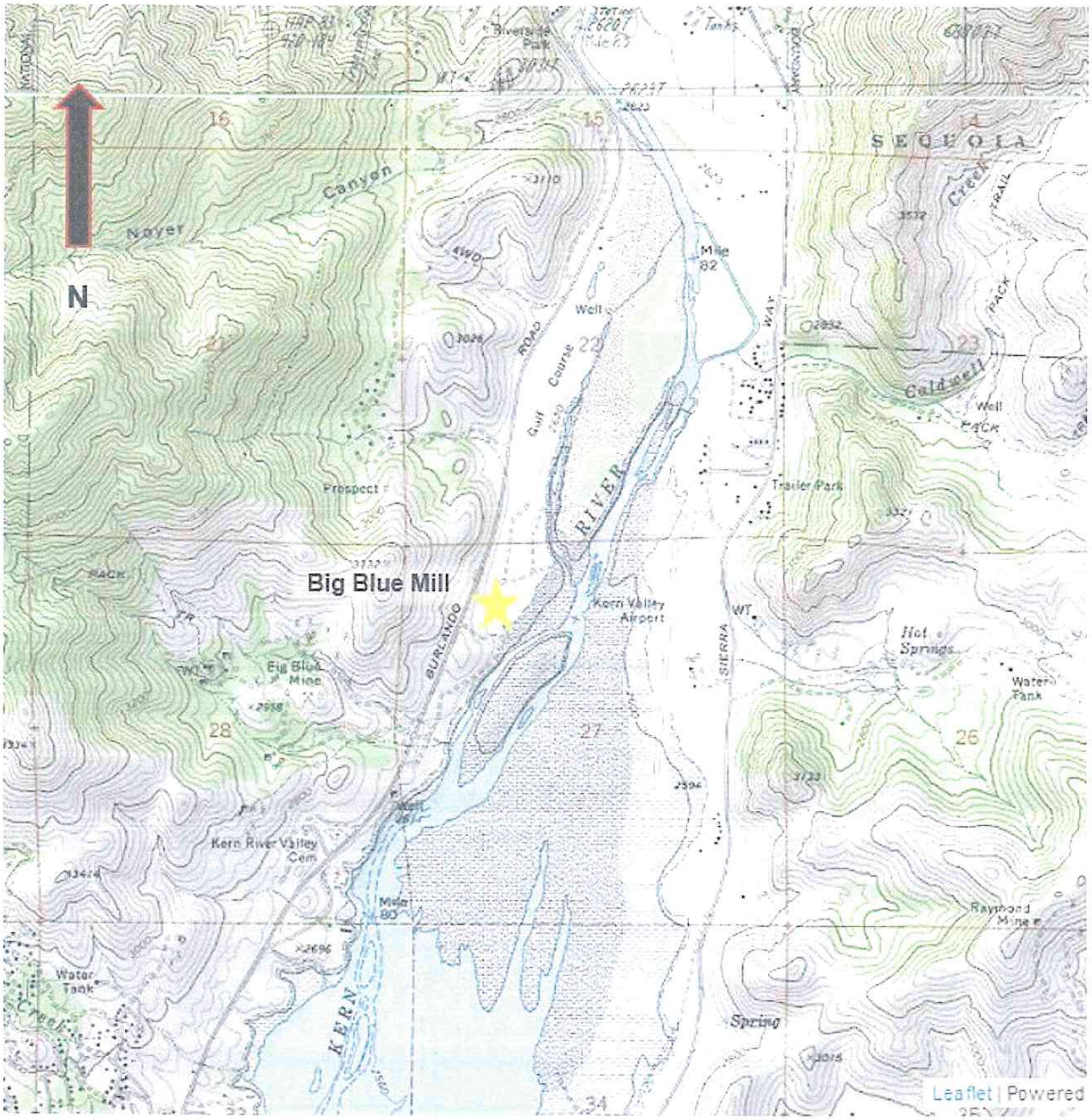



Figure 1 - Map showing location of former Big Blue Mill Site.

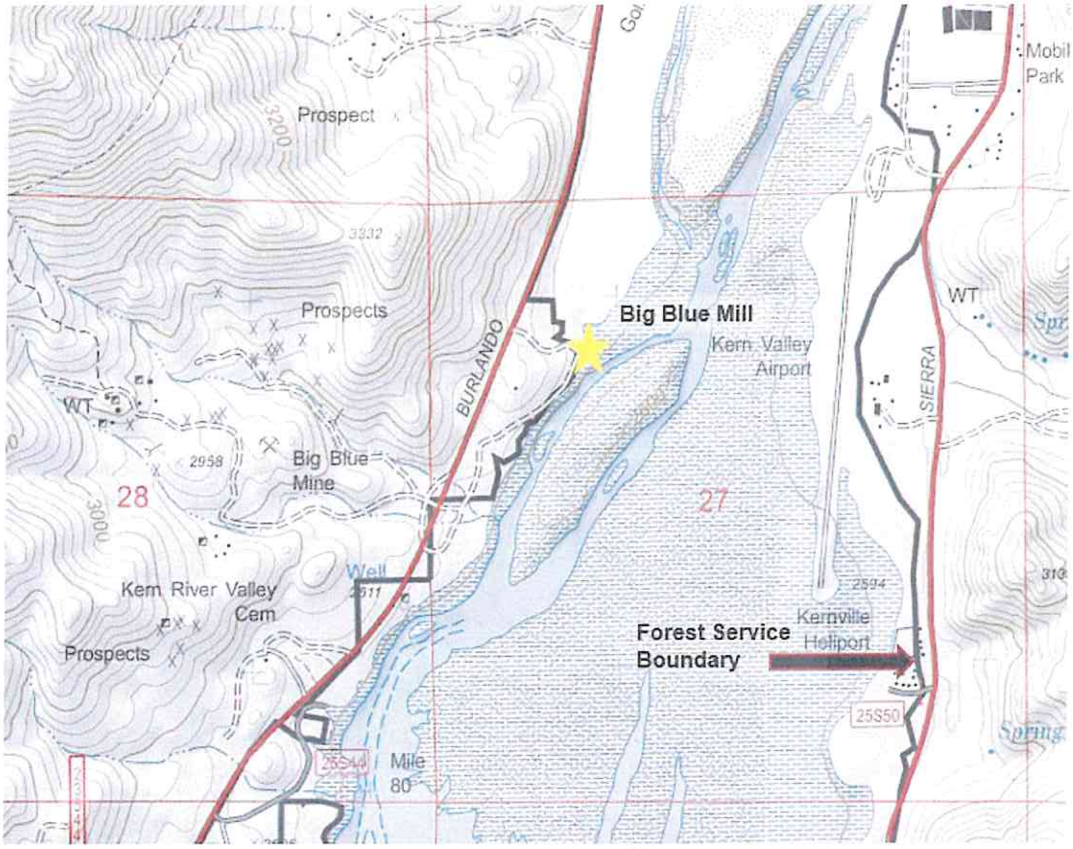



Figure 2 - Forest Service Boundary shown in black above

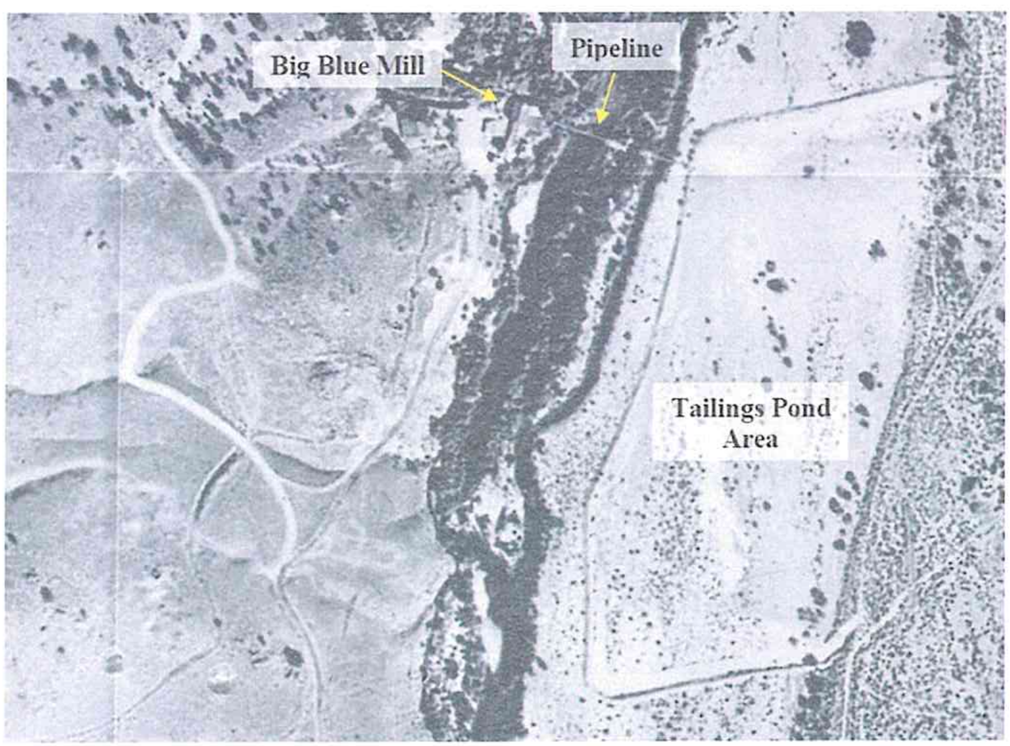



Figure 3 - October 20, 1938 Aerial photo showing Big Blue Mill, pipeline, and tailings pond area


Figure 4 – X-Ray Fluorescence (XRF) Sampling Locations, Big Blue Mill Site

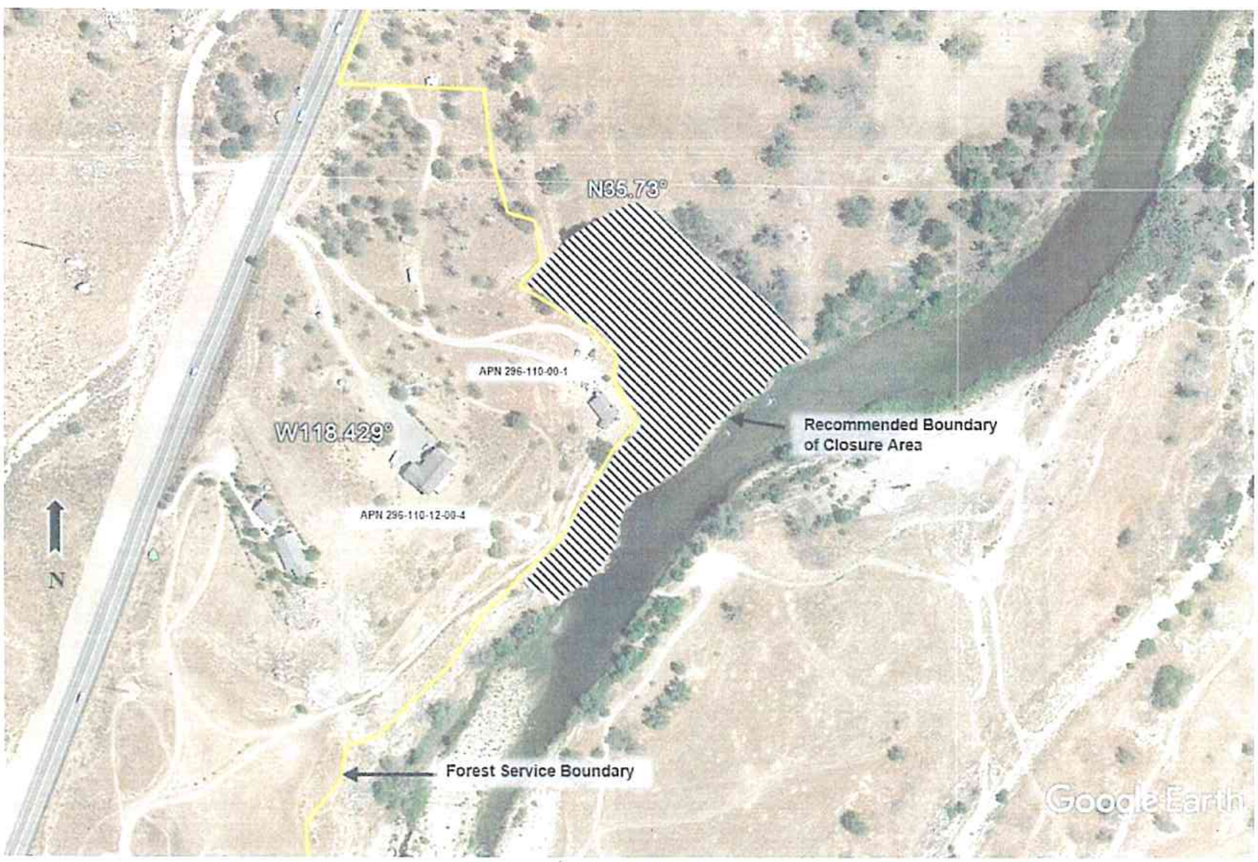
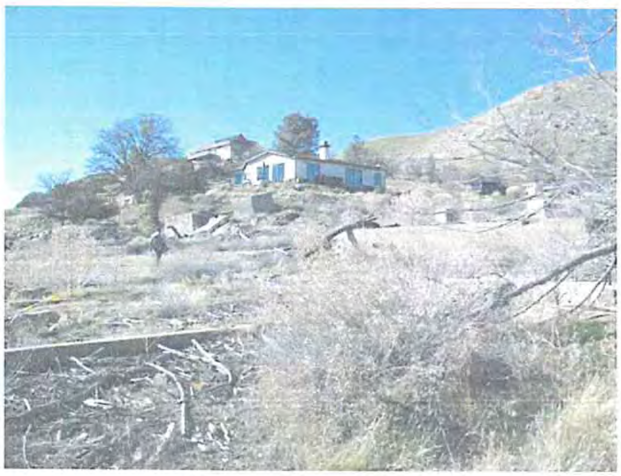
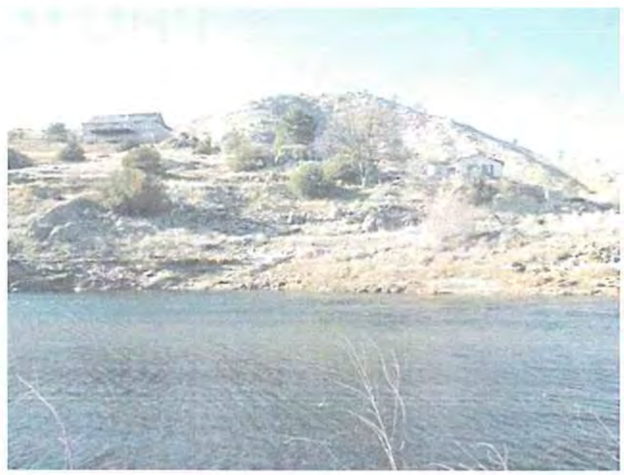



Figure 5 - Approximate Boundaries of Forest Closure Area and Access Restrictions

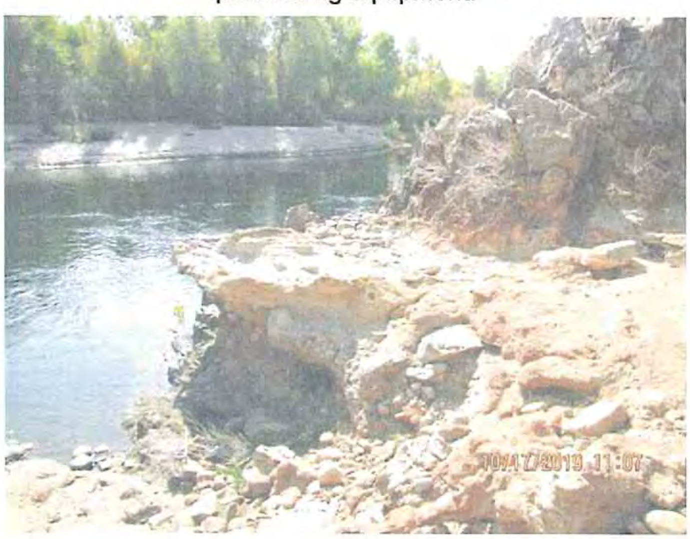
# PHOTOGRAPHS

Photographs 1 & 2 - Concrete foundations that once supported structures and processing equipment at the Big Blue Mill





Photographs 3 & 4 - Proximity of nearby residences to the foundations that once supported structures and processing equipment.



Photograph 5 - Popular fishing platform above the Kern River comprised of mill tailing deposits.

**ORDER NO. 0513-20-03**

SEQUOIA NATIONAL FOREST
KERN RIVER RANGER DISTRICT
BIG BLUE MILL SITE AREA CLOSURE

Pursuant to 16 USC 551 and 36 CFR 261.50(b), and to provide for public safety, the following acts are prohibited within the Big Blue Mill Site Closure Area within the Kern River Ranger District of the Sequoia National Forest. This Order is effective from March 5, 2020, through February 27, 2022.

> Going into or being upon National Forest System lands within the Big Blue Mill Site Closure Area. The Big Blue Mill Site Closure Area boundary begins at a point approximately 750 feet from the southwest corner of the northwest quarter of Section 27, Township 25 South, Range 33 East, Mount Diablo Base and Meridian, then continues north approximately 2,300 feet along the boundary of the Sequoia National Forest to a point 250 feet east of the intersection of the Forest boundary and Burlando Road, then continues due east approximately 1,200 feet to the west bank of the Kern River, then continues south approximately 2,500 feet along the Kern River to a point 650 feet from where the Forest boundary intersects with Burlando Road, then continues due west approximately 220 feet back to the starting point, as shown on the attached map. 36 CFR 261.53(e).

Pursuant to 36 CFR 261.50(e), the following persons are exempt from this Order:

1. Any Federal, State or local officer, or member of an organized rescue or fire-fighting force in the performance of an official duty with explicit approval from the Forest Service Regional On-Scene Coordinator.
2. Persons with a contract from the Forest Service specifically authorizing work within the Big Blue Mill Site Closure Area and their employees, subcontractors or agents, to the extent authorized by the contract.
3. Persons, who have explicit approval from the Forest Service Regional On-Scene Coordinator, with a Permit for Use of Roads, Trails, or Areas Restricted by Regulation or Order (Form FS-7700-48) from the Forest Service specifically authorizing the otherwise prohibited act or omission.

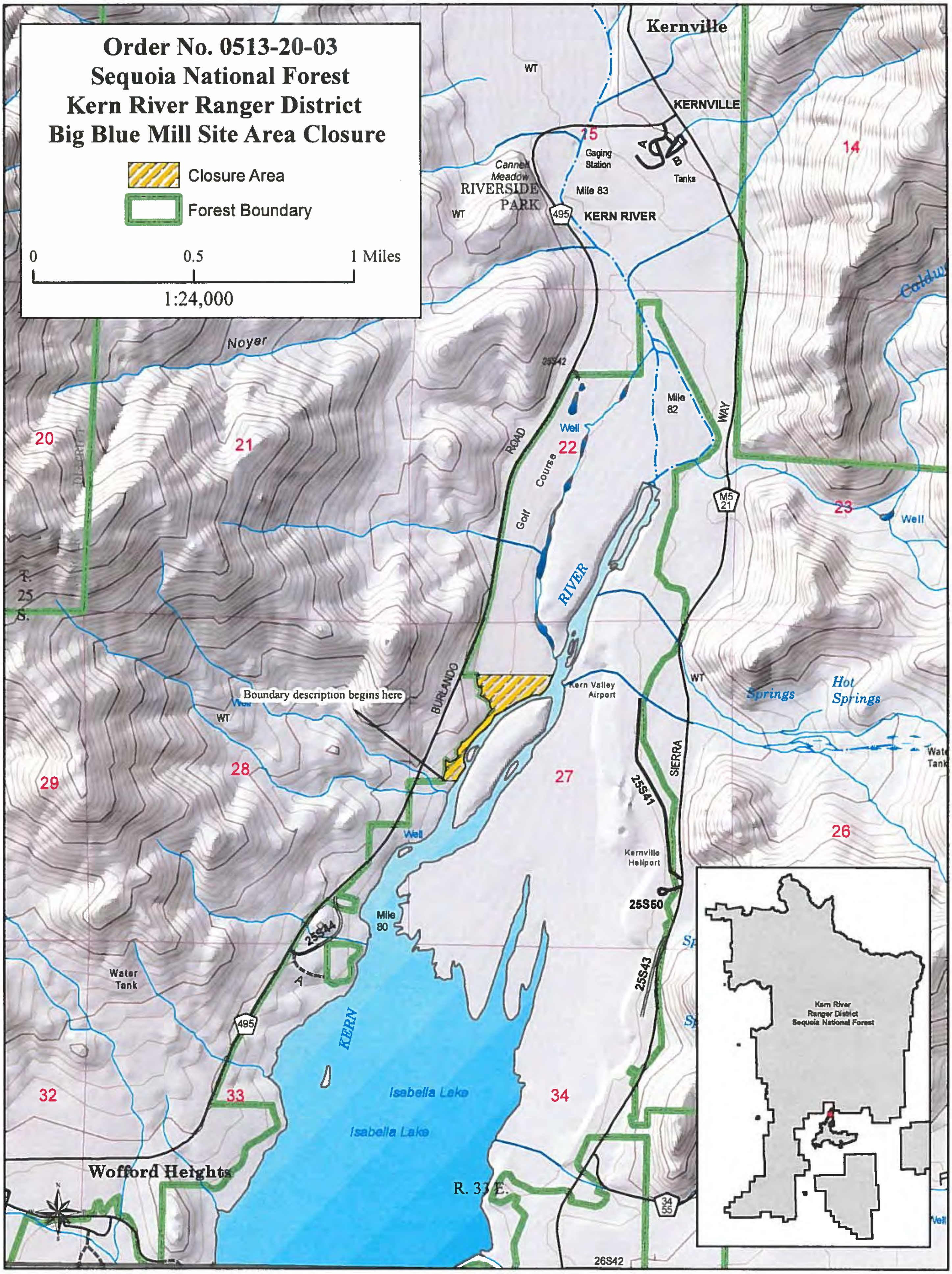
These prohibitions are in addition to the general prohibitions in 36 CFR Part 261, Subpart A. A violation of these prohibitions is punishable by a fine of not more than $5,000 for an individual or $10,000 for an organization, or imprisonment for not more than six months, or both. 16 USC 551 and 18USC 3559, 3571, and 3581.

Executed in Porterville, California this 4th day of March, 2020.

Teresa Benson

TERESA BENSON
Forest Supervisor
Sequoia National Forest

This Order supersedes Order No. 0513-20-02, dated February 27, 2020.



Order No. 0513-20-03
Sequoia National Forest
Kern River Ranger District
Big Blue Mill Site Area Closure
Closure Area
Forest Boundary
0
0.5
1 Miles
1:24,000
Kernville
KERNVILLE
Gaging Station
Tanks
Cannell Meadow
RIVERSIDE PARK
Mile 83
KERN RIVER
495
Noyer
25S42
Mile 82
Well
Golf Course
RIVER
ROAD
WAY
M5 21
Kern Valley Airport
Boundary description begins here
BURLANDO
SIERRA
Hot Springs
Springs
25S41
Kernville Heliport
25S50
25S43
25S44
Mile 80
Water Tank
KERN
Isabella Lake
Wofford Heights
R. 33 E.
T. 25 S.
34 55
26S42
14
15
20
21
22
23
26
27
28
29
32
33
34
Kern River Ranger District Sequoia National Forest


A08-0001


15
22
32
5
26
27
35
34
33
4
T.23S.,R.34E.
T.24S.,R.34E.
KERN RIVER
BIG BLUE MILL
KERNVILLE
CALDWELL
UPPER HOT SPRINGS
SUMNER RANCH
COUNTY ROAD
SPILLWAY
CANAL HEADGATE
TILLY CREEK
Old stake marked ¼ S.
Gov't stake in rock mound.
Stake in rock mound.
Rock in rock mound.
Old axle in rock mound.
Pipe in rock mound.
Rock in rock mound
Iron Pipe
Diversion Dam

# Appendix B
# Soil Map

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for Kern County, Northeastern Part, and Southeastern Part of Tulare County, California

## Big Blue Mill Site


February 20, 2021

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Soil Map


Map Scale: 1:9,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 450, 900, 1800, 2700

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

**Special Point Features**

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kern County, Northeastern Part, and Southeastern Part of Tulare County, California
Survey Area Data: Version 13, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 9, 2015—Nov 2, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

| MAP LEGEND | MAP INFORMATION |
| --- | --- |
| | imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident. |

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 220 | Aquents-Aquolls-Riverwash complex, 0 to 5 percent slopes, flooded | 211.8 | 50.4% |
| 241 | Inyo gravelly loamy coarse sand, 0 to 5 percent slopes | 4.0 | 1.0% |
| 246 | Chollawell gravelly loamy coarse sand, 5 to 15 percent slopes | 49.4 | 11.7% |
| 300 | Stineway-Kiscove association, 30 to 60 percent slopes | 89.3 | 21.2% |
| 310 | Stineway-Kiscove association, 5 to 30 percent slopes | 36.7 | 8.7% |
| 330 | Kernville-Faycreek-Rock outcrop complex, 30 to 75 percent slopes | 5.5 | 1.3% |
| 441 | Inyo-Urban land complex, 0 to 5 percent slopes | 5.4 | 1.3% |
| 509 | Xyno-Faycreek-Rock outcrop complex, 30 to 60 percent slopes | 0.3 | 0.1% |
| 523 | Kernville-Faycreek-Rock outcrop association, 30 to 60 percent slopes | 7.2 | 1.7% |
| W | Water | 11.1 | 2.6% |
| **Totals for Area of Interest** | | **420.6** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Kern County, Northeastern Part, and Southeastern Part of Tulare County, California

## 220—Aquents-Aquolls-Riverwash complex, 0 to 5 percent slopes, flooded

### Map Unit Setting

*National map unit symbol:* hp99
*Elevation:* 2,600 to 3,100 feet
*Mean annual precipitation:* 6 to 8 inches
*Mean annual air temperature:* 59 to 64 degrees F
*Frost-free period:* 200 to 220 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Aquents and similar soils:* 40 percent
*Aquolls and similar soils:* 35 percent
*Riverwash:* 15 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Aquents

#### Setting

*Landform:* Flood plains, mountain valleys, channels, depressions
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear, concave
*Across-slope shape:* Linear, concave
*Parent material:* Alluvium derived from granite

#### Typical profile

*A - 0 to 7 inches:* loamy fine sand
*Cng - 7 to 18 inches:* fine sandy loam
*C - 18 to 60 inches:* loamy fine sand

#### Properties and qualities

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Very poorly drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 6.00 in/hr)
*Depth to water table:* About 0 to 24 inches
*Frequency of flooding:* NoneFrequent
*Frequency of ponding:* Frequent
*Calcium carbonate, maximum content:* 4 percent
*Gypsum, maximum content:* 1 percent
*Maximum salinity:* Nonsaline to slightly saline (1.0 to 4.0 mmhos/cm)
*Sodium adsorption ratio, maximum:* 15.0
*Available water capacity:* Low (about 5.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 4w
*Land capability classification (nonirrigated):* 6w

*Hydrologic Soil Group:* A/D
*Hydric soil rating:* Yes

### Description of Aquolls

#### Setting

*Landform:* Flood plains, mountain valleys, channels
*Landform position (two-dimensional):* Toeslope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from granitoid

#### Typical profile

*An - 0 to 3 inches:* silt loam
*A - 3 to 12 inches:* very fine sandy loam
*C - 12 to 60 inches:* loamy fine sand

#### Properties and qualities

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Very poorly drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* About 0 to 24 inches
*Frequency of flooding:* NoneFrequent
*Frequency of ponding:* Frequent
*Calcium carbonate, maximum content:* 3 percent
*Gypsum, maximum content:* 1 percent
*Maximum salinity:* Nonsaline to slightly saline (1.0 to 5.0 mmhos/cm)
*Sodium adsorption ratio, maximum:* 20.0
*Available water capacity:* Moderate (about 6.6 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 4w
*Land capability classification (nonirrigated):* 6w
*Hydrologic Soil Group:* B/D
*Hydric soil rating:* Yes

### Description of Riverwash

#### Setting

*Landform:* Mountain valleys, channels, drainageways
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from granitoid

#### Properties and qualities

*Slope:* 0 to 2 percent
*Runoff class:* High
*Depth to water table:* About 0 to 12 inches
*Frequency of ponding:* Occasional

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7w

*Hydric soil rating:* Yes

**Minor Components**

**Kelval**

*Percent of map unit:* 6 percent
*Landform:* Mountain valleys, flood plains
*Hydric soil rating:* No

**Inyo, stratified**

*Percent of map unit:* 4 percent
*Landform:* Stream terraces, mountain valleys, inset fans
*Hydric soil rating:* Yes

## 241—Inyo gravelly loamy coarse sand, 0 to 5 percent slopes

**Map Unit Setting**

*National map unit symbol:* hp9j
*Elevation:* 2,500 to 4,000 feet
*Mean annual precipitation:* 5 to 8 inches
*Mean annual air temperature:* 57 to 61 degrees F
*Frost-free period:* 190 to 220 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Inyo and similar soils:* 75 percent
*Minor components:* 25 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Inyo**

**Setting**

*Landform:* Inset fans, alluvial fans
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from mixed

**Typical profile**

*A - 0 to 8 inches:* loamy coarse sand
*C - 8 to 60 inches:* gravelly loamy coarse sand

**Properties and qualities**

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Excessively drained
*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (6.00 to 20.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* RareNone
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 3.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* A
*Ecological site:* R029XF054CA - DRY WASH 8-10 P.Z.
*Hydric soil rating:* No

### Minor Components

**Riverwash**

*Percent of map unit:* 9 percent
*Landform:* Drainageways, intermittent streams
*Hydric soil rating:* No

**Chollawell**

*Percent of map unit:* 9 percent
*Landform:* Alluvial fans, fan remnants
*Hydric soil rating:* No

**Kelval**

*Percent of map unit:* 5 percent
*Landform:* Flood plains
*Hydric soil rating:* No

**Urban land**

*Percent of map unit:* 1 percent
*Landform:* Alluvial fans
*Hydric soil rating:* No

**Kernfork**

*Percent of map unit:* 1 percent
*Landform:* Flood plains
*Hydric soil rating:* No

## 246—Chollawell gravelly loamy coarse sand, 5 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* hp9n
*Elevation:* 4,000 to 4,500 feet
*Mean annual precipitation:* 6 to 9 inches
*Mean annual air temperature:* 57 to 61 degrees F
*Frost-free period:* 190 to 220 days
*Farmland classification:* Farmland of statewide importance

**Map Unit Composition**

*Chollawell and similar soils:* 80 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Chollawell**

**Setting**

*Landform:* Fan remnants
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from granitoid

**Typical profile**

*A - 0 to 19 inches:* gravelly loamy coarse sand
*Bt - 19 to 54 inches:* gravelly coarse sandy loam
*C - 54 to 60 inches:* gravelly loamy coarse sand

**Properties and qualities**

*Slope:* 5 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* RareNone
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 4.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 6e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R029XY182CA
*Hydric soil rating:* No

**Minor Components**

**Inyo**

*Percent of map unit:* 9 percent
*Landform:* Inset fans
*Hydric soil rating:* No

**Riverwash**

*Percent of map unit:* 7 percent
*Landform:* Drainageways
*Hydric soil rating:* No

**Cowspring**

*Percent of map unit:* 3 percent
*Landform:* Hillslopes
*Hydric soil rating:* No

**Kelval**

*Percent of map unit:* 1 percent
*Landform:* Flood plains
*Hydric soil rating:* Yes

## 300—Stineway-Kiscove association, 30 to 60 percent slopes

**Map Unit Setting**

*National map unit symbol:* hpc3
*Elevation:* 2,600 to 5,000 feet
*Mean annual precipitation:* 8 to 12 inches
*Mean annual air temperature:* 54 to 63 degrees F
*Frost-free period:* 150 to 200 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Stineway and similar soils:* 50 percent
*Kiscove and similar soils:* 30 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Stineway**

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from schist and/or residuum weathered from metamorphic rock

**Typical profile**

*A - 0 to 4 inches:* very gravelly sandy loam
*Bt1 - 4 to 10 inches:* very gravelly loam
*Bt2 - 10 to 13 inches:* very gravelly loam
*R - 13 to 23 inches:* bedrock

**Properties and qualities**

*Slope:* 30 to 60 percent
*Surface area covered with cobbles, stones or boulders:* 2.0 percent
*Depth to restrictive feature:* 10 to 20 inches to lithic bedrock
*Drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water capacity:* Very low (about 1.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 6e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Kiscove

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from metamorphic rock

**Typical profile**

*A - 0 to 3 inches:* gravelly loam
*Bt - 3 to 9 inches:* gravelly clay loam
*Cr - 9 to 12 inches:* weathered bedrock
*R - 12 to 22 inches:* bedrock

**Properties and qualities**

*Slope:* 30 to 60 percent
*Depth to restrictive feature:* 5 to 19 inches to paralithic bedrock; 9 to 20 inches to lithic bedrock
*Drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 1.3 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 6e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Minor Components

**Backcanyon**

*Percent of map unit:* 5 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Rock outcrop**

*Percent of map unit:* 4 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Sesame**

*Percent of map unit:* 3 percent

*Landform:* Mountain slopes
*Hydric soil rating:* No

**Southlake**
*Percent of map unit:* 3 percent
*Landform:* Fan piedmonts
*Hydric soil rating:* No

**Alberti**
*Percent of map unit:* 2 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Riverwash**
*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Unnamed, flooded**
*Percent of map unit:* 1 percent
*Landform:* Mountain valleys
*Hydric soil rating:* Yes

**Urban land**
*Percent of map unit:* 1 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

## 310—Stineway-Kiscove association, 5 to 30 percent slopes

### Map Unit Setting
*National map unit symbol:* hpcc
*Elevation:* 2,600 to 3,200 feet
*Mean annual precipitation:* 8 to 12 inches
*Mean annual air temperature:* 52 to 62 degrees F
*Frost-free period:* 170 to 200 days
*Farmland classification:* Not prime farmland

### Map Unit Composition
*Stineway and similar soils:* 50 percent
*Kiscove and similar soils:* 30 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Stineway

**Setting**
*Landform:* Mountain slopes, hillslopes, hills
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank, side slope
*Down-slope shape:* Concave, linear

*Across-slope shape:* Concave, linear
*Parent material:* Residuum weathered from schist and/or residuum weathered from metamorphic rock

**Typical profile**

*A - 0 to 4 inches:* very gravelly sandy loam
*Bt - 4 to 14 inches:* very gravelly loam
*R - 14 to 24 inches:* bedrock

**Properties and qualities**

*Slope:* 5 to 30 percent
*Surface area covered with cobbles, stones or boulders:* 2.0 percent
*Depth to restrictive feature:* 10 to 20 inches to lithic bedrock
*Drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 1 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 1.4 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Kiscove

**Setting**

*Landform:* Hillslopes, mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank, side slope
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Parent material:* Residuum weathered from metamorphic rock

**Typical profile**

*A - 0 to 2 inches:* gravelly sandy loam
*Bt - 2 to 9 inches:* gravelly clay loam
*Cr - 9 to 12 inches:* weathered bedrock
*R - 12 to 22 inches:* bedrock

**Properties and qualities**

*Slope:* 15 to 30 percent
*Depth to restrictive feature:* 5 to 19 inches to paralithic bedrock; 9 to 20 inches to lithic bedrock
*Drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 1.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Rock outcrop**

*Percent of map unit:* 5 percent
*Landform:* Mountain slopes, hillslopes
*Hydric soil rating:* No

**Southlake**

*Percent of map unit:* 4 percent
*Landform:* Mountain valleys, fan piedmonts
*Hydric soil rating:* No

**Backcanyon**

*Percent of map unit:* 3 percent
*Landform:* Hillslopes, mountain slopes
*Hydric soil rating:* No

**Sesame**

*Percent of map unit:* 3 percent
*Landform:* Mountain slopes, hillslopes
*Hydric soil rating:* No

**Goodale**

*Percent of map unit:* 2 percent
*Landform:* Drainageways, channels
*Hydric soil rating:* No

**Unnamed, wet, flooded**

*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Landform position (two-dimensional):* Toeslope
*Hydric soil rating:* Yes

**Urban land**

*Percent of map unit:* 1 percent
*Landform:* Mountain slopes, hillslopes
*Hydric soil rating:* No

**Riverwash**

*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

## 330—Kernville-Faycreek-Rock outcrop complex, 30 to 75 percent slopes

**Map Unit Setting**

*National map unit symbol:* hpcf
*Elevation:* 2,600 to 5,000 feet
*Mean annual precipitation:* 10 to 12 inches
*Mean annual air temperature:* 52 to 61 degrees F
*Frost-free period:* 130 to 210 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Kernville and similar soils:* 35 percent
*Faycreek and similar soils:* 25 percent
*Rock outcrop:* 20 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Kernville**

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Mountaintop, mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from granitoid

**Typical profile**

*A1 - 0 to 5 inches:* gravelly loamy coarse sand
*A2 - 5 to 16 inches:* gravelly loamy coarse sand
*Cr - 16 to 19 inches:* weathered bedrock
*R - 19 to 29 inches:* bedrock

**Properties and qualities**

*Slope:* 30 to 75 percent
*Surface area covered with cobbles, stones or boulders:* 10.0 percent
*Depth to restrictive feature:* 7 to 19 inches to paralithic bedrock; 10 to 20 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 1.0 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Faycreek

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope, shoulder, summit
*Landform position (three-dimensional):* Mountaintop, mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from granitoid

**Typical profile**

*A1 - 0 to 5 inches:* gravelly loamy coarse sand
*A2 - 5 to 12 inches:* gravelly loamy coarse sand
*Cr - 12 to 22 inches:* weathered bedrock

**Properties and qualities**

*Slope:* 30 to 75 percent
*Surface area covered with cobbles, stones or boulders:* 2.0 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Drainage class:* Somewhat excessively drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 0.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Rock Outcrop

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Summit, shoulder, backslope
*Landform position (three-dimensional):* Mountaintop, mountainflank
*Down-slope shape:* Convex
*Across-slope shape:* Convex

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydric soil rating:* No

### Minor Components

**Hungrygulch**
*Percent of map unit:* 5 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Tollhouse**
*Percent of map unit:* 4 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Xyno**
*Percent of map unit:* 3 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Hogeye**
*Percent of map unit:* 3 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Tweedy**
*Percent of map unit:* 2 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Unnamed, wet, flooded**
*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Riverwash**
*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Xerofluvents, flooded**
*Percent of map unit:* 1 percent
*Landform:* Flood plains
*Hydric soil rating:* No

## 441—Inyo-Urban land complex, 0 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 1jpyz
*Elevation:* 2,500 to 4,000 feet
*Mean annual precipitation:* 6 to 8 inches
*Mean annual air temperature:* 57 to 61 degrees F

*Frost-free period:* 190 to 225 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Inyo and similar soils:* 65 percent
*Urban land:* 15 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Inyo**

**Setting**

*Landform:* Alluvial fans, inset fans, mountain valleys
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from mixed

**Typical profile**

*A - 0 to 8 inches:* loamy coarse sand
*C - 8 to 60 inches:* gravelly loamy coarse sand

**Properties and qualities**

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Excessively drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (6.00 to 20.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* RareNone
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Low (about 3.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3e
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* A
*Hydric soil rating:* No

**Description of Urban Land**

**Setting**

*Landform:* Mountain valleys, alluvial fans, inset fans
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydric soil rating:* No

**Minor Components**

**Chollawell**

*Percent of map unit:* 9 percent
*Landform:* Fan remnants, mountain valleys
*Hydric soil rating:* No

**Kelval**

*Percent of map unit:* 5 percent
*Landform:* Flood plains, mountain valleys
*Hydric soil rating:* No

**Riverwash**

*Percent of map unit:* 3 percent
*Landform:* Mountain valleys, drainageways
*Hydric soil rating:* No

**Southlake**

*Percent of map unit:* 2 percent
*Landform:* Mountain valleys, fan remnants
*Hydric soil rating:* No

**Kernfork**

*Percent of map unit:* 1 percent
*Landform:* Mountain valleys, flood plains
*Hydric soil rating:* No

## 509—Xyno-Faycreek-Rock outcrop complex, 30 to 60 percent slopes

**Map Unit Setting**

*National map unit symbol:* hpcr
*Elevation:* 2,600 to 5,200 feet
*Mean annual precipitation:* 8 to 10 inches
*Mean annual air temperature:* 50 to 61 degrees F
*Frost-free period:* 130 to 210 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Xyno and similar soils:* 40 percent
*Faycreek and similar soils:* 20 percent
*Rock outcrop:* 15 percent
*Minor components:* 25 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Xyno**

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank

*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Colluvium derived from granitoid and/or residuum weathered from granitoid

**Typical profile**

*A - 0 to 11 inches:* gravelly loamy coarse sand
*C - 11 to 15 inches:* gravelly loamy coarse sand
*Cr - 15 to 25 inches:* weathered bedrock

**Properties and qualities**

*Slope:* 30 to 60 percent
*Surface area covered with cobbles, stones or boulders:* 0.0 percent
*Depth to restrictive feature:* 8 to 20 inches to lithic bedrock
*Drainage class:* Somewhat excessively drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 0.9 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Faycreek

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Upper third of mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from granitoid

**Typical profile**

*A1 - 0 to 2 inches:* gravelly loamy coarse sand
*A2 - 2 to 10 inches:* gravelly loamy coarse sand
*Cr - 10 to 20 inches:* weathered bedrock

**Properties and qualities**

*Slope:* 30 to 60 percent
*Surface area covered with cobbles, stones or boulders:* 2.0 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Drainage class:* Somewhat excessively drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water capacity:* Very low (about 0.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Description of Rock Outcrop**

**Setting**

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Convex
*Across-slope shape:* Convex

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydric soil rating:* No

**Minor Components**

**Canebrake**

*Percent of map unit:* 8 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Pilotwell**

*Percent of map unit:* 6 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Scodie**

*Percent of map unit:* 4 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Goodale, flooded**

*Percent of map unit:* 2 percent
*Landform:* Alluvial fans, channels
*Hydric soil rating:* No

**Riverwash**

*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Unnamed, wet, flooded**

*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Urban land**

*Percent of map unit:* 1 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Rubble land**

*Percent of map unit:* 1 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Inyo**

*Percent of map unit:* 1 percent
*Landform:* Alluvial fans
*Hydric soil rating:* No

## 523—Kernville-Faycreek-Rock outcrop association, 30 to 60 percent slopes

### Map Unit Setting

*National map unit symbol:* hpd1
*Elevation:* 2,700 to 4,600 feet
*Mean annual precipitation:* 9 to 12 inches
*Mean annual air temperature:* 54 to 61 degrees F
*Frost-free period:* 140 to 200 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Kernville, bouldery, and similar soils:* 45 percent
*Faycreek and similar soils:* 20 percent
*Rock outcrop:* 15 percent
*Minor components:* 20 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Kernville, Bouldery

#### Setting

*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from granitoid

#### Typical profile

*A - 0 to 16 inches:* gravelly loamy coarse sand
*Cr - 16 to 20 inches:* weathered bedrock
*R - 20 to 30 inches:* bedrock

#### Properties and qualities

*Slope:* 30 to 60 percent
*Surface area covered with cobbles, stones or boulders:* 13.0 percent
*Depth to restrictive feature:* 7 to 19 inches to paralithic bedrock; 10 to 20 inches to lithic bedrock

*Drainage class:* Somewhat excessively drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to low (0.00 to 0.01 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 1.0 inches)

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Description of Faycreek**

**Setting**
*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Residuum weathered from granitoid

**Typical profile**
*A1 - 0 to 6 inches:* gravelly loamy coarse sand
*A2 - 6 to 12 inches:* gravelly loamy coarse sand
*Cr - 12 to 22 inches:* weathered bedrock

**Properties and qualities**
*Slope:* 30 to 60 percent
*Surface area covered with cobbles, stones or boulders:* 2.0 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Drainage class:* Somewhat excessively drained
*Runoff class:* High
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water capacity:* Very low (about 0.8 inches)

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Description of Rock Outcrop**

**Setting**
*Landform:* Mountain slopes
*Landform position (two-dimensional):* Backslope
*Landform position (three-dimensional):* Mountainflank

*Down-slope shape:* Convex
*Across-slope shape:* Convex

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8
*Hydric soil rating:* No

### Minor Components

**Hogeye**
*Percent of map unit:* 6 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Hungrygulch**
*Percent of map unit:* 5 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Unnamed, shallow to hard rock**
*Percent of map unit:* 4 percent
*Landform:* Mountain slopes
*Hydric soil rating:* No

**Xerofluvents, flooded**
*Percent of map unit:* 2 percent
*Landform:* Flood plains, drainageways
*Hydric soil rating:* No

**Unnamed, flooded**
*Percent of map unit:* 1 percent
*Landform:* Drainageways, flood plains
*Hydric soil rating:* No

**Riverwash**
*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

**Unnamed, wet, flooded**
*Percent of map unit:* 1 percent
*Landform:* Drainageways
*Hydric soil rating:* Yes

## W—Water

### Map Unit Composition
*Water:* 100 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

# References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

# Appendix C
# IPaC Threatened and Endangered Species List

# Appendix C
# Biological Resources

From USACE 2012. *Isabella Lake Dam Safety Modification Project, Environmental Impact Statement Draft, Volume 1 – Draft Environmental Impact Statement*, March.

## 3.10 BIOLOGICAL RESOURCES

This section presents a discussion of the regulatory setting, methods of data collection, an overview of the affected environment (including special status species), summarizes the environmental consequences from implementing the Action Alternatives, and includes mitigation measures for reducing potential impacts on biological resources.

### 3.10.1 Regulatory Setting

The laws, regulations, or policies relevant to the biological resources affected by the Isabella DSM Project are described in the following paragraphs. State and local requirements are included that were helpful in characterizing the overall context of the analyses, even though some of these requirements do not directly apply to this Federal action.

***Federal***

*Fish and Wildlife Coordination Act of 1958, as amended (16 USC §661 et seq.)*
This act authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with Federal and State agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals. Amendments enacted in 1946 require consultation with the USFWS and the fish and wildlife agencies of states where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources." (For more information see Appendix C).

*Federal Endangered Species Act (16 USC §1531 et seq)*
This act requires that any action authorized by a Federal agency not be likely to jeopardize the continued existence of a threatened or endangered species, or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Section 7 of the ESA, as amended, requires Federal agencies to consult with the USFWS and National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service to ensure that project actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species. (For more information see Appendices C, D and E).

*Federal Water Pollution Control Act (Clean Water Act), Section 404 and 401(33 USC §1344)*
Under Section 404 of the Clean Water Act, the US Army Corps of Engineers (Corps) and the US Environmental Protection Agency (EPA) regulate the discharge of dredge and fill materials into waters of the United States. Section 401 of the act delegates authority to the states to regulate waters of the United States within their borders.

*Executive Order 13112, Invasive Species (3 February 1999)*

This Executive Order requires that Federal agencies, to the extent possible, use relevant programs and authorities to (i) prevent the introduction of invasive species, (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, (iii) monitor invasive species populations accurately and reliably, (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.

*Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (10 January 2001)*

This Executive Order directs Executive departments and agencies to take further actions to implement the Migratory Bird Treaty Act. Federal agencies taking actions that have , or are likely to have, a measurable negative effect on migratory bird populations are directed to develop and implement, within two years, a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations.

*Forest Service Manual and Handbook (FSM/H 2670)*

The USFS develops and implements management practices to ensure that plants and animals do not become threatened or endangered and to ensure their continued viability in national forests. The USFS maintains lists of sensitive plant or animal species identified by the regional forester for which population viability is a concern. It is USFS policy to analyze impacts on sensitive species to ensure management activities do not create a significant trend toward Federal listing or loss of viability.

*Migratory Bird Treaty Act (16 USC §703-712)*

This act implements treaties that the United States has signed with a number of countries to protect birds that migrate across national borders. The act makes unlawful the taking, possessing, pursing, capturing, transporting, or selling of any migratory bird, its nest or its eggs.

*National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq)*

This act establishes policy that promotes the enhancement of the environment by establishing procedural requirements for all Federal agencies to integrate environmental values into their decision making process by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. This is accomplished through the preparation of an Environmental Impact Statement (EIS).

*Sequoia National Forest Land and Resource Management Plan, as amended by the Sierra Nevada Forest Plan Amendment (2001) and the Mediated Settlement Agreement*

This *Plan* requires that field surveys for threatened, endangered, proposed, and sensitive plant species be conducted early enough in the project planning process that the project can be designed to conserve or enhance these plants and their habitat. Additionally, sensitive plant species will be managed to prevent the need for Federal listing as threatened and endangered.

*USFS National Forest Management Act of 1976*
The National Forest Management Act of 1976 (NFMA) (90 Stat. 2949, et seq.; 16 U.S.C. 1601-1614), set standards for land and resource management planning across the National Forest System, including a requirement related to diversity of plant and animal communities. Each forest plan developed under the 1982 Planning Rule for the NFMA was required to identify certain vertebrate and/or invertebrate species as Management Indicator Species (MIS) as one of various elements to address NFMA requirements related to diversity of plant and animal communities [1982: 36 CFR 219.19(a)]. The direction for MIS is related to forest plan development, forest project implementation, and forest plan monitoring. On December 14, 2007, based on a review of all the alternatives assessed in the Final Environmental Impact Statement (FEIS), the Regional Forester for the Pacific Southwest Region made the decision to adopt a common list of MIS and associated monitoring strategies for ten forests in the Sierra Nevada, including the Sequoia National Forest. Rule (1982: 36 CFR 219.19(a)(1)) and in the Forest Service Manual (FSM 2621.1). The 1982 Planning Rule states that species are to be selected as MIS because their population changes are believed to indicate the effects of land management activities (1982: 36 CFR 219.19 (a)(1)).

*USFS, National Threatened, Endangered, and Sensitive Species Program*
This program provides an initiative dedicated to conserve and recover plant and animal species that need special management attention and to restore National Forest and Grassland ecosystems and habitat. Isabella Lake is on National Forest System lands and recreation facilities. Lands associated with the lake are managed by the USFS, which is the cooperating agency for the Isabella DSM Project.

*USFWS Mitigation Policy (46 FR 7644, 23 January 1981)*
Under this policy, resources are assigned to one of four distinct resource categories, each having a mitigation planning goal consistent with USFWS values. The Mitigation Policy does not apply to threatened and endangered species, nor does it apply to USFWS recommendations for completed Federal projects, projects permitted or licensed prior to the enactment of USFWS authorities, or USFWS recommendations related to the enhancement of fish and wildlife resources.

***State***

*California Endangered Species Act (CESA)*
The USFWS works with all interested persons, agencies, and organizations to protect and preserve sensitive biological resources and their habitats. These resources include all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants and their habitats that are threatened with extinction and those experiencing a significant decline. The CESA also allows for take incidental to otherwise lawful development projects. CESA emphasizes early consultation to avoid potential impacts on rare,

endangered, and threatened species and to develop appropriate mitigation planning to offset losses of listed species caused by the project.

*California Fish and Game Code (Sections 3511, 4700, 5050, and 5515)*
This code defines Fully Protected Animals. Fish, mammal, amphibian, reptile, and bird species that may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. Most fully protected species have been listed as State threatened or endangered under more recent endangered species laws and regulations.

*California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants*
The CNPS maintains a comprehensive database of rare and endangered plants. Although the society has no regulatory authority, its lists are generally consulted when preparing baseline conditions reports.

*Porter-Cologne Water Quality Control Act*
This act establishes Water Quality Control Boards in California responsible for overseeing water quality and preparing Water Quality Control Plans (Basin Plans) that establish beneficial uses of a water body, water quality standards, and actions to maintain the identified standards.

#### *Local*

*Kern River Valley Specific Plan and Environmental Impact Report*
The *Specific Plan* addresses approximately 110,510 acres in the northeastern portion of Kern County. Currently, the land use development in the Specific Plan Area is guided by the Kern County General Plan and the South Lake Specific Plan and the Kelso Valley Specific Plan. The county plans to implement the General Plan and to replace the specific plans with a single comprehensive planning document. This will integrate the policies and programs of the General Plan, the South Lake Specific Plan, and the Kelso Valley Specific Plan to provide a clear and unified vision and direction to guide future land use development within the Kern River Valley (Kern County 2011a, 2011b).

### 3.10.2 Affected Environment

#### *Physical*

Isabella Lake and much of the Kern River are in the foothills of Sequoia National Forest. Hydrologic features, such as natural springs, hot springs, tributaries of the Kern River, and the Kern River itself, dominate the surrounding landscape and support extensive areas of riparian and limnetic habitat, as well as some fringing wetland habitat, flanked by upland that is dominated by oak and pine woodlands or patches of sagebrush-scrub uplands. Urban, rural, and public lands also surround Isabella Lake. Climate in this region is generally Mediterranean, with cool wet winters and hot dry summers.

***Vegetation***

Isabella Lake is in the California Floristic Province (Hickman 1993), which is the largest and most significant geographic unit in California (Hickman 1993; see Smithsonian Institution 2010). Vegetation alliances in the proposed project area were classified according to Sawyer et al. (2009). This method was used to describe vegetation communities because this is the only system accepted by the California Department of Fish and Game's (CDFG) Vegetation Classification and Mapping Program (CDFG 2009). The Sawyer et al. (2009) classification system is hierarchical, with alliances representing the generic vegetation units. This system relies on diagnostic species which have similar composition and reflects subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes (CDFG 2009a). The primary purpose of this system is to assist in locating and determining the significance and abundance of vegetation types for tracking purposes in the California Natural Diversity Database (CNDDB) (CDFG 2010).

Vegetation alliances identified in the proposed project area include: *Salix gooddingii*, *Populus fremontii* and *S. laevigata* Woodland Alliances (collectively riparian woodlands), *Quercus wislizeni* Woodland Alliance (oak woodlands), *Pinus sabiniana* Woodland Alliance (pine woodlands), *Ericameria nauseosa* Shrubland Alliance (sagebrush-scrub upland) and *Bromus rubens-Schismus (arabicus, barbatus)* Semi-Natural Herbaceous Stands (valley grasslands). General cover types in the proposed project area are illustrated in Figures 3-17 to 3-19.

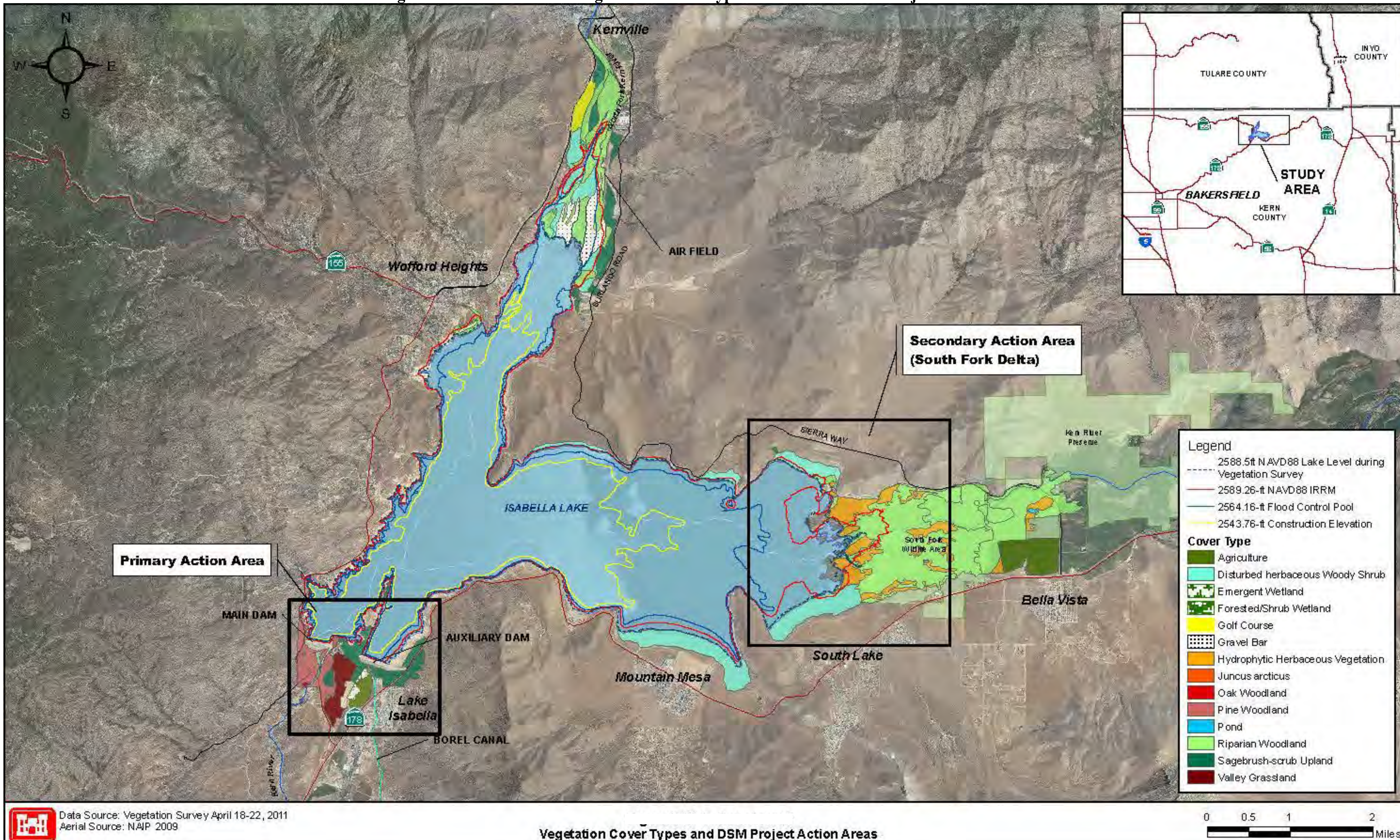
Numerous non-native and invasive plant species are also found in the project area.

Riparian woodlands (*Salix gooddingii*, *Populus fremontii*, and *S. laevigata* Woodland Alliances)

Riparian woodlands are common in the proposed project area upstream of the limnetic zone of Isabella Lake along the North and South Fork Kern Rivers (Figure 3-17). The riparian woodland cover type is dominated by Goodding's willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), and red willow (*S. laevigata*). Also common in some areas is Pacific willow (*S. lasiandra*), yellow willow (*S. lutea*), narrowleaf willow (*S. exigua*), shining willow (*S. lucida* ssp.), boxelder (*Acer negundo*), California buckeye (*Aesculus californica*), and white alder (*Alnus rhombifolia*) (Sawyer et al. 2009). Black elderberry (*Sambucus nigra*) is also found in this vegetation type. Tree canopy height can be up to 80 feet and is open to continuous (Sawyer et al. 2009). Common shrubs in the riparian woodlands include mule-fat (*Baccharis salicifolia*), coyote brush (*B. pilularis*), and redosier dogwood (*Cornus sericea*), which also form an open to continuous cover (Sawyer et al. 2009). The herbaceous layer is variable and is often dominated by primary colonizers such as rough cocklebur (*Xanthium strumarium*), stinging nettle (*Urtica dioica*), goosegrass (*Elusine indica*), common rush (*Juncus effusus*), common knotweed (*Polygonum lapathifolium*), common plantain (*Plantago major*), and cress (*Cardamine* sp.) (Sawyer et al. 2009).

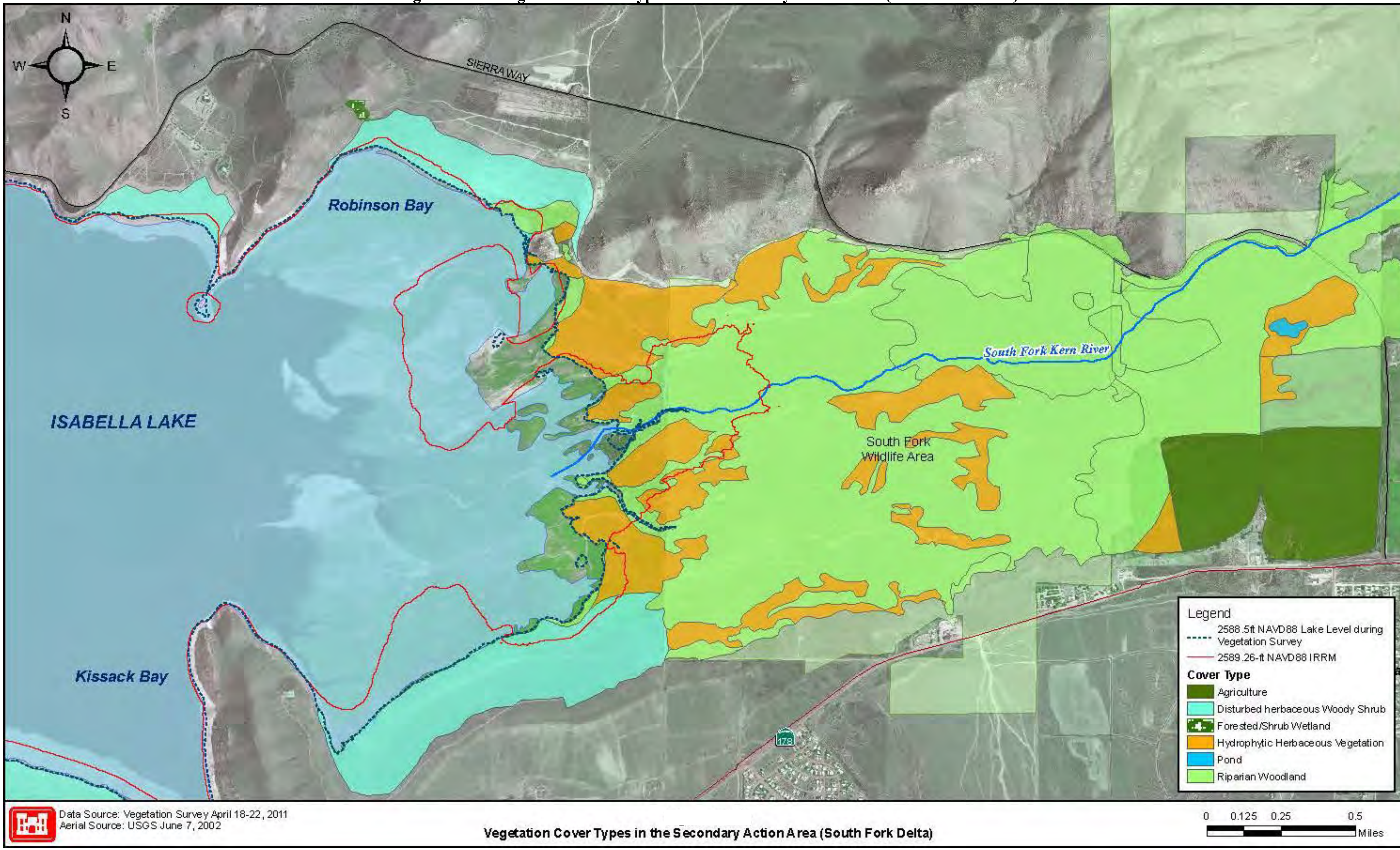
*This page intentionally left blank.*

**Figure 3-17 Overview of Vegetation Cover Types and Isabella DSM Project Action Areas**



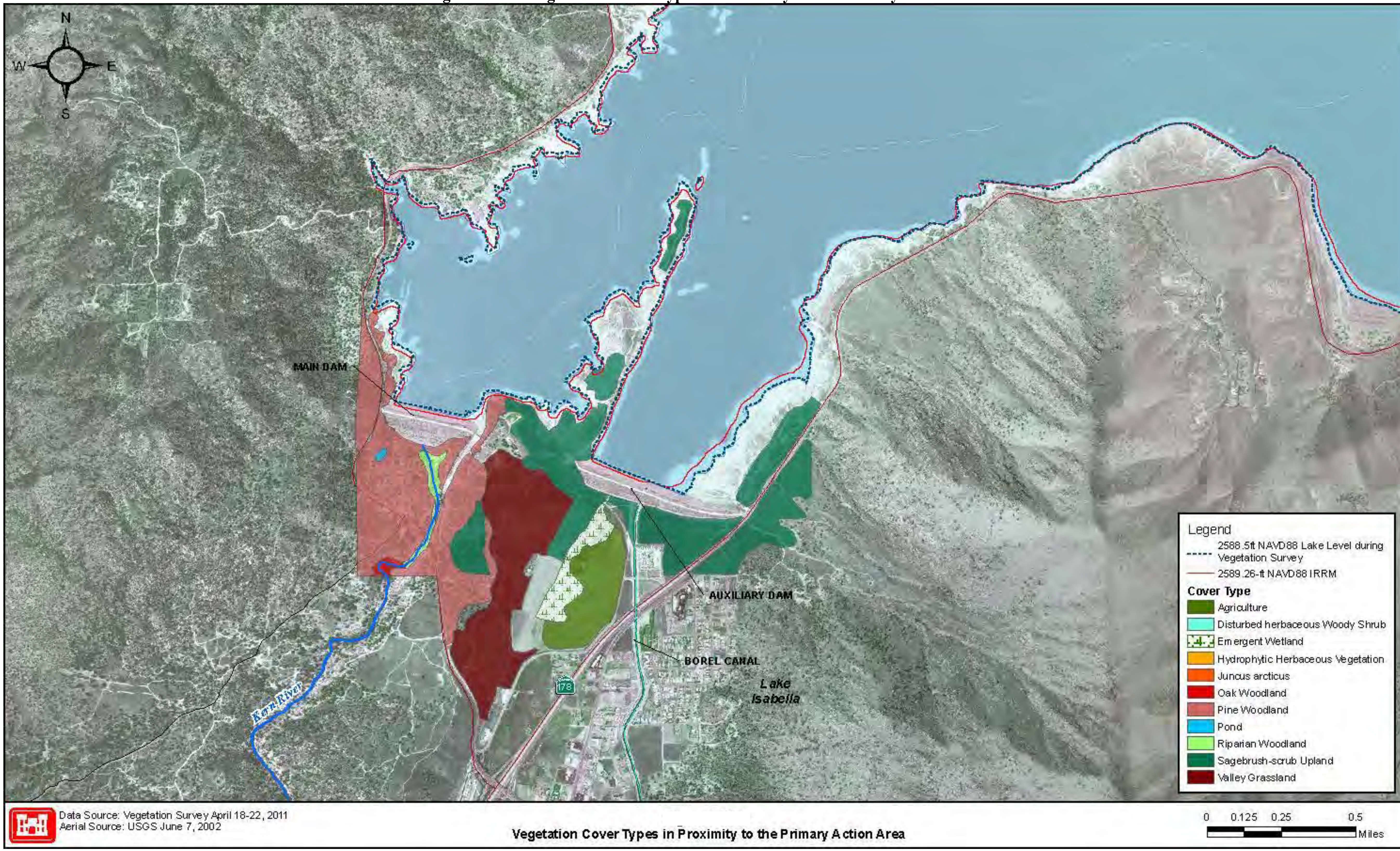
*This page intentionally left blank.*

**Figure 3-18 Vegetation Cover Types in the Secondary Action Area (South Fork Delta)**



*This page intentionally left blank.*

**Figure 3-19 Vegetation Cover Types in Proximity to the Primary Action Area**



The broad floodplain along the South Fork Kern River gently slopes up from Isabella Lake, causing it to be frequently inundated, contributing to the regeneration of Goodding's willow and long-term maintenance of the riparian forest (Figure 3-18). These characteristics function to maintain diverse species composition and forest structure essential for Federally listed species, such as southwestern willow flycatchers (*Empidonax traillii extimus*) and least Bell's vireos (*Vireo bellii pusillus*) (Jones & Stokes 2003, 2004, 2006, 2008; Whitfield and Henneman 2009).

Oak Woodlands (*Quercus wislizeni* Woodland Alliance)

Oak woodland in the Primary Action Area is restricted to a thin patchy band on either side of the Kern River, downstream of the Main Dam and west of Hwy 155 (Figure 3-19). The oak woodland cover type is dominated in the tree canopy by interior live oak (*Quercus wislizeni*), California buckeye, gray pine (*Pinus sabiniana*), canyon live oak (*Quercus chrysolepis*), and blue oak (*Q. douglasii*) (Sawyer et al. 2009). The tree canopy of oak woodland is usually less than 65 feet high and forms either intermittent or continuous cover in canyons or basins, or in open areas, a savanna-like canopy (Sawyer et al. 2009). The shrub and herbaceous layers are open to intermittent and host a diversity of species common to grasslands or other upland plant communities, disturbed areas, or riparian buffers. This cover type occurs on upland slopes, valley bottoms, or on terraces with soils that are shallow and moderately to excessively drained (Sawyer et al. 2009).

Along the Kern River, clusters of interior live oaks grow, primarily with gray pine, immediately above the ordinary high-water elevation of the Lower Kern River. In this area, stream flows are buffered due to modulation by the Main Dam (Pope et al. 2004), and the presence of well-drained soils and steep stream banks that abruptly transition to upland conditions all likely contribute to this alliance becoming established so near the streambed.

Pine-Oak Woodland (*Pinus sabiniana* and *Quercus wislizeni* Woodland Alliances)

Pine-oak woodland dominates much of the upland area surrounding Isabella Lake; however, in the Primary Action Area, it is found only downstream of the Main Dam, specifically in the Main Dam Campground (see Figure 3-19). The pine-oak woodland cover type is dominated by gray pine with intermittent interior live oak, blue oak, canyon live oak, California buckeye, western juniper (*Juniperus occidentalis*), and Coulter pine (*Pinus coulteri*) (Sawyer et al. 2009). Tree canopy is typically less than 65 feet high and is open to intermittent and one to two tiered (Sawyer et al. 2009). Shrubs are common or infrequent and include a mix of such species as rubber rabbitbrush (*Ericameria nauseosa*), black mustard (*Brassica nigra*), California buckwheat (*Eriogonum fasciculatum*), Russian thistle (*Salsola tragus*), Mormon tea (*Ephedra viridis*), California scrub oak (*Quercus berberidifolia*), *Datura* sp., *Cirsium* spp., yerba santa (*Eriodictyon trichocalyx*), flatspine bur ragweed (*Ambrosia acanthicarpa*), chaparral yucca (*Hesperoyucca whipplei*), and common mullein (*Verbascum thapsus*). The herbaceous layer is sparse or grassy and hosts species such as Italian rye grass (*Lolium multiflorum*), foxtail chess (*Bromus madritensis*), and common fiddleneck (*Amsinckia menziesii*). Pine-oak woodland is found on streamside terraces, valleys, slopes, and ridges where soils are shallow, often stony, infertile, moderately to excessively drained, and at elevations between 990 and 6,990 feet (Sawyer et al. 2009).

The patch of pine-oak woodland near the Main Dam has been partially altered by the establishment of the campground and the outlet facility for the Main Dam. Construction of dam infrastructure, access roads, campsites, parking areas, and a small constructed reservoir have all diminished the extent of native habitat in this area. Human disturbance has allowed for the introduction and establishment of various invasive plant species. Planting of ornamental species, mainly Aleppo pine (*Pinus halepensis*), has also reduced the quality of native habitat.

Sagebrush-scrub upland (*Ericameria nauseosa* Shrubland Alliance)

Sagebrush-scrub upland dominates much of the upland area surrounding Isabella Lake. In the Primary Action Area, it is found in upland areas near the Main and Auxiliary Dams (see Figure 3-19). The sagebrush-scrub upland cover type is dominated by rubber rabbitbrush with other species including big sagebrush (*Artemisia tridentata*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), Mormon tea, California buckwheat, western juniper, and antelope bitterbrush (*Purshia tridentata*); immature junipers or pine may also be present at low cover (Sawyer et al. 2009). The shrub canopy is typically less than 10 feet high and is open to continuous (Sawyer et al. 2009). The herbaceous layer is sparse or grassy and primarily includes annual grasses and herbs, such as *Bromus* spp., California poppy (*Eschscholzia californica*), longbeak stork's bill (*Erodium boytrys*), red-stemmed filaree (*E. cicutarium*), perennial goldfields (*Lasthenia californica*), miniature lupine (*Lupinus bicolor*), slender oat (*Avena barbata*), wild oat (*A. fatua*), mustards (*Brassica* spp.), owl's-clover (*Castilleja exserta*), Italian rye grass, and yellow star-thistle (*Centaurea solstitialis*) (Sawyer and Keeler-Wolf 1995). Sagebrush-scrub upland is found in all topographic settings, especially in disturbed settings. Soils are well-drained sand and gravel at elevations ranging between 0 and 10,500 feet (Sawyer et al. 2009). Locally, stands are usually associated with broad intermittent watercourses, road cuts, and other clearings.

Many of the areas dominated by sagebrush-scrub species are frequently disturbed by vehicles and machinery.

Valley Grasslands (*Bromus rubens-Schismus (arabicus, barbatus)* Semi-Natural Herbaceous Stands)

Valley grasslands are restricted to a small ridgeline between and downstream of the Main and Auxiliary Dams (see Figure 3-19). The valley grassland cover type is dominated by red brome grass (*Bromus rubens*), Mediterranean grass (*Schismus barbatus*), and Arabian schismus (*Schismus arabicus*), along with other nonnative species growing in the herbaceous layer (Sawyer et al. 2009). Other common species include California poppy, longbeak stork's bill, red-stemmed filaree, perennial goldfields, miniature lupine, slender oat, wild oat, mustards, owl's-clover, Italian rye grass, and yellow star-thistle. Emergent shrubs may be present at low cover. Herbs in this stand are usually less than 2.5 feet tall, and cover is intermittent to continuous (Sawyer et al. 2009).

The ridgeline between the Main and Auxiliary Dams dominated by valley grasslands has been highly disturbed in the past by human activities, including cattle ranching and off-road vehicle use.

*Wetlands and Other Waters of the U.S.*

A preliminary delineation of wetlands and other waters of the U.S. was conducted in the project area by Tetra Tech biologists on April 19 to 22, 2011. Wetlands were described according to Cowardin et al. (1979). Within the Primary and Secondary Action Areas, riverine, freshwater emergent wetlands and freshwater forested/shrub wetlands were observed (Table 3-59); however, it should be noted that these acreages are estimates due to limited access (e.g., private property, flooding, etc.).

**Table 3-59**
**Wetland Type and Preliminary Coverage Estimate within the Proposed Project Area**

| Wetland | Type | Approximate Acres |
|---|---|---|
| Auxiliary Dam | Emergent | 18 |
| Hanning Flat | Forested/Shrub | 1.8 |
| South Fork Mosaic 1 | Forested/Shrub | 1,360 |
| South Fork Mosaic 2 | Emergent | 337 |

Approximately 18 acres of emergent wetlands were observed below the Auxiliary Dam, just south of Barlow Road (see Figure 3-19). During the site visit, there was no access to the adjacent private property to the south, but wetland vegetation was observed in the area. Therefore, acreage estimates for this wetland are thus largely based on aerial photography and data from the National Wetland Inventory (NWI) (USFWS 2011). It should be noted that NWI was only used for descriptive purposes and not for the purpose of determining the actual extent of jurisdictional features. Wetland plant species observed included: *Juncus balticus* (an obligate [OBL] wetland species meaning there is more than a 99% probability the species will occur in a wetland) and *Rumex crispus* (a facultative wetland [FACW] species meaning there is between 67% and 99% probability the species will be occur in a wetland).

A mosaic of forested/shrub and emergent wetlands were observed in the South Fork Delta area, although much of the wetlands are east of the Secondary Action Area (Supplemental sand filter borrow area west of Patterson Lane and Rabbit Island). A 1.8 acre, spring-fed, forested wetland was observed on the western edge of Hanning Flat, located northwest of Rabbit Island. Dominant wetland species observed near Hanning Flat included: *J. balticus*, *Distichlis spicata* (FACW), *Salix laevigata* (FACW), *Scirpus americanus* (OBL), and *Polygonum lapathifolium* (OBL).

The North Fork and South Fork Kern Rivers are the dominant riverine systems in the project area. The North Fork Kern River has a fairly defined bed and bank, with sediment deposited bars and a developing riparian community (see Figure 3-17). Near the confluence with Isabella Lake, the North Fork Kern River is braided, with intermittent freshwater emergent and forested/shrub wetlands. By contrast, much of the South Fork Kern River is highly braided, with a mosaic of forested/shrub and freshwater emergent wetlands, particularly at the confluence with Isabella Lake (see Figure 3-17; Table 3-18). Dominant wetland plant species in the South Fork area included: *Salix gooddingii* (OBL), *J. balticus*, *Urtica dioica* (FACW), *Eleocharis macrostachya* (OBL).

The lower Kern River is located downstream of the Main Dam where water is released directly into the natural stream channel and through the Isabella Partners Hydroelectric Project facility. The lower Kern River is characterized by a defined bed and bank without associated riparian wetlands. The Auxiliary Dam releases water directly into the Borel Canal or through seepage that is collected in a drain ditch, where it flows to a sump and is pumped into the Borel Canal.

Isabella Lake is the dominant lacustrine system in the project area. Isabella Lake is operated as a multipurpose reservoir for flood control, downstream water users, and recreation. As previously mentioned, the maximum conservation storage level is 2,609.26 feet (Corps 2008a); however, the lake is maintained at or below 2,589.26 feet as an IRRM.

Other freshwater emergent wetlands within the ordinary high water mark (OHWM) of Isabella Lake were observed in the vicinity of Wofford Heights and another south of the golf course west of the North Fork Kern River; however these wetlands are not in the Isabella DSM Project Action Areas.

Three freshwater ponds were identified in proximity to the project area: a previously mentioned seepage collection channel below the Auxiliary Dam, an oxidation pond below the Main Dam, and Prince Pond east of the South Fork Wildlife Area.

*Non-native and Invasive Vegetation*

Numerous non-native and/or nuisance plants are found in the vicinity of Isabella Lake (Table 3-60). No invasive plants found in the project area are listed on the Federal Noxious Weed List (USDA 2006); however, some are listed by California Department of Food and Agriculture's (CDFA) Pest Ratings of Noxious Weed Species and Noxious Weed Seed (CDFA 2010). These include common Russian thistle (*Salsola tragus*), perennial pepperweed (*Lepidium latifolium*), purple loosestrife (*Lythrum salicari*), and tree-of-heaven (*Ailanthus altissima*).

Of particular concern for the proposed Isabella DSM Project is the potential for non-native or invasive plant species to be transported from one location to another during construction.

**Table 3-60**
**Non-native or Nuisance Plant Species in or near the Proposed Project Area**

| Common Name | Species | CDFA List[1] |
|---|---|---|
| Bermuda grass | *Cynodon dactylon* L. | NA |
| black mustard | *Brassica nigra* | NA |
| brass buttons | *Cortula coronopifolia* L. | NA |
| broadleaf birdsfoot trefoil | *Lotus corniculatus* | NA |
| Cheatgrass | *Bromus tectorum* | NA |
| common Russian thistle | *Salsola tragus* L. | C |
| curly dock | *Rumex crispus* L. | NA |
| flix weed/tansy mustard | *Descurainia sophia* | NA |
| floating primrose willow | *Ludwigia peploides* | NA |
| Kentucky bluegrass | *Poa pratensis* L. | NA |
| perennial pepperweed | *Lepidium latifolium* | B |
| prickly sow thistle | *Sonchus asper* | NA |
| prickly wild rose | *Rosa acicularis* | NA |
| purple loosestrife | *Lythrum salicaria* | B |
| red brome | *Bromus rubens* L. | NA |
| redstem filaree | *Erodium cicatarium* | NA |
| rough cocklebur | *Xanthium strumarium* | NA |
| Russian olive | *Elaeagnus angustifolia* L. | NA |
| spotted knapweed | *Centaurea stoebe* | NA |
| tree-of-heaven | *Ailanthus altissima* | C |
| wild oat | *Avena fatua* | NA |

[1] CDFA 2010
A list (noxious weed)
B list (noxious weed)
C list (noxious weed)

### *Wildlife*

The diversity of habitats around Isabella Lake attracts a variety of wildlife species, including many residents and abundant migrants. The extensive riparian areas found in the deltas of the North and South Fork Kern Rivers are the most substantial habitat for wildlife found in the vicinity of Isabella Lake. These areas host expanses of mature riparian woodland growing in braided stream channels, pools, and wetlands. In particular, the South Fork Wildlife Area has been identified as one of the largest intact patches of riparian habitat remaining in California. It is estimated that over 300 species of birds use this area, with most being neotropical migrants that nest and forage during summer and overwinter in Central and South America (Audubon 2011).

Common birds include passerines such as flycatchers, warblers, kinglets, chickadees, thrushes, jays, blackbirds, sparrows, finches, towhees, wrens, nuthatches, and swallows. Other common birds are hummingbirds, woodpeckers, water birds, waders, and various raptors such as owls, buteos, and smaller accipiters (Audubon 2011). Wildlife species common in this area include mammals such as foxes, coyote, bobcat, striped skunk, spotted skunk, raccoon, Virginia opossum, bats, and woodrats. Reptiles and amphibians that are relatively common include the Pacific chorus frog, western toad, bullfrog, and valley garter snake (Audubon 2011). Many invertebrates are also common in this area and provide the dietary basis for the high densities seen in some wildlife species.

Much of the upland habitat around Isabella Lake hosts species adapted to arid environments. Common reptiles include side-blotched lizard, southern alligator lizard, western fence lizard, California kingsnake, Pacific gopher snake, and Northern Pacific rattlesnake (Audubon 2011). Common upland bird species include California quail, scrub jay, goldfinches, wrentit, and acorn woodpecker. Mammals that are expected to be in the area include pocket gophers, mice, tree and ground squirrels, mule deer, mountain lion, and a diversity of bats. Isabella Lake and the Kern River host a variety of waterfowl, including migratory and resident waterfowl such as American coot, grebes, cormorants, gulls, and waders (Audubon 2011).

***Fish***

The open water of Isabella Lake and the Kern River hosts a variety of aquatic species, including native fishes (e.g. Sacramento pikeminnow, hardhead, Sacramento sucker, Kern River rainbow trout), and introduced fishes (e.g. smallmouth bass, rainbow trout, redear sunfish, spotted bass, crappie, bluegill, brown bullhead, brown trout) (Table 3-61).

**Table 3-61**
**Fish Species of Isabella Lake and Vicinity**

| Common Name | Species | Status |
|---|---|---|
| black crappie | *Pomoxis nigromaculatus* | Introduced |
| bluegill | *Lepomis macrochirus* | Introduced |
| brown bullhead | *Ameiurus nebulosus* | Introduced |
| brown trout | *Salmo trutta* | Introduced |
| carp | *Cyprinus carpio* | Introduced |
| channel catfish | *Ictalurus punctatus* | Introduced |
| Chinook salmon | *Oncorhynchus tshawytscha* | Introduced |
| coho salmon | *Oncorhynchus kisutch* | Introduced |
| fathead minnow | *Pimephales promelas* | Introduced |
| golden shiner | *Notemigonus crysoleucas* | Introduced |
| goldfish | *Carassius auratus* | Introduced |
| green sunfish | *Lepomis cyanellus* | Introduced |
| hardhead | *Mylopharodon conocephalus* | Native |
| Kern River rainbow trout[1] | *Oncorhynchus mykiss gilberti* | Native |
| kokanee salmon | *Oncorhynchus nerka* | Introduced |
| largemouth bass | *Micropterus salmoides* | Introduced |
| Little Kern golden trout | *Oncorhynchus mykiss whitei* | Native |
| mosquitofish | *Gambusia affinis* | Introduced |
| rainbow trout[2] | *Oncorhynchus mykiss* | Introduced |
| redear sunfish | *Lepomis microlophus* | Introduced |
| Sacramento pike minnow | *Ptychocheilus grandis* | Native |
| Sacramento hitch | *Lavinia exilicauda* | Native |
| Sacramento sucker | *Catostomus occidentalis* | Native |
| San Joaquin roach | *Lavinia symmetricus* | Native |
| smallmouth bass | *Micropterus dolomieui* | Introduced |
| spotted bass | *Micropterus punctulatus* | Introduced |

| Common Name | Species | Status |
|---|---|---|
| threadfin shad | *Dorosoma petenense* | Introduced |
| white catfish | *Ictalurus catus* | Introduced |
| white crappie | *Pomoxis annularis* | Introduced |

Sources: CDFG et al. 1999, SCE 1991a.
[1] Likely extirpated from Isabella Lake
[2] Hatchery-reared stock

Isabella Lake has been managed as both a coldwater and warmwater fishery since the 1950s, (CDFG et al. 1999). Introductions of coldwater fish include domesticated rainbow trout that began in 1927 with the establishment of the Kern River Fish Hatchery. The native rainbow trout population of Isabella Lake has been supplemented with several strains of rainbow trout in an effort to develop a self-perpetuating population adapted to conditions in the lake and Kern River above the lake. Since 1969 California Department of Fish and Game (CDFG) has stocked catchable-size rainbow trout when water temperatures are cooler - during the winter and spring months (CDFG et al. 1999).

The optimal temperature range for adult rainbow trout is about 9 to 17°C (48.2 to 62.6°F) with an upper limit of 28 to 29°C (82.4 to 84.2°F) (Lee and Rinne 1980; McCauley et al. 1977; Molony 2001). Chinook salmon have also been introduced to Isabella Lake and, while they grow well in the lake, they are not successful spawners in the Kern River thus their population is not self-sustaining (CDFG et al. 1999).

Numerous warmwater fish species have also been introduced to Isabella Lake since the 1950s - specifically, sport fish such as largemouth bass, black crappie, white crappie, and white catfish (see Table 3-61). Similarly, various forage fish have been introduced including golden shiners and fathead minnows; bluegill were introduced as both a forage food and sport fish. Later introductions included threadfin shad to compensate for declines in the crappie populations observed in the 1960s. The hardy and long-lived Florida strain largemouth bass, smallmouth bass, and spotted bass were introduced in the 1970s; however, smallmouth are now only observed in the Kern River above the lake and spotted bass have not been appreciably successful (CDFG et al. 1999). Carp were likely illegally introduced for live bait and have successfully established in Isabella Lake. Adult largemouth bass have an optimum temperature range of 25 to 30°C (77 to 86°F) and an upper limit of 36°C (96.8°F) (summarized in Jobling 1981).

The warmwater fish species are self-sustaining in Isabella Lake; however, increased temperatures, low pH and low dissolved oxygen negatively impacts cold freshwater habitat beneficial uses such that continuous stocking of rainbow trout is required. CDFG maintains a hatchery facility along the North Fork Kern River. Rainbow trout are stocked by CDFG according to the following criteria:

> *"Catchable trout shall not be stocked in streams when water temperatures reach 75°F and it appears that such temperatures will continue to occur regularly, or when stream flows drop below 10 cfs. The exception is that suitable streams with flows between 2 and 10 cfs may be planted if water*

> *temperatures do not exceed 70°F and other conditions are satisfactory. Stocking shall be discontinued if conditions are unsuitable because of shallow water, lack of pools, growth of algae, poor water quality, or other reasons*
>
> *Catchable trout shall not be stocked in lakes or reservoirs after surface water temperatures reach 78°F and it appears that such temperatures will continue to occur regularly, nor after a trout die-off is attributed in whole or in part to an oxygen deficiency. Stocking shall be discontinued if algae blooms, aquatic weed growth, high turbidity, high alkalinity, or other conditions render the lake unsuitable for catchable trout or for fishing.*
>
> *Catchable trout shall not be stocked in lakes or reservoirs until water temperatures reach 42°F or higher most afternoons, or in streams until water temperatures reach 45°F or higher most afternoons. Catchable trout stocking may be suspended in reservoirs during periods of spill in order to avoid losses of planted fish to downstream areas where the trout may not be readily available to anglers" (CDFG 2011).*

Natural fish habitat in Isabella Lake is extremely limited. This is largely attributed to 1) the extreme changes in water level in Isabella Lake that results in little recruitment of large wood from riparian corridors or establishment of submersed aquatic vegetation and 2) the basin morphology is quite flat with soils that are typically alluvium derived sand and silt (USDA-NRCS 2010). Nest-building spawners such as largemouth bass and bluegill prefer sand and gravel substrates; however, known areas with appropriate nest building materials are limited to Hanning Flat, Brown's Cove, Kissack Cove, near the South Fork boat launch, French Gulch, Boulder Gulch north to Orick Cove, and the western side of the North Fork Kern River confluence with the lake (CDFG et al. 1999). Various habitat improvements and artificial structures have been added to Isabella Lake including cages of various designs and materials and wood structure such as planted willows and anchored Christmas trees (CDFG et al. 1999).

***Threatened, Endangered, and Other Special Status Species***

The special status species addressed in this Draft EIS include the following:

- Those species considered endangered, threatened, or of special concern by the USFWS.
- Those considered sensitive by the USFS.
- Those considered threatened, endangered, or fully protected by CDFG.
- Those considered threatened by the California Native Plant Society (CNPS).

Federal (USFWS and USFS) and State (CDFG) special status plant and animal species are legally protected according to provisions and codes previously identified in Section 3.12.1 Regulatory Setting. Overall, there are 45 special status species (USFWS, USFS, CDFG, and CNPS) with the potential (low, medium, or high) to occur in or near the proposed Isabella DSM Project area (Tables 3-62, 3-63, and 3-64).

The USFWS (2011) identified 29 special status invertebrate, fish, amphibian, reptile, bird, mammal and plant species within Kern County and the following U.S .Geologic Survey (USGS) Quads: Breckenridge Mtn (238A), Mt. Adelaide (238B), Rio Bravo Ranch (239A), Oil Center (239B), Stevens (240C), Tupman (241D), Walker Pass (259A), Onyx (259B), Cane Canyon (259C), Weldon (260A), Lake Isabella North (260B), Lake Isabella South (260C), Woostalf Creek (260D), Alta Sierra (261A), Glennville (261B), and Democrat Hot Springs (261C) (Appendix E). Of the 29 USFWS (2011) special status species, those with "low" potential for occurrence were excluded from further evaluation in this Draft EIS. This exclusion was done in consultation with the USFWS (Biological Resources Meeting 7/19/2011; notes available in the Administrative Record). In general, species were excluded because sufficient suitable habitat (e.g., habitat for breeding rearing, cover, food, water, and protection from disturbance) is not available and/or the species is not known to occur in or near the Proposed Action areas (Corps 2012).

The USFS Sequoia National Forest lists five plant species and nine animal species as sensitive (USFS 2007a). CNPS lists level 1, 2, and 3 Threat Rank plants near Isabella Lake. CDFG lists two rare and five endangered plant species and six threatened, four endangered, and one fully protected animal species.

Life history characteristics of species with a "high" potential for occurring in the action areas of the Isabella DSM Project are further discussed following Table 3-62 through Table 3-64. Information on the plant and animal species with a high potential to occur in or near the Isabella DSM Project Action Areas was gathered from a variety of sources including: CNDDB (2011), Corps (2010a), CDFG (2011b), USFWS (2010), and USFWS (2011i). Aside from recent surveys conducted for other studies (e.g. *Barlow Road Geotechnical Investigations*, *Final Environmental Assessment for the Planned Deviation from the Water Control Plan*, and compliance reports for the *Valley Elderberry Longhorn Beetle [VELB] Management Plan*), additional targeted field surveys have not yet been conducted within the Isabella DSM Project Action Areas.

Those species identified in Table 3-62 that have a high probability of occurring in the project action Areas are briefly described in the following paragraphs.

*Alkali mariposa lily*

Alkali mariposa lily (Calochortus striatus) is listed as USFS sensitive. Alkali mariposa lily is a small perennial herb that arises from an underground bulb and flowers in the spring, roughly from April to June. It occurs in elevations 2,000 to 3,700 feet and prefers springs and wet alkaline meadows. The plant is considered a facultative wetland (FACW) species according to USFWS (1993a). FACW plant species usually occur in wetlands (estimated probability 67% to 99%), but occasionally are found in non-wetlands.

**Table 3-62**
**Special Status Plant Species Known to Occur in or near the Project Area**

| Common Name | Species | Status | | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|---|
| | | Federal[1/2] | CDFG[3] | CNPS[4] | | |
| Alkali mariposa lily | *Calochortus striatus* | None/S | None | 1B.2 | High | Suitable habitat near the action areas; occurs within one mile of action areas |
| Bakersfield cactus | *Opuntia treleasei* | FE/S | SE | 1B.1 | Low | Suitable habitat not found within the action areas |
| Bakersfield smallscale | *Atriplex tularensis* | None | SE | 1B.1 | Low | Habitat absent in action area; requires low elevation (91-96m) subalkaline margins of alkali sinks |
| California jewel-flower | *Caulanthus californicus* | FE/S | SE | 1B.1 | Low | Habitat absent in action area; requires undisturbed low elevation, open subalkaline or sandy loam basins |
| Keck's checkerbloom | *Sidalcea keckii* | FE | None | 1B.1 | Low | Habitat absent in action area; requires relatively open areas on grassy slopes with serpentine soils; poor competitor |
| Kern mallow | *Eremalche kernensis* | FE | None | 1B.1 | Low | Habitat absent in action area; grows under and around *Atriplex* spp. and in patches with other herbaceous cover but with shrub cover less than 25% and variable herbaceous cover; soils are alkaline, sandy loam, or clay. |
| Mojave tarplant | *Deinandra mohavensis* | None | SE | 1B.3 | Low | Suitable habitat not found within the action areas |
| Red rock tarplant | *Deinandra arida (=Hemizonia arida)* | None | Rare | 1B.2 | Low | Habitat absent in action area; requires clay soil of washes with creosote bush scrub at moderate elevations; only known from Red Rock Canyon |
| San Joaquin adobe sunburst | *Pseudobahia peirsonii* | FT/S | SE | 1B.1 | Low | Suitable habitat (heavy clay adobe soils) not present in the project area; elevation range (0 to 1,000 ft.) well below that of the project area |
| San Joaquin woollythreads | *Monolopia congdonii (=Lembertia congdonii)* | FE | None | 1B.2 | Low | Historically occurred in the San Joaquin Valley; nearest populations near Bakersfield |

| Common Name | Species | Status | | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|---|
| Striped adobe lily | *Fritillaria striata* | None/S | ST | 1B.1 | Low | Suitable habitat (open areas in grassland and blue oak woodland, pockets or islands of heavy adobe clay) not found within the action areas |
| Twisselmann's nemacladus | *Nemacladus twisselmannii* | None | Rare | 1B.2 | Low | Habitat absent in action area; grows among high-elevation granite in the southern Sierra Nevada |

[1] USFWS URL: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=06029. Accessed 27 October 2010.
[2] USDA Forest Service. 2011. Regional Foresters Sensitive Plant List, dated 2006. Pacific Southwest Region. Received January 12, 2011.
[3] CNDDB 2010. URL: http://www.dfg.ca.gov/biogeodata/cnddb/plants_and_animals.asp. Accessed October 27, 2010
[4] CNPS URL: http://cnps.site.aplus.net/cgi-bin/inv/inventory.cgi. Accessed October 27, 2010
FT = Federal threatened
FE = Federal endangered
FC = Federal candidate
S = USFS sensitive
SE = State endangered
ST = State threatened

**Table 3-63**
**Special Status Plant Species CNPS Threat Ranking**

| Rank | Description |
|---|---|
| CNPS Threat Rank 0.1 | Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat). |
| CNPS Threat Rank 0.2 | Fairly threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat). |
| CNPS Threat Rank 0.3 | Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known). |

**Table 3-64**
**Special Status Animal Species that may occur in or near the Project Area**

| Common Name | Species | Status | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|
| | | Federal[1/2] | CDFG[3] | | |
| **Invertebrates** | | | | | |
| Conservancy fairy shrimp | *Branchinecta conservatio* | FE | None | Low | Suitable habitat not found within the action areas |
| Longhorn fairy shrimp | *Branchinecta longiantenna* | FE | None | Low | Suitable habitat not found within the action areas |
| Vernal pool fairy shrimp | *Branchinecta lynchi* | FT | None | Low | Suitable habitat (vernal pools) not found within the action areas |
| Kern primrose sphinx moth | *Euproserpinus euterpe* | FT | None | Low | Limited or no habitat present in action area; requires desert scrub, particularly in and around washes, where its host plant (an evening primrose) grows |
| Valley elderberry longhorn beetle | *Desmocerus californicus dimorphus* | FT | None | High | Host plant known to occur within the Isabella DSM Project Action Areas |
| **Fish** | | | | | |
| Delta smelt | *Hypomesus transpacificus* | FT | SE | Low | No suitable habitat (freshwater-saltwater mixing zones) in the Action Areas |
| Hardhead | *Mylopharodon conocephalus* | S | None | High | Species observed in the Isabella DSM Project Action Areas |
| Volcano Creek (=California) golden trout | *Oncorhynchus. mykiss aguabonita* | S | None | Medium | Observed in drainages of the Kern River in the vicinity of Bald Mountain, upstream of Isabella Lake |

| Common Name | Species | Status | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|
| | | Federal[1/2] | CDFG[3] | | |
| **Amphibians** | | | | | |
| California red-legged frog | *Rana draytonii* | FT | None | Low | Isabella DMS Project Action Areas are outside current species distributional range |
| California tiger salamander | *Ambystoma californiense* | FT | None | Low | Habitat absent in action area; requires annual grassland and grassy understory of valley-foothill hardwoods; breeds in vernal pools and some human-made ponds w/o fish, <1,000 feet in elevation |
| Foothill yellow-legged frog | *Rana boylii* | S | None | Medium | Suitable habitat (low gradient streams) and reported population (CNDDB) north of Wofford Heights; no known populations or suitable habitat in the vicinity of the action areas |
| Kern Canyon slender salamander | *Batrachoseps simatus* | None | ST | Medium | Limited to lower Kern River Canyon which has not been identified as occurring in the action area |
| Mountain yellow-legged frog | *Rana muscosa* | FC/S | None | Low | Suitable habitat not found within the action areas; nearest CNDDB reported population in the Taylor Creek drainage of the South Fork Kern River outside the action areas |
| Tehachapi slender salamander | *Batrachoseps stebbinsi* | None | ST | Low | Limited to the Caliente Creek drainage and Piute Mountains; neither of these areas fall within the action area |
| **Reptiles** | | | | | |
| Blunt-nosed leopard lizard | *Gambelia (=Crotaphytus) sila* | E | SE | Low | Not in action area; found in open grassland of the valley floor below 1,000' elevation |

| Common Name | Species | Status | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|
| | | Federal[1/2] | CDFG[3] | | |
| California legless lizard | *Anniella pulchra* | S | None | Medium | CNDDB indicates two populations, one in Orchard quad in SW Kern County and other in Gosford quad west of Bakersfield |
| Giant garter snake | *Thamnophis couchi gigas* | FT | ST | Low | Endemic to wetlands in the Sacramento and San Joaquin Valleys; historic range limited to Bakersfield area; suitable habitat (low gradient streams and wetlands) present in the project area, but not known to historically or currently occur |
| Southwestern pond turtle | *Clemmys marmorata pallida* | S | None | High | Species known to occur upstream (Kern R. to Cannell Creek in Tulare Co. and downstream of Lake Isabella; potential habitat in SFWA |
| **Birds** | | | | | |
| Bald eagle | *Haliaeetus leucocephalus* | D, S | SE | High | Common winter resident to Isabella Lake |
| Bank swallow | *Riparia riparia* | None | ST | Low | Habitat not present in action area; require eroding mud banks they can excavate into for nesting and roost sites |
| California condor | *Gymnogyps californianus* | FE | SFP | Low | Isabella DSM Project Action Areas do not contain suitable roosting habitat and does not overlap with designated Critical Habitat |
| Least Bell's vireo | *Vireo bellii pusillus* | FE | SE | High | Species observed in the Isabella DSM Project Action Areas |
| Southwestern willow flycatcher | *Empidonax traillii extimus* | FE | SE | High | Species observed in the Isabella DSM Project Action Areas |
| Swainson's hawk | *Buteo swainsoni* | None | ST | Low | Habitat not present in action area; require open grassland with moderately tall trees or structures for nesting and hunting |
| Western snowy plover | *Charadrius alexandrinus nivosus* | FT | None | High | Species observed in the Isabella DSM Project Action Areas |

| Common Name | Species | Status | | Potential to Occur in Action Areas | Justification |
|---|---|---|---|---|---|
| | | Federal[1/2] | CDFG[3] | | |
| Western yellow-billed cuckoo | *Coccyzus americanus occidentalis* | FC/S | SE | High | Species observed in the Isabella DSM Project Action Areas |
| **Mammals** | | | | | |
| Buena Vista Lake shrew | *Sorex ornatus relictus* | FE | None | Low | Habitat not present in action area; only known from marshes in the San Joaquin Valley |
| Fisher | *Martes pennanti* | FC | SCT | Low | Habitat not present in action area; found in mature coniferous and mixed conifer and hardwood forests |
| Giant kangaroo rat | *Dipodomys ingens* | FE | SE | Low | Habitat not present in action area; inhabit undisturbed grassland and shrub communities on a variety of soils at elevations up to 2,850 feet |
| Pallid bat | *Antrozous pallidus* | S | None | High | Species known to occur near the Isabella DSM Project Action Areas |
| San Joaquin kit fox | *Vulpes macrotis mutica* | FE | ST | Low | Not present in the project area Nearest historic distribution included San Joaquin Valley in southern Kern County; suitable habitat (grasslands and shrublands) |
| Sierra Nevada big horn sheep | *Ovis canadensis californiana* | FE | SE | Low | Not present in the action area; inhabit portions of eastern Sierra Nevada at elevations between 1,460 m and 4,300 m |
| Tipton kangaroo rat | *Dipodomys nitratoides nitratoides* | FE | SE | Low | Not present in the action area; limited to arid-land communities occupying the Tulare Basin Valley floor in level or nearly level terrain |

[1] USFWS, URL: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=06029. Accessed 27 October 2010.
[2] USDA Forest Service. 2011. Regional Foresters Sensitive Animal List (Sequoia National Forest), dated 2007. Pacific Southwest Region. Received January 12, 2011.
[3] CNDDB 2010. URL: http://www.dfg.ca.gov/biogeodata/cnddb/plants_and_animals.asp. Accessed October 27, 2010.
D = Federal delisted
FT = Federal threatened
FE = Federal endangered

FC = Federal candidate
FP = Federal proposed
S = USFS sensitive
SE = State endangered
SCT = State candidate threatened
SFP = State fully protected
ST = State threatened

There are no USFWS NWI mapped wetlands near the Main Dam or campground; however, USFWS NWI forested/shrub and emergent wetlands are identified in the vicinity of the Kern Valley Airport (USFWS 2010a) where the CNDBB (2010) also indicates an occurrence of alkali mariposa lily. Also, CNDDB (2010) indicates an occurrence of the alkali mariposa lily within a mile of the main dam and spillway.

*Bald eagle*

Although the bald eagle (*Haliaeetus leucocephalus*) was federally delisted as threatened in 2007, it has been listed as state endangered since 1980 and is USFS sensitive. The bald eagle inhabits forested areas near large bodies of water, nesting in large, old growth, or dominant live trees with open branches (e.g., ponderosa pine). During the winter, they can be found in coastal areas along large rivers and large unfrozen lakes. They can be found from Alaska throughout Canada and in scattered localities in nearly all of the lower 48 states of the United States. There are no occurrences of bald eagles near Isabella Lake recorded in the CNDDB (2010); however, Audubon - California birders commonly see them around Isabella Lake during winter, in and near the Kern River Preserve (Audubon - California 2010).

*Least Bell's vireo*

Least Bell's vireo (*Vireo bellii pusillus*) was listed as federally endangered May 2, 1986 (Federal Register 51(85): 16474-16481) and as State endangered October 10, 1980. The least Bell's vireo is a migratory songbird that depends on riparian habitat for breeding. The least Bell's vireo inhabits dense, low, shrubby vegetation, generally early successional stages in riparian areas, brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushland, often near water in arid regions below 2,000 feet.

The historic range of the least Bell's vireo included western Kern and Tulare counties, including the proposed project area. There are areas of mature riparian willows and other shrubby vegetation along the Kern River corridor; however, much of this area lacks substantial understory vegetation and is therefore less suitable for nesting than more early and mid-successional riparian stands where dense understory vegetation is present (Douglas 2008). Least Bell's vireo is endangered primarily from loss of riparian habitat and cowbird parasitism, and populations continue to decline throughout its range.

Surveys for least Bell's vireos have been conducted along the South Fork Kern River since 1997 to determine its current status in the Kern River Valley (Douglas 2008). Although only one male has been observed (July 9, 2002), from 1992 through 1997, at least eight other individuals have been reported to have moved through the Kern River Valley (Douglas 2008). The CNDDB (2011) documents one occurrence in southwestern Kern County along the San Emigdio River.

There is no critical habitat designation for the least Bell's vireo within the proposed Isabella DSM Project area (Federal Register 59(22): 4845-4867).

<u>*Southwestern willow flycatcher*</u>

Southwestern willow flycatcher (*Empidonax traillii extimus*) was listed as Federal endangered February 27, 1995 (Federal Register 60: 10693). The geographic area occupied by the southwestern willow flycatcher is widespread as a result of its behavior, breeding range, known migration, and dispersal habits (USFWS 2005). The southwestern willow flycatcher, a neotropical migrant, travels annually through diverse migratory habitats from its wintering grounds in Central and South America to its breeding grounds in the United States. The riparian habitat it uses for breeding, foraging, migrating, dispersing, and shelter is dynamic in quality, growth, and location due to its proximity to water and susceptibility to disturbance by flooding (USFWS 2002c; Koronkiewicz et al. 2004; Cardinal and Paxton 2005).

Southwestern willow flycatchers are a riparian obligate species that have specific habitat requirements, typically dominated by willows (*Salix* spp.) and alders (*Alnus* spp.), and permanent water often in the form of low-gradient watercourses, ponds, lakes, wet meadows, marshes, and seeps in and next to forested landscapes (Sogge et al. 1997; Craig and Williams 1998; USFWS 2005). In general, southwestern willow flycatchers inhabit monotypic high-elevation willow forests, monotypic exotic stands of saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus* spp.), native broadleaf deciduous forests, and mixed native/exotic forests (Sogge et al. 1997). The dynamic habitat preferred by southwestern willow flycatchers is regularly disturbed by flooding, drought, or occasionally by fire, continually driving successional transitions in vegetation. Throughout this process, some trees and shrubs of appropriate height and structure must remain in the system in order for it to remain useful to flycatchers. Although nesting typically requires larger mature trees (Jones & Stokes 2004, 2006, 2008; Whitfield and Henneman 2009), even if this feature is lacking, a habitat patch could retain utility for migration or foraging. Transitions are usually temporary, and patches may cycle back into suitability for breeding if allowed to mature (USFWS 2002c).

Survey results suggest that southwestern willow flycatchers do not settle randomly in willow and cottonwood forest but choose to establish territories and nest sites in areas with specific vegetative features (Whitfield and Henneman 2009). Southwestern willow flycatchers have been shown to prefer areas with greater canopy cover and understory vegetation than what has been generally available in the area, clarifying why only a small fraction of the area that appears suitable for breeding is actually used (Whitfield and Henneman 2009).

Southwestern willow flycatchers forage either by aerially gleaning (capturing an insect from a substrate while hovering) from trees, shrubs, and herbaceous vegetation, or by hawking larger insects on the wing by waiting on exposed forage perches and capturing insects in flight (Craig and Williams 1998). During the breeding season, the qualities that are important for this species are a high-quality local source of nutrients to meet the nutritional needs of territorial establishment and defense, mating, nest building, egg laying, brooding, and nestling rearing (Craig and Williams 1998). After the breeding season, when fledglings become more mobile and are able to forage for themselves, the adults are not as dependent on local food sources (Craig and Williams 1998), allowing them to forage more broadly.

Individuals typically breed in different locations each year (Luff et al. 2000; Kenwood and Paxton 2001; USFWS 2002c; Newell et al. 2003). Although they do not usually exhibit nest-site fidelity, they demonstrate loose territory fidelity by returning to the same general area where they previously bred or hatched (Luff et al. 2000; Kenwood and Paxton 2001; USFWS 2002c; Newell et al. 2003). This life history trait results in the geographical area occupied by this species to be much broader than what the specific locations used while nesting would indicate.

Studies have estimated that only 938 to 1,256 southwestern willow flycatcher territories remain (Sogge et al. 2003; Durst et al. 2005). Riparian woodlands found throughout the riparian zone of the SFWA forms one of the most extensive riparian woodlands remaining in California (USFS 2010), and provides essential structure for Southwestern willow flycatchers which have been closely monitored in the area since 1989 (Whitfield 1990, Jones & Stokes 2004, 2006, 2008; Whitfield and Henneman 2009). In fact, the South Fork Kern River Valley population may be the largest in California (Unitt 1987; Craig and Williams 1998).On the South Fork Kern River, southwestern willow flycatchers tend to nest in areas that have more trees greater than 17 feet tall, a larger amount of tree canopy cover, and a larger amount of foliage volume (Copeland 2004), from 0 to 13 feet (Whitfield 1990).

Southwestern willow flycatchers migrate across a wide distribution over the lowlands of California, from as early as April at the South Fork Kern River to as late as mid-June in Red Bluff (Craig and Williams 1998). Transients are observed in California through mid-September (Zeiner et al. 1990), but little is known about the post-breeding season movements of each local subspecies (Craig and Williams 1998). Grinnell and Miller (1944) reported that post-breeding fall migrations may include invasions of the species into habitat higher in elevation than the highest breeding habitat. At desert oases in eastern Kern County, the earliest summer date is July 28 and the latest fall record is October 18, with peak of migration from mid-August to early September (Craig and Williams 1998). Other observations document adults departing mainly during the last half of August, remaining rarely as late as September 4 (Unitt 1987). Juveniles remain later in September, but all depart by October 1 (Unitt 1987). Little data exists on use of migratory stopover sites, but it appears that willow flycatchers pause only briefly in these areas (Craig and Williams 1998).

Since surveys began, the population size of breeding southwestern willow flycatchers in the South Fork Kern River Valley has steadily decreased from 40 males and 30 females in 1989 to 13 males and 7 females in 2008 (Jones & Stokes 2004, 2006, 2008; Whitfield and Henneman 2009). During the same interval, Mayfield Nest Success Estimates have ranged from a low of 17 percent in 1991, to 90 percent in 2008, and the annual number of fledglings may be in decline (see Whitfield and Henneman 2009). Results of resident southwestern willow flycatcher surveys from 1998 to 2011 are provided in Table 3-65.

The mechanism for this decline remains unclear, despite comparable breeding parameters between this population and those measured in stable or increasing populations elsewhere (Whitfield and Henneman 2009).

**Table 3-65**
**Numbers of Adult Resident Southwestern Willow Flycatchers Detected in the South Fork Wildlife Area (1988-2011)**

| Year | No. Residents Detected | Year | No. Residents Detected |
|---|---|---|---|
| 1988 | 2[a] | 2000 | 1 |
| 1989 | 15 | 2001 | 4 |
| 1990 | 10 | 2002 | 10 |
| 1991 | 8 | 2003 | 10 |
| 1992 | 4 | 2004 | 15 |
| 1993 | 10 | 2005 | 11 |
| 1994 | 8 | 2006 | 8 |
| 1995 | 13 | 2007 | 4 |
| 1996 | 4 | 2008 | 0 |
| 1997 | 7 | 2009 | 3 |
| 1998 | 6 | 2010 | 4[b] |
| 1999 | 2 | 2011 | 3 |

Source: Correspondence from Mary J. Whitfield, Research Director, Southern Sierra Research Station, to Mitch Stewart, U.S. Army Corps of Engineers, Sacramento District, September 14, 2011.

[a] No willow flycatcher surveys conducted in 1988, these birds were detected while doing other bird work.

[b] Only a few, limited willow flycatcher surveys conducted in 2010, some birds were detected while conducting other bird fieldwork.

Loss and degradation of riparian habitat and brood parasitism by the invading brown-headed cowbird appears to be responsible for the southwestern willow flycatcher's decline (Unitt 1987; Marshall and Stoleson 2000; Periman and Kelly 2000; USFWS 2005; Brodhead et al. 2007). Overgrazing by cattle has also been an important factor in habitat reduction in some areas (Marshall and Stoleson 2000; Periman and Kelly 2000). Cattle eat and trample understory vegetation that southwestern willow flycatcher rely upon (Unitt 1987; USFWS 2005). Loss of vegetation reduces cover for the birds and reduces soil permeability which in turn causes declines in the water table (Unitt 1987; USFWS 2005). This can lead to the desiccation of wetlands and ultimately the elimination of quality habitat (Marshall and Stoleson 2000). Other processes that disrupt the water table, such as overpumping for agriculture, urban use, soil compaction, or accelerating runoff, also adversely affect the flycatcher's habitat (Unitt 1987; USFWS 2005).

Water level can play a significant role in the availability of riparian habitat for southwestern willow flycatcher. For some lakes, such as Isabella Lake, drought can lead to reduced water storage which in turn increases the exposure of wet soils along the shoreline and allows for increased vegetation. The increase in riparian vegetation may provide sufficient nesting habitat for flycatchers (Ellis et al. 2008). Conversely, in 1995, 700 acres of willow habitat were inundated in the SFWA, resulting in the loss of flycatcher nests and subsequent decline in the number of breeding flycatchers (Whitfield and Strong 1995; USFWS 1997).

**Critical Habitat.** The action addressed within this Draft EIS does not fall within the current critical habitat under Section 4(b)(2) of the ESA for the southwestern willow flycatcher. Critical habitat was designated on October 19, 2005 (50 CFR, Part 17) although it was excluded from the SFWA, Sprague Ranch and an easement on the Haffenfeld property. These areas were excluded because a panel of scientists, convened by the USFWS, determined that the impacts of routine operations of Isabella Lake was an attractive nuisance resulting from periodic inundation, and further determined that the SFWA had no value to southwestern willow flycatcher habitat. These areas are co-managed by the Corps and USFS to protect riparian habitat values, in accordance with a long-term biological opinion (USFWS 2005).

According to the Corp's 1999 Revised Project Description in the Isabella Lake and Dam Routine Operating Procedures for Anticipated Future Operations,

> *"…routine reservoir operations contemplate storage ranging between 30,000 acre-feet and 245,000 acre-feet during the November through February period. Any storage in excess of the 2,584-foot elevation during the winter period of October 1 to March 20, which results in inundation of a portion of the SFWA, would be due to temporary rain flood conditions. An evacuation of water above 2,584 feet after March 20 would require a deviation from the Isabella Water Control Plan. Such short-term inundation does not coincide with the breeding and nesting cycle of the flycatcher since the flycatcher arrives in the area in mid-May and has migrated south and out of the region by the end of August or early September. Likewise, any such short-term inundation is predominantly during the dormant non-growing season for riparian trees and herbaceous plants located in the SFWA."*

On August 15, 2011, USFWS proposed to revise critical habitat for the southwestern willow flycatcher under ESA. The revised critical habitat proposal includes the upper 1.0 km (0.6 mi) of Isabella Lake (including the SFWA), and the Sprague Ranch and Haffenfeld conservation easement. Comments on the proposed rule were accepted until October 14, 2011. All Primary Constituent Elements (PCE) of critical habitat for the southwestern willow flycatcher are found in the riparian ecosystem in the 100-year floodplain of the South Fork Kern River Delta (see USFWS 2005). The PCEs include: (a) PCE 1 – Riparian Vegetation; and (b) PCE 2 – Insect Prey Populations. These elements are discussed below.

*PCE 1 – Riparian Vegetation*. Riparian habitat in a dynamic river or lakeside, natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyer's willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of the following:

- Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 m to 30 m (about 6 to 98 ft.). Lower-stature thickets (2 to 4 m or 6 to 13 ft. tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle and lower-elevation riparian forests; and/or
- Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft.) above ground or dense foliage only at the shrub or tree level as a low, dense canopy; and/or
- Sites for nesting that contain a dense (about 50 percent to 100 percent) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground); and/or
- Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).

*PCE 2 – Insect prey populations*. A variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

*Western snowy plover*

The western snowy plover (*Charadrius alexandrinus nivosus*) was federally listed as threatened March 5, 1993 (Federal Register 66: 42676-42677). The western snowy plover can be found across North and South America, Eurasia, and Africa. In North America, it is restricted to the Gulf and Pacific coasts of the United States and scattered inland localities from Saskatchewan to California and Texas (USFWS 1993b).

Winter range habitat is primarily coastal beaches, tidal flats, lagoon margins, and salt-evaporation ponds. Inland populations in California regularly winter at agricultural wastewater ponds in the San Joaquin Valley and at desert saline lakes in Southern California (e.g., the Salton Sea) (USFWS 1993b).

Western snowy plovers breed up to 10,000 feet in elevation on barren to sparsely vegetated ground, generally near alkaline or saline lakes, reservoirs, and ponds, on riverine sand bars, and at sewage, salt-evaporation, and agricultural wastewater ponds (USFWS 1993b). The snowy plover frequently raises two broods a year and sometimes three in places where the breeding season is long (USFWS 1993b). At around the time chick's hatch, females, which brood the precocial chicks, desert their mate and initiate a new breeding attempt with a different male.

The CNDDB (2011) lists limited occurrences of the western snowy plover in Kern County, near the mouth of the Kern River, in areas of appropriate habitat in the Buena Vista Lakebed, and in the Freemont Valley southeast of the proposed project area. The proposed project area encompasses some aspects of preferred habitat for the western snowy plover, and birds were observed in the South Fork Kern River area during a site visit August 2011 by the Corps and USFWS.

There is no critical habitat designation under Section 4(b)(2) of the ESA for the western snowy plover in the proposed Isabella DSM Project area.

<u>Western yellow billed cuckoo</u>
The western yellow billed cuckoo *(Coccyzus americanus occidentalis)* is a Federal species of concern and listed as endangered by the State of California and sensitive by the USFS. Nesting habitat for the western yellow-billed cuckoo is characterized by a dense subcanopy or shrub layer (regeneration canopy trees, willows, or other riparian shrubs) in lowland riparian areas. Overstory in these habitats may be either large gallery-forming trees 33 to 90 feet, or developing trees 10 to 33 feet, usually cottonwoods (USFWS 1982; Wiggins 2005). Riparian habitat is critical for breeding, wintering, migration stopovers, and as corridors for juvenile dispersal. The earliest spring arrival date for western yellow-billed cuckoo in California is April 23 (Laymon 1998). While there are regularly a few arrivals in May, although not every year, most breeding pairs arrive from June to early July (Laymon and Halterman 1989). Western yellow-billed cuckoos are rarely detected during spring migration in California.

Distribution, habitat, and life history information on the western yellow-billed cuckoo was compiled primarily from the Layman (1998), Layman et al. (1997), Laymon and Halterman (1985, 1989), and USFWS (1982, 2010b, 2010c). Recent distribution information for the action area was provided by Whitfield and Stanek (2010).

Historically, the western yellow-billed cuckoo was a common breeding species in riparian habitat throughout much of lowland California (Grinnell 1915; Grinnell and Miller 1944; Laymon 1998). Early accounts from the Central Valley list the species as common (Belding 1890). Grinnell and Miller (1944) described the cuckoo's range as the coastal valleys from the Mexican border to Sebastopol, Sonoma County, and the Central Valley, from Bakersfield and Weldon, Kern County, north to Redding, Shasta County. Small populations were also found in Northern California along the Shasta River, Siskiyou County, and in Surprise Valley, Modoc County. Populations were also found in suitable habitat east of the Sierra Nevada in the Owens Valley and along the Colorado and Mojave Rivers. By 1944, cuckoos were no longer present in many areas where they were once found "because of removal widely of essential habitat conditions" (Grinnell and Miller 1944). Estimates of the number of current breeding pairs range widely but it is apparent that cuckoos' population and range have been largely diminished since Ridgway (1877) first described the subspecies. Currently, the range of the cuckoo is limited to fragments of riparian habitats (USFWS 2010c).

Western yellow-billed cuckoos are long-range migrants that winter in northern South America in tropical deciduous and evergreen forests (Ehrlich et al. 1988). In California, breeding populations of greater than five pairs that persist every year are limited to the Sacramento River, from Red Bluff to Colusa, and the South Fork Kern River, from Isabella Reservoir to Canebrake Ecological Reserve (Layman 1998), although they may breed in a few other California locations (Laymon and Halterman 1997). Prior surveys also showed cuckoo populations to be most consistent in these locations (Layman and Halterman 1989; Halterman 1991), which have proved to be the only localities in California that sustain breeding populations (USFWS 2010c). Continuous surveys along the South Fork Kern River from 1985 to 2000 showed a population that varied from a low of two pairs in 1990 to a high of 24 pairs in 1992 (Laymon et al. 1997; Whitfield and Stanek 2010). The most recent survey in this area (Whitfield and Stanek 2010) detected a total of 71 cuckoos during the breeding season (mid-June to mid-August). The majority of detections (68 of the 71) were in the SFWA, although 3 detections were made in the Kern River Preserve.

Western yellow-billed cuckoos along the South Fork Kern River are typically associated with upland sites early in the season during wet years but not in dry years (Laymon 1998). It is likely that flooding in wet years reduces the survival of the larvae of the preferred prey (katydids [Tettigonioidea] and sphinx moth [Sphingidae]), which winter underground (Laymon 1998). These conditions restrict cuckoos to foraging in upland areas until the prey base in the lower floodplain begins to recover later in the breeding season (Laymon 1998). Locally, most extant riparian habitat is in the primary floodplain making the potential high for a large reduction in the prey base during wet years (Laymon 1998). If this occurs along with baseline habitat losses from agriculture and urban development (USFWS 1982), the cuckoo population in the action area could be significantly compromised. Restoration would include planting at least a portion of forests on upper terrace sites that do not regularly flood.

The peak of the breeding season at the South Fork Kern River is in the first half of July, though nests have been started as early as June and as late as early August (Laymon 1998). The period of incubation to the point when nestlings leave the nest is typically 16 to 20 days, and while typically only one brood is raised per year (Laymon 1998) at the South Fork Kern River, in years of abundant food resources, two and even three broods have been successfully fledged (Laymon et al. 1997). While nests are almost always placed in willows, cottonwoods are extremely important for foraging. These birds are primarily foliage gleaners in riparian habitats, though at times they sally from a perch and catch flying prey, such as dragonflies (Odonata) or butterflies (Lepidoptera), or drop to the ground to catch grasshoppers (Orthoptera) or tree frogs (*Pseudacris regilla*) (Laymon 1998). They also require upland habitat where they can forage on various other insect species (Laymon 1998). The humid shady environment creates a microclimate that protects the nesting birds, eggs, and fledglings from the dry heat of late summer in the western United States (USFWS 1982). Territory size at the South Fork Kern River ranges from 8 to 100 acres (Laymon and Halterman 1985).

The CDFG's CNDDB (2010) lists only one occurrence of the western yellow-billed cuckoo in the general region of Isabella Lake. The single occurrence is found within the boundary of the nine quads directly surrounding the lake. Birders know the cuckoo from the South Fork Valley of the Kern River, and while they are rarely spotted, they possibly nest in vicinity of the SFWA (Audubon - California 2010).

*Hardhead Minnow*

The hardhead minnow (*Mylopharodon conocephalus*) is a USFS sensitive and State species of concern. They typically inhabit deep, rocky and sandy pools of small and large rivers (e.g. Sacramento-San Joaquin and Russian River drainages) (Page and Burr 1991). Hardhead are present in the Kern River, Lake Isabella, and the lower Kern River. Little is known about their juvenile life history, but based on gill net sampling and shore seining in Isabella Lake in 1999 and 2000; their numbers represented only 1% of the total fish population of the lake (USFS unpublished data in McGuire 2009).

Isabella Lake is not the preferred habitat for the hardhead minnow, and similar to the rainbow trout, hardheads are intolerant of low DO, high water temperatures, and high turbidity (Moyle 2002). Unlike rainbow trout, hardhead prefer water temperatures of 20°C (68°F) or better (McGuire 2009). Though it has been suggested that rainbow trout prey upon hardheads, there is insufficient evidence to support this due to incongruent water temperature preferences between the two species (McGuire 2009).

*Valley elderberry longhorn beetle*

Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) was listed as federally threatened in August 8, 1980 (Federal Register 45: 52803). The valley elderberry longhorn beetle depends on its host plant, the elderberry (*Sambucus* spp.), which is a locally common component of the fragmented riparian forests and savannas of the Central Valley. In most cases, the only evidence of the shrub's use by the beetle is an exit hole created by the larva just before the pupal stage. Larvae tend to be distributed in elderberry stems that are one inch or greater in diameter at ground level (USFWS 1999). Studies suggest that based on the spatial distribution of occupied shrubs, the beetle is a poor disperser (Barr 1991; Collinge et al. 2001). Low density and limited dispersal capability adversely impact the beetle, particularly isolated small subpopulations in fragmented habitat. Moreover, once a small beetle population has been extirpated from an isolated habitat patch, the species may be unable to recolonize the patch if it is unable to disperse from nearby occupied habitat (USFWS 2007a).

The nearest extant population of valley elderberry longhorn beetles is found along the South Tule River east of Porterville (CNDDB 2011).

Potential habitat that could support valley elderberry longhorn beetles is present in the action area. Three valley elderberry shrubs were identified below the Auxiliary Dam during a site visit on April 8, 2008 (Corps 2008b). Although no exit holes were observed, based on the shrubs diameter, they could provide potential habitat. Habitat features that could potentially support longhorn beetles were also identified along the Borel Canal. During surveys conducted in 2001 at the Borel facilities, three elderberry stands were found within the fenced Borel powerhouse area and were determined to provide suitable habitat (Psomas 2010). However, no beetles were observed during these surveys or within 150 feet of the Borel Canal or the elevated flumes, which run between the Lake Isabella Auxiliary Dam and the Bodfish siphon (Psomas 2010). Additional elderberry shrubs were identified along the Kern River away from the Borel Project but no exit holes were observed. The elderberry stands near the Borel Canal were re-surveyed in 2008, 2009, and 2010. The shrubs remained relatively intact as they were found in 2001, but no beetles were observed and only 6 new exit holes were apparent (Psomas 2010).

There is no critical habitat designation under Section 4(b)(2) of the Endangered Species Act (ESA) for the valley elderberry longhorn beetle within the proposed Isabella DSM Project area.

<u>Pallid bat</u>
The pallid bat *(Antrozous pallidus)* is a USFS sensitive species. Pallid bats are found statewide except Sierra Nevada, northwest portions of the Kern Valley and the southern Tehachapi Mountains. They prefer deserts, grasslands, shrubslands, woodlands, and forests and are most common in open, dry habitats, with rocky areas for roosting. Pallid bats are opportunistic generalist that feed on beetles, centipedes, cicadas, crickets, and other invertebrates, and either capture prey on substrates or on the wing. Mating occurs from October to February and females have one to two pups per year. Adult and yearling males may roost in maternity colony structures, but remain separate from females. Little is known about its winter habitat; however, they do not appear to migrate long distances between summer and winter sites, when they occasionally use different sites. Overwinter sites tend to have relatively cool and stable temperatures and are located in protected structures beneath the forest canopy or on the ground and out of direct sunlight. In the summer, roosts must protect bats from high temperatures. Pallid bats are very sensitive to disturbance of roosting sites, such as vandalism, recreational activities, or where man-made structures are occupied, demolished, or modified.

CNDDB (2010) indicates two occurrences of pallid bats in the vicinity of Isabella Lake. The nearest to Isabella DSM Project action area is an occurrence along Hwy 155 at the Kern River and an occurrence along the South Fork Kern River northeast of the community of Bella Vista.

<u>Southwestern pond turtle</u>
The southwestern pond turtle (*Clemmys marmorata pallida)* is a USFS sensitive species. Western pond turtles occur from northern Baja California Norte, Mexico to the Puget Sound region in Washington (Bury 1970, Nussbaum et al. 1983, Iverson 1986, Stebbins 2003). They occur in a variety of aquatic habitats including rivers, streams, ponds, lakes, marshes, vernal pools, and even wastewater and stock ponds (Storer 1930, Germano and

Bury 2001, Buskirk 2002) in areas with mild wet winters and dry, hot summers (Bury and Germano 2008).

Though they prefer low gradient ponds and streams, they can be found up to one mile from perennial waters for as long as six months (Bury and Germano 2008). Preferential aquatic habitat features include abundant basking sites (logs, boulders, vegetation mats, and muddy riparian zones), sufficient plunge pools Western pond turtles are opportunistic feeders, primarily consuming aquatic larvae of mayfies, dragonflies, stoneflies, caddisflies, beetles, midges, and beetles (Holland 1985, Bury 1986). Lesser food items include fishes, anurans, macrophytes, and filamentous algae.

Historic threats to the Western pond turtle population was commercial harvesting for human consumption and the aquarium trade (Bury and Germano 2008). Current primary threats to the southwestern pond include loss, alteration, and fragmentation of aquatic and terrestrial habitat (Bury and Germano 2008). The CNDDB does not report observations of Clemmys sp. in the vicinity of Isabella Lake; however, the USFS reports their presence in the Kern River to Cannell Creek (north of Kernville).

### 3.10.3 Environmental Consequences

This section discusses the potential impacts on biological resources that are anticipated from the Proposed Action Alternatives and support actions. The discussion includes a description of the methods and assumptions used to conduct the analysis and the criteria for determining the level of the potential impacts.

***Scope and Methods***

Numerous sources of information were used to compile information to characterize the biological resources found in the Primary and Secondary Action Areas. Tetra Tech obtained a list of endangered, threated, proposed, and candidate species from the USFWS on January 11, 2012 (Document No. 120111031623; Appendix E). Additional sources of information included: California Department of Fish and Game's (CDFG) California Natural Diversity Database (CNDDB) and the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants. Following review of existing information, a reconnaissance-level habitat and vegetation survey was conducted in the proposed project area from October 12 to 14, 2010 by Tetra Tech biologists. During the survey, the surface elevation of Isabella Lake was at 2,562.75 feet. A follow up vegetation and preliminary wetland and other waters of the U.S. delineation was conducted April 18 to 22, 2011 when Isabella Lake was between 2,581.25 and 2,583.15 feet. The USFWS list, information from the field reconnaissance and existing information was used in the development by Tetra Tech of a Biological Data Report (BDR) that was provided to the Corps and the USFWS in April 2011. Information in the BDR was used by the USFWS for the planning aid letter provided to the Corps (letter dated May 10, 2011 (Appendix E).

The factors that are important for evaluating the context and intensity of impacts on vegetation and wildlife species include a qualitative assessment of whether the action would cause a substantial loss, degradation, or fragmentation of any sensitive natural

**IPaC** **U.S. Fish & Wildlife Service**

# IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.



## Location

Kern County, California


## Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

# Endangered species

**This resource list is for informational purposes only and does not constitute an analysis of project level impacts.**

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

# Mammals

| NAME | STATUS |
|---|---|

Fisher Pekania pennanti — Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/3651

# Birds

| NAME | STATUS |
|---|---|
| California Condor Gymnogyps californianus<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/8193 | Endangered |
| Least Bell's Vireo Vireo bellii pusillus<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/5945 | Endangered |
| Southwestern Willow Flycatcher Empidonax traillii extimus<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/6749 | Endangered |
| Yellow-billed Cuckoo Coccyzus americanus<br>There is **proposed** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/3911 | Threatened |

# Amphibians

| NAME | STATUS |
|---|---|
| California Red-legged Frog Rana draytonii<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/2891 | Threatened |

# Fishes

| NAME | STATUS |
|---|---|
| Delta Smelt Hypomesus transpacificus<br>Wherever found<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>https://ecos.fws.gov/ecp/species/321 | Threatened |

# Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

# Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf



The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME

BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

California Thrasher Toxostoma redivivum — Breeds Jan 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Clark's Grebe Aechmophorus clarkii — Breeds Jan 1 to Dec 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Costa's Hummingbird Calypte costae — Breeds Jan 15 to Jun 10

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9470

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Rufous Hummingbird selasphorus rufus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Song Sparrow Melospiza melodia — Breeds Feb 20 to Sep 5

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Spotted Towhee Pipilo maculatus clementae — Breeds Apr 15 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/4243

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.



# Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

**Probability of Presence** (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that

week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

**Breeding Season** ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

**Survey Effort** (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

**No Data** (–)
A week is marked as having no data if there were no survey events for that week.

**Survey Timeframe**
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

**What does IPaC use to generate the migratory birds potentially occurring in my specified location?**

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

### What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

### How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

**What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

**Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.



# Facilities

## National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

## Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

# Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1Ah

FRESHWATER FORESTED/SHRUB WETLAND

- PSSAh
- PFOAh

LAKE

- L1UBHh
- L2USCh
- L2UBHh

RIVERINE

- R4SBC
- R5UBF



A full description for each wetland code can be found at the National Wetlands Inventory website

#### Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

#### Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

### Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

# Appendix D
# Field Notes and Forms

# Air I_ nitoring Form

ECM Consultants
address 3525 H Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

Site Address: Big Blue Mill Expanded SI
Client: USFS

Date: 10/21/20
Recorded by: JSK

| Sample ID | Date Sampled | Pump Start Time | Pump End Time | Flow Rate (L/min) | Cassette Type | Lab Method | Wind Direction | Wind Speed (mph) | Notes: |
|---|---|---|---|---|---|---|---|---|---|
| BB-D-1.1 | 10/21/20 | 1230 | 1430 | 2.5 | w/cyclone | Resp metals | SW | 3 | wind from SW to NE |
| BB-D-1.2 | 10/21/20 | 1230 | 1430 | 2.5 | | Total Dust metals | SW | 3 | " |
| BB-D-1.3 | 10/21/20 | 1230 | 1430 | 2.5 | w/cyclone | Resp Mercury | SW | 3 | " |
| BB-MV-01 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1310 |
| BB-D-2.1 | 10/21/20 | 1300 | 1500 | 2.5 | cyclone | Resp Metals | SW | 3 | |
| BB-D-2.2 | 10/21/20 | 1300 | 1500 | 2.5 | | Total Dust Metals | SW | 3 | |
| BB-D-2.3 | 10/21/20 | 1300 | 1500 | 2.5 | cyclone | Resp Mercury | SW | 3 | |
| BB-MV-02 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1312 |
| BB-MV-03 | 10/21/20 | — | — | — | — | — | SW | 4 | MV=.000 1314 |

Comments: D=Dust, MV=Mercury Vapor completed w/ Jerome 431-X, MV results in mg/m³
BB-D-1+2 location track recorded in Gaia. ~90°, SW wind 3-4 mph, no visible dust in air. Walked property boundary + mill area, collect XRF samples @ mill foundation area

Air Monitoring Form

ECM Consultants

address 3525 [illegible] d Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

Site Address: Big Blue Mill Expanded SI

Client: USFS

Date: 10/21/20

Recorded by: JSK

| Sample ID | Date Sampled | Pump Start Time | Pump End Time | Flow Rate (L/min) | Cassette Type | Lab Method | Wind Direction | Wind Speed (mph) | Notes: |
|---|---|---|---|---|---|---|---|---|---|
| BB-MV-04 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1316 |
| BB-MV-05 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1318 |
| BB-MV-06 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1320 |
| BB-MV-07 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1321 |
| BB-MV-08 | 10/21/20 | — | — | — | — | — | SW | 3 | MV= .000 1323 |
| BB-MV-09 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .0000 1325 |
| BB-MV-10 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= .000 1327 |
| BB-MV-11 | 10/21/20 | — | — | — | — | — | SW | 4 | MV= ~~.00~~ 0.005 ~~1245~~ ~~.027~~ 1340 |
| | | | | | | | | | |

Comments: BB-MV-11 taken near truck parking near point BB-54

Page ____ of ____

# Air [illegible]nitoring Form

ECM Consultants
address 3525 H[illegible] Ave #200
Costa [illegible], CA 92626
phone 714.662.2759
web ecmconsults.com

Site Address: Big Blue Mill Expanded SI

Client: USFS

Date: 10/22/20

Recorded by: JSK

| Sample ID | Date Sampled | Pump Start Time | Pump End Time | Flow Rate (L/min) | Cassette Type | Lab Method | Wind Direction | Wind Speed (mph) | Notes: |
|---|---|---|---|---|---|---|---|---|---|
| BB-D-3.1 | 10/22/20 | 1200 | 1400 | 2.5 | cyclone | Resp metals | S | 1 | Collected at low beach area between eroded cemented tailings face + water |
| BB-D-3.2 | 10/22/20 | 1200 | 1400 | 2.5 | | Total Dust metals | S | 1 | level. Collect BB-23 during dust sample (+subsurface) |
| BB-D-3.3 | 10/22/20 | 1200 | 1400 | 2.5 | cyclone | Resp Mercury | S | 1 | |
| BB-D-4.1 | 10/22/20 | 1200 | 1400 | 2.5 | cyclone | Resp Metals | S | 1 | |
| BB-D-4.2 | 10/22/20 | 1200 | 1400 | 2.5 | | Total Dust Metals | S | 1 | |
| BB-D-4.3 | 10/22/20 | 1200 | 1400 | 2.5 | cyclone | Resp Mercury | S | 1 | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

**Comments:** Recorded GPS track of sampling area on Gaia GPS phone app?

# Surface Sampling Form

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

Site Address: Big Blue Mill Site

Client: USFS

Date: 10/20-

Recorded by: JSK

| Sampling Location | Time Gauged | Flowing? | River Width | River Depth | Flow Rate (fps) | Parabolic (P) Flat (F) | Temp (°C) | Electric Conductivity | pH | ORP | Turbidity (NTU) | Dissolved Oxygen | Sample Time | Notes: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rinsate Blank-01 | — | — | — | — | — | — | — | — | — | — | — | — | 1715 | 10/20/20 |
| Rinsate Blank-02 | — | — | — | — | — | — | — | — | — | — | — | — | 1745 | 10/21/20 |
| BB-SW-02 | 1330 | Yes | ~40' | ~2-10'? | ~3 | F | 16.39 | 181 | 8.38 | 35.4 | 0.71 | 0.94 | 1330 | 10/22/20 |
| Rinsate Blank 03 | — | — | — | — | — | — | — | — | — | — | — | — | 1130 | 10/22/20 sampled after subsurface borings |
| DUP-01 | 1335 | Yes | ~40' | ~2-10'? | ~3 | F | 16.39 | 181 | 8.38 | 35.4 | 0.71 | 0.94 | 1335 | 10/22/20 Dup of SW-2 |
| ~~BB-MT-01~~ | — | — | — | — | — | — | — | — | — | — | — | ~~1.01~~ | — | — |
| BB-SW-03 | 1545 | Yes | ~20' | ~2' | ~3 | F | 16.91 | 184 | 8.03 | 107.7 | 0.90 | 1.01 | 1545 | 10/22/20 |
| BB-SW-01 | 1715 | Yes | ~50' | ~3-5' | ~2 | F | 16.45 | 186 | 7.87 | 129.5 | 1.05 | 1.04 | 1715 | 10/22/20 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

**Comments:**

## Soil Sampling Form

ECM Consultants
address 3525 ... and Ave #200
Costa Mesa, CA 92626
phone 714 662 2759
web ecmconsults.com

Site Address: Big Blue Mill Expanded SI

Client: USFS

Date: 

Recorded by: JSK

| Sample ID | Date Sampled | Time Sampled | Sample Type (Discrete, ISM, Background) | Location Description (Background, tailings pile, wash, next to headframe, near ore pile, etc.) | Media Description (Gravelly sand, fine tailings, streambed sediment, etc.) | Notes: |
|---|---|---|---|---|---|---|
| BB-B-Comp-01 | 10/19/20 | 1540 | Bg composite | BG | Medium sand w/ soil, dry | |
| BB-SW-02-Sed | 10/22/20 | 1330 | Colocated Sediment | River bank | Medium sand, poorly sorted | |
| BB-M1-4Sed-01 | 10/22/20 | 1510 | Mod-01 Sediment downstream | Sediment submerged in river along bank | ~~Medium~~ Sand, medium grained, poorly sorted | |
| BB-~~[illegible]~~ SW-03-Sed | 10/22/20 | 1545 | Colocated Sediment | River bank on Mod Island | Sand, medium grained, poorly sorted | |
| BB-SW-01-Sed | 10/22/20 | 1715 | Colocated Sediment | River bank upstream of site | Sand, medium grained, well sorted | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Comments:

# Industria. .lygiene Chain of Custody

EMSL Order Number (Lab Use Only):

| | | |
|---|---|---|
| Report To Contact Name: David Allison | Bill To Company: ECM Consultants | Client ID # |
| Company Name: ECM Consultants | Attention To: Mona Mansell & David Allison | # Samples in Shipment: 12 |
| Street: 3525 Hyland Ave, Suite 200 | Street: 3525 Hyland Ave, Suite 200 | Date of Shipment: 10/26/2020 |
| City: Costa Mesa State/Province: CA Zip/Postal Code: 92626 | City: Costa Mesa State/Province: CA Zip/Postal Code: 92626 | Sampled By (Signature): [signature] |
| Phone : 208-407-1440 Fax : | Phone: 714-662-2759 Fax: | Purchase Order: |
| Email Results To: dallison@ecmconsults.com | Project Name: Big Blue Mill U.S. State where Samples Collected: CA | |

**Turnaround Time (TAT) – Please Check: If No Selection Made, Standard 2 Week TAT Will Apply**

| 2 Week | 1 Week | 4 Day | 3 Day | 2 Day | 1 Day | Other (Call Lab) |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Media Type:
Manufacturer/Part #:
Lot #:

| Client Sample ID | Location/Description | Analyte / Method | Media | Flow (lpm) | Sample Time On | Sample Time Off | Volume / Area | Sample Type | Sample Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| BB-D-1.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-1.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | |
| BB-D-1.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1300 | 1430 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | |
| BB-D-2.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ☒ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-3.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-3.2 | Near river and cemented tailings | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | |
| BB-D-3.3 | Near river and cemented tailings | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-4.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | Collected with cyclone |

*Note: Most NIOSH and OSHA methods require field blanks. It is the IH field sampler's responsibility to submit the proper number of field blanks and duplicates.*

| Released By | Date | Received By | Date |
|---|---|---|---|
| Jared Kemper ECM Consultants [signature] | 10/26/2020 | | |
| | | | |
| | | | |

Comments:

BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

# Chain of Custody

* Required Fields

TEMP: ______

| Client/Company Name *: ECM Consultants | Report Attention *: David Allison | Phone * #: 208-407-1440 FAX * #: E-mail: dallison@ecmconsults.com |
|---|---|---|
| Address *: 3525 Hyland Ave. Suite 200 | City *: Costa Mesa State *: CA | Zip *: 92626 |
| Project Information: USFS Big Blue Mill | PO #: BCL Quote #: | Carbon Copies: CDHS [ ] Fresno Co [ ] EPA [ ] Merced Co [ ] Tulare Co [ ] Other: |

How would you like your completed results sent? [x] E-Mail [ ] Fax [ ] EDD [ ] Mail Only

Sampler Name Printed / Signature: Jared Kemper (signature)

QC Request: [x] STD [ ] Level II

Result Request ** Surcharge: [x] STD [ ] 5 Day** [ ] 2 Day** [ ] 1 Day**

Regulatory Compliance: Electronic Data Transfer: Y [ ] N [ ] System No. *

Matrix Types: RSW = Raw Surface Water; RGW = Raw Ground Water; CFW = Chlorinated Finished Water; FW = Finished Water; CWW = Chorinated Waste Water; WW = Waste Water; SW = Storm Water; BW = Bottled Water; DW = Drinking Water; SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Sampled Date | Sampled Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Ag, V, Zn | 6020-Sb, As, Se, Tl | 7471A-Hg | ABA Sobek | WET | Bioaccessibility by 1340 Sb, As, Pb, Hg | TCLP-HOLD SAMPLES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10/19/20 | 1535 | BB-B-Comp-01 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1108 | BB-025 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1113 | BB-020 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1223 | BB-123 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1414 | BB-011 | SO | MS/MSD | X | X | X | | | | | | |
| | | 10/20/20 | 1432 | BB-012 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1442 | BB-127 | SO | | X | X | X | X | X | X | | | |
| | | 10/20/20 | 1452 | BB-129 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1457 | BB-129-0.5 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1606 | BB-018 | SO | | X | X | X | | | | | | |
| | | 10/20/20 | 1606 | DUP-02 | SO | | X | X | X | | | | | | |

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| (signature) Jared Kemper | ECM | 10/23/20 | 1215 | (signature) | BC |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
| | | | | | |

| Received for Lab by: (Signature and Printed Name) | Date | Time | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init. |
|---|---|---|---|
| | | | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

# BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

## Chain of Custody

* Required Fields

TEMP: ____

| Client/Company Name *: | Report Attention *: | Phone * #: 208-407-1440 FAX * #: |
|---|---|---|
| ECM Consultants | David Allison | E-mail: dallison@ecmconsults.com |

| Address * | City * | State * | Zip * |
|---|---|---|---|
| 3525 Hyland Ave. Suite 200 | Costa Mesa | CA | 92626 |

Project Information: USFS Big Blue Mill

PO #

BCL Quote #

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Sampler Name Printed / Signature: Jared Kemper

QC Request: ☑ STD ☐ Level II

Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

Regulatory Compliance: Electronic Data Transfer: Y☐ N☐ System No. *

**Matrix Types:** RSW = Raw Surface Water CFW = Clorinated Finished Water CWW = Chorinated Waste Water BW = Bottled Water RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Sampled Date | Sampled Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Ag, V, Zn | 6020-Sb, As, Se, Tl | 7471A-Hg | ABA-Sobek | WET | Bioavailability by 1340 Sb, As, Pb, Hg | TCLP-HOLD SAMPLES | 8260 full list VOCs | 8270C SIM SVOCs | 200.8 Total Metals | 245.1 Total Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10/20/20 | 1623 | BB-023 | SO | | X | X | X | X | X | | | | | | |
| | | 10/20/20 | 1628 | BB-022 | SO | VOC only | ~~X~~ | ~~X~~ | JK | | | | | X | X | | |
| | | 10/20/20 | 1715 | RinsateBlank-01 | W | Total Metals only | | | | | | | | | | X | X |
| | | 10/21/20 | 1108 | BB-025 | SO | | X | X | X | | | | | | | | |
| | | 10/21/20 | 1441 | BB-043 | SO | VOC only | ~~X~~ | ~~X~~ | ~~X~~ JK | | | | | X | X | | |
| | | 10/21/20 | 1745 | RinsateBlank-02 | W | Total Metals Only | ~~X~~ | ~~X~~ | ~~X~~ JK | | | | | | | X | X |
| | | 10/22/20 | 1213 | BB-023-1 | SO | | X | X | X | X | X | | | | | | |
| | | 10/22/20 | 0908 | BB-025-0.5 | SO | | X | X | X | | | | | | | | |
| | | 10/22/20 | 0845 | BB-097 | SO | | | | | | | | | X | X | | |
| | | 10/22/20 | 1028 | BB-116-SO-01 | SO | | X | X | X | | | | | X | X | | |
| | | 10/22/20 | 1033 | BB-116-SO-01-0.5 | SO | | X | X | X | X | X | X | | | | | |

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| Jared Kemper | ECM | 10/23/20 | 1215 | [signature] | |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
| | | | | | |

| Received for Lab by: (Signature and Printed Name) | Date | Time | Payment Received at Delivery: |
|---|---|---|---|
| | | | Date: Amount: Check/Cash/Card PIA # Init. |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

# BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

## Chain of Custody

* Required Fields

TEMP: ________

Client/Company Name *: ECM Consultants
Report Attention *: David Allison
Phone * #: 208-407-1440 FAX * #:
E-mail: dallison@ecmconsults.com

Address *: 3525 Hyland Ave. Suite 200 City *: Costa Mesa State *: CA Zip *: 92626

Project Information: USFS Big Blue Mill
PO #
BCL Quote #

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Regulatory Compliance
Electronic Data Transfer: Y☐ N☐
System No. *

Sampler Name Printed / Signature: Jared Kemper [signature]

QC Request: ☑ STD ☐ Level II

Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

**Matrix Types:** RSW = Raw Surface Water CFW = Clorinated Finished Water CWW = Chorinated Waste Water BW = Bottled Water
RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Sampled Date | Sampled Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba,Be,Cd,Cr,Co,Cu Pb,Mo,Ni,Ag,V,Zn | 6020-Sb,As,Se,Tl | 7471A-Hg | TCLP-HOLD SAMPLES | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10/22/20 | 1447 | BB-M1-01 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1458 | BB-M1-02 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1513 | BB-M1-03 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1517 | BB-M1-04 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1522 | BB-M1-05 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1528 | BB-M1-06 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1535 | BB-M1-07 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1553 | BB-M1-08 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1600 | BB-M1-09 | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1605 | BB-M1-10 | SO | MS/MSD | X | X | X | | | | | | |
| | | 10/22/20 | 1715 | BB-SW-01-Sed | SO | | X | X | X | | | | | | |

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| [signature] Jared Kemper | ECM | 10/23/20 | 1215 | [signature] | |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
| | | | | | |
| Received for Lab by: (Signature and Printed Name) | | Date | Time | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init. | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

**BC** LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

# Chain of Custody

* Required Fields

TEMP: ________

| Client/Company Name *: ECM Consultants | Report Attention *: David Allison | Phone * #: 208-407-1440 FAX * #: E-mail: dallison@ecmconsults.com |
|---|---|---|

Address *: 3525 Hyland Ave. Suite 200 | City *: Costa Mesa | State *: CA | Zip *: 92626

Project Information: USFS Big Blue Mill | PO # | BCL Quote #

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Regulatory Compliance — Electronic Data Transfer: Y☐ N☐ — System No. *

Sampler Name Printed / Signature: Jared Kemper (signature)

QC Request: ☑ STD ☐ Level II

Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

**Matrix Types:** RSW = Raw Surface Water CFW = Clorinated Finished Water CWW = Chorinated Waste Water BW = Bottled Water RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Date | Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Ag, V, Zn | 6020-Sb, As, Se, Tl | 7471A-Hg | 200.8 + 245.1 Total + Dissolved | TCLP HOLD SAMPLES | 8260 | 8270 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10/22/20 | 1330 | BB-SW-02-Sed | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1545 | BB-SW-03-Sed | SO | | X | X | X | | | | | | |
| | | 10/22/20 | 1715 | BB-SW-01 | W | Lab filter for dissolved metals | | | | X | | | | | |
| | | 10/22/20 | 1330 | BB-SW-02 | W | Lab filter for dissolved metals | | | | X | | | | | |
| | | 10/22/20 | 1545 | BB-SW-03 | W | Lab filter for dissolved metals | | | | X | | | | | |
| | | 10/22/20 | 1335 | DUP-01 | W | Lab filter for dissolved metals | | | | X | | | | | |
| | | 10/22/20 | 1130 | Rinsate Blank-03 | W | Total metals only | | | | X | | | | | |
| | | 10/22/20 | 1200 | Trip Blank | W | 8260 only | | | | | ~~X~~ JK | X | ~~X~~ | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| (signature) Jared Kemper | ECM | 10/23/20 | 1215 | (signature) | |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
| | | | | | |

Received for Lab by: (Signature and Printed Name) | Date | Time | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init.

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

ECM Consultants

10/23/20

Big Blue Mill    Sampled: Jared Kemper    PM: David Allison

Report metals totals before running TCLP ~~+ Bioavailability~~
Lab to filter water samples for dissolved metals
Run 6010B for barium, beryllium, cadmium, chromium, cobalt,
copper, lead, molybdenum, nickel, silver, vanadium, zinc
Run 6020 for antimony, arsenic, selenium, thallium
Run Bioavailability ~~on~~ for antimony, arsenic, lead, mercury

# Tailgate Safety Meeting

ECM Consultants
address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | |
|---|---|
| Project Name: Big Blue Mill Site | Date: 10/19/20 |
| Project Manager: David Allison | |
| Presented By: Jared Kemper | |

***Daily Activities:*** XRF

- [x] emergency procedures & evacuation route
- [x] site safety plan review and location
- [ ] Safety First / self-check before every task
- [ ] equipment and machinery familiarization
- [x] sharp object, rebar, and scrap metals
- [x] slips, trips, and falls
- [ ] vehicle safety and driving/road conditions
- [ ] overhead utility locations and clearance
- [x] open pits, excavations, and site hazards
- [ ] excavation/trenching inspections/documentation
- [ ] Smoking in designated areas
- [ ] Eye wash station locations
- [ ] employee Right-To-Know/MSDS location
- [ ] no short cuts
- [x] heat and cold stress
- [x] operational discipline
- [ ] hazard identification
- [x] daily work scope
- [x] directions to hospital
- [ ] Stop Work Authority
- [ ] pinch points
- [ ] lifting techniques
- [x] orderly site and housekeeping
- [x] traffic safety
- [x] backing up hazards
- [ ] electrical ground fault
- [ ] noise hazards
- [ ] refueling procedures
- [ ] decontamination procedures
- [x] first aid, safety, and PPE location
- [ ] no horseplay
- [x] visitors
- [x] cell phones
- [ ] securing loads/cargo
- [x] site specific hazards
- [ ] personal protective equipment
- [ ] strains and sprains
- [ ] buddy system (as needed)
- [x] portable tool safety and awareness
- [x] public safety and fences
- [ ] parking & lay down/ wheel chocks
- [ ] hot work permits
- [ ] flying debris hazards
- [x] fire extinguisher location
- [ ] excavator swing and loading
- [x] dust and vapor control
- [ ] effects of the night before
- [ ] demobilization safety
- [ ] bee stings, insects, biological hazards
- [ ] Critical Allergies
- [x] NOBODY GETS HURT!

Level D personal protection equipment is required on site. If hazardous conditions specified in the Site Health and Safety Plan are met, Onsite personnel will upgrade to level C or above as appropriate. The project manager will be notified immediately of condition change and field personnel will be authorized to continue or stop work, as necessary.

| LIST JHAs REVIEWED (As Applicable) | COVID | XRF |
|---|---|---|
| | | |

| NAME | SIGNATURE | COMPANY |
|---|---|---|
| Jared Kemper | [signature] | ECM |
| Chris McCormack | [signature] | ECM |
| Noelle Wakoshi | [signature] | USFS |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| ***AFTERNOON SAFETY BREAK TOPICS*** | | ***TIME:*** |
|---|---|---|
| | | |
| | | |

Conduct a daily safety meeting prior to beginning each day's site activities. Follow-up on any noted items and document resolution.

# Daily Field Report

ECM Consultants

address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | | | |
|---|---|---|---|
| Client: | USFS | Date: 10/19/20 | Mo ✓ / Tu / We / Th / Fr / Sa / Su |
| Job Site: | Big Blue Mill Site | Weather: Sunny, ~90° | |
| Location | Kern County, CA | Subcontractors onsite: | |
| Observer | | | |

**Daily Activities:** XRF BG + Delineation, Mobilize

| Time | Description |
|---|---|
| 0630 | Meet @ Ripon, |
| 1200 | Drop off trailer @ camp Kernville |
| 1300 | Onsite, investigate background location, sample BG |
| 1800 | Noelle onsite, discuss sampling + delineation. She approved background |
| | location. Discuss beam length (40, 60, 90 sec) + how it affects LOD. She |
| | agreed 14 LOD for As @ 40 sec is acceptable. Discuss 6200+ in-situ, |
| | she said in-situ fine for grid events, but request homogenization |
| | for tailings |
| 1730 | Offsite |

SK

Work Permit Required? N Y#______
Mileage: ________ miles

# Tailgate Safety Meeting

ECM Consultants

address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | |
|---|---|
| Project Name: Big Blue Mill Site | Date: 10/20/20 |
| Project Manager: David Allison | |
| Presented By: Jared Kemper | |

***Daily Activities:*** XRF, Soil sampling

- [x] emergency procedures & evacuation route
- [x] site safety plan review and location
- [x] Safety First / self-check before every task
- [x] equipment and machinery familiarization
- [x] sharp object, rebar, and scrap metals
- [x] slips, trips, and falls
- [x] vehicle safety and driving/road conditions
- [x] overhead utility locations and clearance
- [x] open pits, excavations, and site hazards
- [ ] excavation/trenching inspections/documentation
- [ ] Smoking in designated areas
- [x] Eye wash station locations
- [x] employee Right-To-Know/MSDS location
- [ ] no short cuts
- [ ] heat and cold stress
- [ ] operational discipline
- [ ] hazard identification
- [x] daily work scope
- [x] directions to hospital
- [ ] Stop Work Authority
- [ ] pinch points
- [x] lifting techniques
- [x] orderly site and housekeeping
- [x] traffic safety
- [x] backing up hazards
- [ ] electrical ground fault
- [ ] noise hazards
- [ ] refueling procedures
- [ ] decontamination procedures
- [x] first aid, safety, and PPE location
- [x] no horseplay
- [ ] visitors
- [x] cell phones
- [ ] securing loads/cargo
- [x] site specific hazards
- [x] personal protective equipment
- [x] strains and sprains
- [ ] buddy system (as needed)
- [x] portable tool safety and awareness
- [ ] public safety and fences
- [x] parking & lay down/ wheel chocks
- [ ] hot work permits
- [ ] flying debris hazards
- [x] fire extinguisher location
- [ ] excavator swing and loading
- [x] dust and vapor control
- [ ] effects of the night before
- [x] demobilization safety
- [ ] bee stings, insects, biological hazards
- [x] Critical Allergies
- [ ] NOBODY GETS HURT!

Level D personal protection equipment is required on site. If hazardous conditions specified in the Site Health and Safety Plan are met, Onsite personnel will upgrade to level C or above as appropriate. The project manager will be notified immediately of condition change and field personnel will be authorized to continue or stop work, as necessary.

| LIST JHAs REVIEWED (As Applicable) | COVID | |
|---|---|---|
| | | |

| NAME | SIGNATURE | COMPANY |
|---|---|---|
| Chris McCormick | [signature] | ECM |
| Jared Kemper | [signature] | ECM |
| | | |
| Noelle Graham-Wakoski | [signature] | USFS |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| ***AFTERNOON SAFETY BREAK TOPICS*** | | ***TIME:*** |
|---|---|---|
| | | |
| | | |

Conduct a daily safety meeting prior to beginning each day's site activities. Follow-up on any noted items and document resolution.

# Daily Field Report

ECM Consultants

address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | | | |
|---|---|---|---|
| Client: USFS | Date: 10/20/20 | Mo Tu ✓ We Th Fr Sa Su | |
| Job Site: Big Blue Mill Site | Weather: Sunny, ~85° | | |
| Location Kern County, CA | Subcontractors onsite: | | |
| Observer Jared Kemper | | | |

**Daily Activities:** XRF, soil sample

| Time | Description |
|---|---|
| 0700 | Onsite, set up equipment |
| 0730 | Shoot blank standard w/ XRF, 40/20 sec beams. Had to warm |
| | unit in truck to override detector tube error |
| 0745 | Start XRF on northern boundary at grid. Bagging + homogenizing all sampling |
| 0930 | Noelle onsite, explain delineation criteria, Pb + Hg < bg to N + E, but |
| | As is slightly higher in some places (24 vs 19 bg). Explained that results |
| | are very similar to bg + should consider these boundaries delineated |
| | Noelle agreed |
| 1100 | Move toward water, collecting XRF |
| 1200 | Delineate SW boundary |
| 1230 | XRF cemented mine waste pedestal sidewall as a depth/boring sample. |
| | Relocate XRF sample BB-123 to sample this as a focused area. Chisel |
| | Cemented mine waste into baggie from sidewall + homogenize sediment in |
| | bag, then shoot each interval w/ XRF. Sam XRF @ 0", 0.5', 1', 2', 3', 4' |
| | bgs. Material too hard to hand auger. Cemented mine waste is fine/medium |
| | grained sediments w/ cobbles. 0-0.5' is orange, finer grained, fewer cobbles, |
| | higher XRF. 1'-4' darker sediment, more + larger cobbles |
| 1300 | Continue XRF along trail near river and cemented tailings. XRF BB-129 @ |
| | depth intervals like BB-123 (0.5', 1', 2', 3', 4', 5') 5' shot was ~~agai~~ in material |
| | against bedrock ~~also~~ |
| 1500 | XRF toward mill foundation and GPS the foundations @ site, water |
| | level, cemented tailings @ aerial extent. |
| 1700 | Complete 100th XRF shot, talk to home owner @ small house closest to |
| | river about drone work. |
| 1715 | Decon field equipment and collect Rinsate Blank |
| 1730 | Offsite |
| | |
| | JK |
| | |

Work Permit Required? N Y#______
Mileage: __________ miles

# Tailgate Safety Meeting

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Project Name: Big Blue Mill Site | Date: 10/~~20~~ 21/20 |
|---|---|
| Project Manager: David Allison | |
| Presented By: Jared Kemper | |
| ***Daily Activities:*** Drone flight, XRF, Soil + SW sampling | |

- [x] emergency procedures & evacuation route
- [x] site safety plan review and location
- [x] Safety First / self-check before every task
- [x] equipment and machinery familiarization
- [x] sharp object, rebar, and scrap metals
- [x] slips, trips, and falls
- [x] vehicle safety and driving/road conditions
- [x] overhead utility locations and clearance
- [x] open pits, excavations, and site hazards
- [ ] excavation/trenching inspections/documentation
- [ ] Smoking in designated areas
- [x] Eye wash station locations
- [ ] employee Right-To-Know/MSDS location
- [x] no short cuts
- [x] heat and cold stress
- [x] operational discipline
- [x] hazard identification
- [x] daily work scope
- [x] directions to hospital
- [x] Stop Work Authority
- [x] pinch points
- [ ] lifting techniques
- [ ] orderly site and housekeeping
- [x] traffic safety
- [ ] backing up hazards
- [ ] electrical ground fault
- [x] noise hazards
- [ ] refueling procedures
- [x] decontamination procedures
- [x] first aid, safety, and PPE location
- [x] no horseplay
- [x] visitors
- [x] cell phones
- [x] securing loads/cargo
- [x] site specific hazards
- [x] personal protective equipment
- [x] strains and sprains
- [x] buddy system (as needed)
- [x] portable tool safety and awareness
- [x] public safety and fences
- [ ] parking & lay down/ wheel chocks
- [ ] hot work permits
- [x] flying debris hazards
- [x] fire extinguisher location
- [ ] excavator swing and loading
- [ ] dust and vapor control
- [ ] effects of the night before
- [x] demobilization safety
- [ ] bee stings, insects, biological hazards
- [ ] Critical Allergies
- [x] NOBODY GETS HURT!

Level D personal protection equipment is required on site. If hazardous conditions specified in the Site Health and Safety Plan are met, Onsite personnel will upgrade to level C or above as appropriate. The project manager will be notified immediately of condition change and field personnel will be authorized to continue or stop work, as necessary.

| LIST JHAs REVIEWED (As Applicable) | COVID | |
|---|---|---|
| | | |

| *NAME* | *SIGNATURE* | *COMPANY* |
|---|---|---|
| Jared Kemper | [signature] | ECM |
| Chris McCormack | [signature] | ECM |
| Noelle Graham-Wakosth | [signature] | USGS |
| Thomas F. Gustaff | [signature] | CEI |
| | | |
| Mike Edwards | [signature] | CEI |
| | | |
| | | |
| | | |

***AFTERNOON SAFETY BREAK TOPICS*** ***TIME:***

| | | |
|---|---|---|
| | | |
| | | |

Conduct a daily safety meeting prior to beginning each day's site activities. Follow-up on any noted items and document resolution.

# Daily Field Report

ECM Consultants
address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | | | |
|---|---|---|---|
| Client: | USFS | Date: 10/21/20 | Mo / Tu / We ✓ / Th / Fr / Sa / Su |
| Job Site: | Big Blue Mill Site | Weather: Hazy, 80° | |
| Location | Kern County, CA | Subcontractors onsite: Cornerstone (Drone Survey) | |
| Observer | Jared Kemper | | |

**Daily Activities:** Drone Survey, XRF, Soil + SW sampling

| Time | Description |
|---|---|
| 0645 | Onsite, prep paperwork. Call w/ Cornerstone, setting up drone on hillside. |
| 0700 | Noelle onsite, asked for property boundaries to be shown on figures |
| 0730 | Cornerstone onsite, discuss scope + safety for drone survey |
| 0800 | Cornerstone begins placing drone markers |
| 0840 | Talk w/ ~~BLM onsite~~ ~~USFS~~ BLM Archaeologist |
| | - Could be roasting near bricks onsite, used lime in roasting + could have made cement w/ native cobbles |
| | - Roasting was experimental here potentially, used to get rid of sulfides |
| | - Flood of 1966 deposited sediment on banks, 80,000 CFS |
| | - Water powered generator in drainage, best spot for oil/fuel impacts. No historical record of fuel powered equipment |
| | - Also a foundry w/ slag + coke onsite |
| 0900 | Continue XRF, collect soil @ BB43 for VOCs |
| 1100 | Cornerstone onsite ~~after~~ for survey marker ~~location~~ installation |
| 1200 | Set up ~~@ BB43~~ Jerome 431-X, zero cal + adjust zero. Set up pumps + cassettes for dust monitoring |
| 1230 | Cornerstone finish survey posts, begin sampling dust and mercury vapor BB-D-1.1, 1.2, 1.3 collected by Chris 1230, BB-D-2.1, 2.2, 2.3 collected by Jared @ 1300. Walk property boundary + XRF near Mill foundation. |
| 1245 | Collect Jerome 431 mercury vapor samples along property boundary |
| 1430 | Finish BB-D-1 |
| 1500 | Finish BB-D-2 |
| ☆1230 | Cornerstone set posts @ 56+57, not 56+58. Chris notified Noelle who said to leave the post @ 57 but add location 58. |
| 1530 | Talk to David Allison, said to collect extra volume @ hottest surface + subsurface location for Bioavailability + TCLP, etc. Also agreed w/ Noelle's request to sample sediment instead of soil @ Mill locations for a few sample points |
| 1600 | Continue XRF, using backup battery pack that blocks camera |
| 1745 | Finish XRF, offsite, collect rinsate blank |

Work Permit Required? N Y#_______
Mileage: ___________ miles

Page _____of_____

# Tailgate Safety Meeting

ECM Consultants

address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | |
|---|---|
| Project Name: Big Blue Mill Site | Date: 10/22/20 |
| Project Manager: David Allison | |
| Presented By: Jared Kemper | |
| ***Daily Activities:*** XRF, Soil + Water Sampling | |

- [x] emergency procedures & evacuation route
- [x] site safety plan review and location
- [x] Safety First / self-check before every task
- [x] equipment and machinery familiarization
- [x] sharp object, rebar, and scrap metals
- [x] slips, trips, and falls
- [x] vehicle safety and driving/road conditions
- [ ] overhead utility locations and clearance
- [x] open pits, excavations, and site hazards
- [ ] excavation/trenching inspections/documentation
- [ ] Smoking in designated areas
- [x] Eye wash station locations
- [ ] employee Right-To-Know/MSDS location
- [ ] no short cuts
- [x] heat and cold stress
- [x] operational discipline
- [ ] hazard identification
- [x] daily work scope
- [x] directions to hospital
- [ ] Stop Work Authority
- [x] pinch points
- [x] lifting techniques
- [x] orderly site and housekeeping
- [x] traffic safety
- [x] backing up hazards
- [ ] electrical ground fault
- [ ] noise hazards
- [ ] refueling procedures
- [x] decontamination procedures
- [x] first aid, safety, and PPE location
- [x] no horseplay
- [x] visitors
- [x] cell phones
- [x] securing loads/cargo
- [x] site specific hazards
- [x] personal protective equipment
- [x] strains and sprains
- [ ] buddy system (as needed)
- [ ] portable tool safety and awareness
- [ ] public safety and fences
- [ ] parking & lay down/ wheel chocks
- [ ] hot work permits
- [ ] flying debris hazards
- [x] fire extinguisher location
- [ ] excavator swing and loading
- [x] dust and vapor control
- [ ] effects of the night before
- [x] demobilization safety
- [x] bee stings, insects, biological hazards
- [ ] Critical Allergies
- [x] NOBODY GETS HURT!

Level D personal protection equipment is required on site. If hazardous conditions specified in the Site Health and Safety Plan are met, Onsite personnel will upgrade to level C or above as appropriate. The project manager will be notified immediately of condition change and field personnel will be authorized to continue or stop work, as necessary.

| LIST JHAs REVIEWED (As Applicable) | COVID | |
|---|---|---|
| | | |

| NAME | SIGNATURE | COMPANY |
|---|---|---|
| Jared Kemper | [signature] | ECM |
| Chris McCormick | [signature] | ECM |
| Noelle Graham-Wakoski | [signature] | USFS |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

***AFTERNOON SAFETY BREAK TOPICS*** ***TIME:***

| | | |
|---|---|---|
| | | |
| | | |

Conduct a daily safety meeting prior to beginning each day's site activities. Follow-up on any noted items and document resolution.

# Daily Field Report

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | | | |
|---|---|---|---|
| Client: | USFS | Date: 10/22/20 | Mo / Tu / We / Th ✓ / Fr / Sa / Su |
| Job Site: | Big Blue Mill Site | Weather: Sunny, | |
| Location | Kern County, CA | Subcontractors onsite: USFS Surveyor | |
| Observer | Jared Kemper | | |

**Daily Activities:** XRF, Soil+Water Sampling

| Time | Description |
|---|---|
| 0700 | Arrive onsite, set up XRF + field sheets, call w/ Dave |
| 0730 | Discuss sample locations w/ Noelle, she suggested/requested that |
| | we take a subsurface sample in the mill foundation @ BB-116 |
| 0800 | Surveyors removed post 57 |
| 0900 | Take XRF shots on trail from parking area (near BB-105) to the past the |
| | chain gate. |
| 0930 | Attempt subsurface sampling w/ shovel + hand auger. Hit @ BB-25. Hit |
| | refusal on bedrock or large smooth cobble @ 18"-20". Stepped out 3ft |
| | to the east + hit refusal @ 12". XRF'd every 6" interval. Noelle |
| | said there is no need to step out more in that area as there is likely |
| | more cobble. Refusal @ BB-25-SO-01 was brick. Will sample BB-25-0.5. |
| 1000 | Attempt subsurface sampling @ BB-116. Hit refusal @ concrete foundation floor |
| | @ 6". Shot 0-6" w/ XRF, 60,000+ As. Step out 11ft south to outside |
| | foundation to attempt subsurface boring. Top 2" are crust w/ gravel. Hit |
| | sandy layer @ ~16" w/out gravel, gravel again @ ~20". Hit refusal @ ~28" |
| | on smooth rock, either large cobble or bedrock. Noelle approved sampling |
| | BB-116-SO-1 w/out further step outs. Sample surface + 0.5' bgs. |
| 1130 | Finish subsurface borings, setting up dust monitors, sampling BB-116-SO-1 for |
| | VOCs, PID = 0.0 VOCs |
| 1145 | Set up dust monitors |
| 1200 | Begin dust monitoring @ beach between trail + water level |
| 1300 | XRF + Sample subsurface @ BB-23 |
| 1320 | Collect SW + sed @ BB-SW-02 |
| 1335 | Collect DUP-01 @ BB-SW-02 |
| 1400 | Finish dust sampling, organize samples @ truck |
| 1415 | Sample Mod area + SW/Sed 03 w/ Noelle |
| 1630 (~~1615~~) | Sample XRF at SW/Sed 01. Noelle asked for focused shots on property line tomorrow. |
| 1800 | Organize truck + depart site |
| | JK |

Work Permit Required? N Y#_______
Mileage: __________ miles

# Tailgate Safety Meeting

ECM Consultants

address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | |
|---|---|
| Project Name: Big Blue Mill Site | Date: 10/23/20 |
| Project Manager: David Allison | |
| Presented By: Jared Kemper | |
| **Daily Activities:** XRF, pickup sample bags | |

- [x] emergency procedures & evacuation route
- [x] site safety plan review and location
- [x] Safety First / self-check before every task
- [x] equipment and machinery familiarization
- [x] sharp object, rebar, and scrap metals
- [x] slips, trips, and falls
- [x] vehicle safety and driving/road conditions
- [x] overhead utility locations and clearance
- [x] open pits, excavations, and site hazards
- [x] excavation/trenching inspections/documentation
- [x] Smoking in designated areas
- [x] Eye wash station locations
- [x] employee Right-To-Know/MSDS location
- [x] no short cuts
- [x] heat and cold stress
- [x] operational discipline
- [x] hazard identification
- [x] daily work scope
- [x] directions to hospital
- [x] Stop Work Authority
- [x] pinch points
- [x] lifting techniques
- [ ] orderly site and housekeeping
- [ ] traffic safety
- [ ] backing up hazards
- [ ] electrical ground fault
- [ ] noise hazards
- [ ] refueling procedures
- [x] decontamination procedures
- [x] first aid, safety, and PPE location
- [x] no horseplay
- [x] visitors
- [x] cell phones
- [x] securing loads/cargo
- [x] site specific hazards
- [x] personal protective equipment
- [x] strains and sprains
- [x] buddy system (as needed)
- [x] portable tool safety and awareness
- [x] public safety and fences
- [x] parking & lay down/ wheel chocks
- [x] hot work permits
- [ ] flying debris hazards
- [x] fire extinguisher location
- [x] excavator swing and loading
- [x] dust and vapor control
- [x] effects of the night before
- [x] demobilization safety
- [x] bee stings, insects, biological hazards
- [x] Critical Allergies
- [x] NOBODY GETS HURT!

Level D personal protection equipment is required on site. If hazardous conditions specified in the Site Health and Safety Plan are met, Onsite personnel will upgrade to level C or above as appropriate. The project manager will be notified immediately of condition change and field personnel will be authorized to continue or stop work, as necessary.

| LIST JHAs REVIEWED (As Applicable) | Boots | COVID |
|---|---|---|
| | | |

| NAME | SIGNATURE | COMPANY |
|---|---|---|
| Chris McCormick | [signature] | ECM |
| Jared Kemper | [signature] | ECM |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**AFTERNOON SAFETY BREAK TOPICS** | **TIME:**

| | | |
|---|---|---|
| | | |
| | | |

Conduct a daily safety meeting prior to beginning each day's site activities. Follow-up on any noted items and document resolution.

# Daily Field Report

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Client: USFS | Date: 10/23/20 | Mo | Tu | We | Th | Fr | Sa | Su |
| | | | | | | ✓ | | |
| Job Site: Big Blue Mill Site | Weather: Sunny, ~70° | | | | | | | |
| Location Kern County, CA | Subcontractors onsite: | | | | | | | |
| Observer Jared Kemper | | | | | | | | |

**Daily Activities:** XRF, demob

| Time | Description |
|---|---|
| 0640 | Onsite, set up XRF + GPS |
| 0700 | XRF near property boundary |
| 0830 | Finish floodplain XRF |
| 0900 | Pick up bags @ site (ziplocs w/ soil left in place) |
| 0945 | Finish picking up bags around site. Owner of middle house |
| | Rich Wildhaber came down to talk. Was friendly, told him we |
| | were collecting soil samples |
| 1030 | Offsite, demob to lab |
| 1230 | Drop off samples @ BC in Bakersfield |
| 1730 | @ Ripon, pick up car |
| 1900 | @ home |
| | |

Work Permit Required? N Y#_______
Mileage: __________ miles

Page ____ of ____

# Appendix E
# Photographic Log

# PHOTOGRAPHIC LOG

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: | Site Location: | Project Name: |
| --- | --- | --- |
| US Forest Service | Big Blue Mill<br>Kern County, California | Big Blue Mill – Site Inspection |

**Photo No. 1**

**Description:**

Floodplain north of mill site.

**Photo No. 2**

**Description:**

Downstream view of Kern River

## PHOTOGRAPHIC LOG

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: | Site Location: | Project Name: |
|---|---|---|
| US Forest Service | Big Blue Mill<br>Kern County, California | Big Blue Mill – Site Inspection |

**Photo No. 3**

**Description:**

"Cemented tailings" along river bank.

**Photo No. 4**

**Description:**

Tailings and foundation bricks located near BB-09

**PHOTOGRAPHIC LOG**

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: US Forest Service | Site Location: Big Blue Mill Kern County, California | Project Name: Big Blue Mill – Site Inspection |
|---|---|---|

**Photo No. 5**

**Description:**

In-place tailings over native river rock/cobbles.

**Photo No. 6**

**Description:**

Grain size and cemented material example of Sample BB-25-0.5

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| **Client Name:** US Forest Service | **Site Location:** Big Blue Mill Kern County, California | **Project Name:** Big Blue Mill – Site Inspection |
|---|---|---|

**Photo No. 7**

**Description:**

Existing mill foundations shown downslope of occupied residences.

**Photo No. 8**

**Description:**

Location of Sample 116 showing concrete below surface. Unable to collect sub surface sample.

ECM Consultants
address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: | Site Location: | Project Name: |
|---|---|---|
| US Forest Service | Big Blue Mill<br>Kern County, California | Big Blue Mill – Site Inspection |

**Photo No. 9**

**Description:**

Approximate location of step-out location Sample BB-116-SO1.


**Photo No. 10**

**Description:**

Measured thickness of observed tailings over native soil. Approximately 62 inches.

ECM Consultants
address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| **Client Name:** US Forest Service | **Site Location:** Big Blue Mill Kern County, California | **Project Name:** Big Blue Mill – Site Inspection |
|---|---|---|

**Photo No. 11**

**Description:**

Tailings shown over native river rock/cobbles along Kern River bank.

**Photo No. 12**

**Description:**

Personal air sampling pumps for monitoring metals in total dust and respirable fraction dust.

## PHOTOGRAPHIC LOG

ECM Consultants
address 3525 Hyland Ave #200
Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: | Site Location: | Project Name: |
|---|---|---|
| US Forest Service | Big Blue Mill<br>Kern County, California | Big Blue Mill – Site Inspection |

**Photo No.**
**13**

**Description:**

Sand bar sampling locations down stream of Site.

**Photo No.**
**14**

**Description:**

Sand bar sampling locations down stream of Site.

## PHOTOGRAPHIC LOG

ECM Consultants
address 3525 Hyland Ave #200 Costa Mesa, CA 92626
phone 714.662.2759
web ecmconsults.com

| Client Name: | Site Location: | Project Name: |
|---|---|---|
| US Forest Service | Big Blue Mill<br>Kern County, California | Big Blue Mill – Site Inspection |

**Photo No.** **15**

**Description:**

"Cemented" tailings along river bank near Sample BB-129

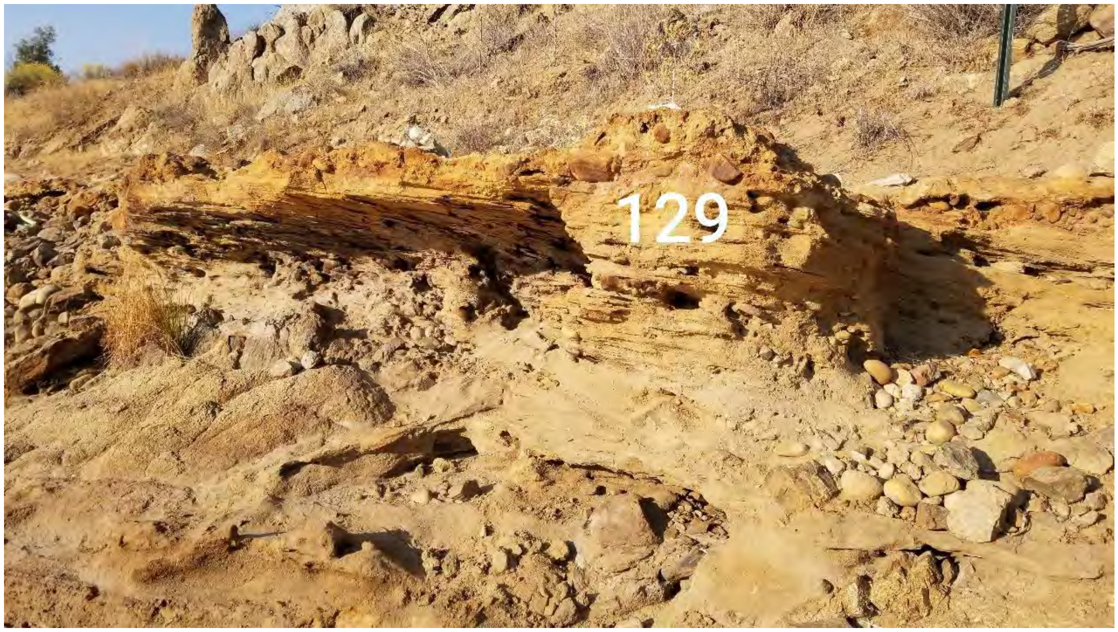



**Photo No.** **16**

**Description:**

"Cemented" tailings along river bank with USFS installed property boundary warning signs. Fishing platform located near large rock outcrop.

# Appendix F
# Laboratory Analytical Reports and Chain-of-Custody Records

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone: (714) 828-4999 Fax: (714) 828-4944 Email: gardengrovelab@latesting.com

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

11/11/2020

Phone: (510) 964-4399
Fax: (510) 295-2656

The following analytical report covers the analysis performed on samples submitted to LA Testing on 10/28/2020. The results are tabulated on the attached data pages for the following client designated project:

**Big Blue Mill**

The reference number for these samples is EMSL Order #332019281. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (714) 828-4999.

Approved By:

Michael Chapman

Michael Chapman, Laboratory Manager

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

LA Testing Order: 332019281
CustomerID: ENCM42
CustomerPO:
ProjectID:

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Phone: (510) 964-4399
Fax: (510) 295-2656
Received: 10/28/2020 10:25 AM
Collected: 10/22/2020

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-1.3 Near property boundary and walking trail — ***Collected:*** 10/21/2020 — ***Lab ID:*** *332019281-0001*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| ID-145 | Mercury | <0.056 | 0.056 | µg/m³ | 11/9/2020 | DP | 11/9/2020 | DP |

***Client Sample Description*** BB-D-2.3 Near property boundary and walking trail — ***Collected:*** 10/21/2020 — ***Lab ID:*** *332019281-0002*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| ID-145 | Mercury | <0.056 | 0.056 | µg/m³ | 11/9/2020 | DP | 11/9/2020 | DP |

***Client Sample Description*** BB-D-3.3 Near river and cemented tailings — ***Collected:*** 10/22/2020 — ***Lab ID:*** *332019281-0003*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| ID-145 | Mercury | <0.056 | 0.056 | µg/m³ | 11/9/2020 | DP | 11/9/2020 | DP |

***Client Sample Description*** BB-D-4.3 Near river and cemented tailings — ***Collected:*** 10/22/2020 — ***Lab ID:*** *332019281-0004*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| ID-145 | Mercury | <0.056 | 0.056 | µg/m³ | 11/9/2020 | DP | 11/9/2020 | DP |

**Definitions:**
MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

| | |
|---|---|
| LA Testing Order: | 332019283 |
| CustomerID: | ENCM42 |
| CustomerPO: | |
| ProjectID: | |

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Project: **Big Blue Mill**

| | |
|---|---|
| Phone: | (510) 964-4399 |
| Fax: | (510) 295-2656 |
| Received: | 10/28/2020 10:25 AM |
| Analysis Date: | 10/30/2020 |
| Collected: | 10/21/2020 |

# Test Report: Respirable Dust by NIOSH 0600

| *Sample* | *Location* | *Volume (L)* | *Sample Weight (mg)* | *Concentration ($mg/m^3$)* | *Reporting Limit ($mg/m^3$)* | *Notes* |
|---|---|---|---|---|---|---|
| BB-D-1.1 *332019283-0001* | Near property boundary and walking trail | 450 | <0.050 | <0.11 | 0.11 | |
| BB-D-2.1 *332019283-0002* | Near property boundary and walking trail | 450 | <0.050 | <0.11 | 0.11 | |
| BB-D-3.1 *332019283-0003* | Near river and cemented tailings | 450 | <0.050 | <0.11 | 0.11 | |
| BB-D-4.1 *332019283-0004* | Near river and cemented tailings | 450 | 0.10 | 0.22 | 0.11 | |

Notes: Discernable field blank not submitted with samples.
Results are not field blank corrected.

Analyst(s)

*Christine Do (4)*

Michael Chapman, Laboratory Manager
or other approved signatory



Initial report from 10/30/2020 15:29:20

OrderID: 332019283

# Industrial Hygiene Chain of Custody

EMSL Order Number (Lab Use Only): #332019283

| | | |
|---|---|---|
| **Report To Contact Name:** David Allison | **Bill To Company:** ECM Consultants | **Client ID #** |
| **Company Name:** ECM Consultants | **Attention To:** Mona Mansell & David Allison | **# Samples in Shipment:** 12 |
| **Street:** 3525 Hyland Ave, Suite 200 | **Street:** 3525 Hyland Ave, Suite 200 | **Date of Shipment:** 10/26/2020 |
| **City:** Costa Mesa **State/Province:** CA **Zip/Postal Code:** 92626 | **City:** Costa Mesa **State/Province:** CA **Zip/Postal Code:** 92626 | **Sampled By (Signature):** [signature] |
| **Phone :** 208-407-1440 **Fax :** | **Phone:** 714-662-2759 **Fax:** | **Purchase Order:** |
| **Email Results To:** dallison@ecmconsults.com | **Project Name:** Big Blue Mill **U.S. State where Samples Collected:** CA | |

**Turnaround Time (TAT) – Please Check: If No Selection Made, Standard 2 Week TAT Will Apply**

| 2 Week | 1 Week | 4 Day | 3 Day | 2 Day | 1 Day | Other (Call Lab) |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Media Type:**
**Manufacturer/Part #:**
**Lot #:**

| Client Sample ID | Location/Description | Analyte / Method | Media | Flow (lpm) | Sample Time On | Sample Time Off | Volume / Area | Sample Type | Sample Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| BB-D-1.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-1.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | |
| BB-D-1.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1300 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ■ Personal | 10/21/2020 | |
| BB-D-2.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-3.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-3.2 | Near river and cemented tailings | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | |
| BB-D-3.3 | Near river and cemented tailings | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-4.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |

*Note: Most NIOSH and OSHA methods require field blanks. It is the IH field sampler's responsibility to submit the proper number of field blanks and duplicates.*

| Released By | Date | Received By | Date |
|---|---|---|---|
| Jared Kemper ECM Consultants [signature] | 10/26/2020 | [signature] (FX) | 10/28/20 10:25 |
| | | | |
| | | | |

**Comments:**

# Industrial Hygiene
# Chain of Custody

EMSL Order Number (Lab Use Only):

#332019283

*Additional Pages of the Chain of Custody are only necessary if needed for additional sample information*

| Client Sample ID | Location/Description | Analyte / Method | Media | Flow (lpm) | Sample Time On | Sample Time Off | Volume / Area | Sample Type | Sample Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| BB-D-4.2 | Near river and cemented tailings | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | |
| BB-D-4.3 | Near river and cemented tailings | Respirable Dust Niosh 7303 Hg | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | Collected with cyclone |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |

**Comments:**

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone: (714) 828-4999 Fax: (714) 828-4944 Email: gardengrovelab@latesting.com

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

11/10/2020

Phone: (510) 964-4399
Fax: (510) 295-2656

The following analytical report covers the analysis performed on samples submitted to LA Testing on 10/28/2020. The results are tabulated on the attached data pages for the following client designated project:

**Big Blue Mill**

The reference number for these samples is EMSL Order #332019286. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (714) 828-4999.

Approved By:

Michael Chapman

Michael Chapman, Laboratory Manager

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements unless specifically indicated. The final results are not blank corrected unless specifically indicated. The laboratory is not responsible for final results calculated using air volumes that have been provided by non-laboratory personnel. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

| | |
|---|---|
| LA Testing Order: | 332019286 |
| CustomerID: | ENCM42 |
| CustomerPO: | |
| ProjectID: | |

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

| | |
|---|---|
| Phone: | (510) 964-4399 |
| Fax: | (510) 295-2656 |
| Received: | 10/28/2020 10:25 AM |
| Collected: | 10/22/2020 |

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-1.1 Near property boundary and walking trail ***Collected:*** 10/21/2020 ***Lab ID:*** *332019286-0001*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-2.1 Near property boundary and walking trail ***Collected:*** 10/21/2020 ***Lab ID:*** *332019286-0002*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

LA Testing Order: 332019286
CustomerID: ENCM42
CustomerPO:
ProjectID:

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Phone: (510) 964-4399
Fax: (510) 295-2656
Received: 10/28/2020 10:25 AM
Collected: 10/22/2020

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-2.1 Near property boundary and walking trail — ***Collected:*** 10/21/2020 ***Lab ID:*** *332019286-0002*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-3.1 Near river and cemented tailings — ***Collected:*** 10/22/2020 ***Lab ID:*** *332019286-0003*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-4.1 Near river and cemented tailings — ***Collected:*** 10/22/2020 ***Lab ID:*** *332019286-0004*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | 3.7 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

LA Testing Order: 332019286
CustomerID: ENCM42
CustomerPO:
ProjectID:

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Phone: (510) 964-4399
Fax: (510) 295-2656
Received: 10/28/2020 10:25 AM
Collected: 10/22/2020

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-4.1
Near river and cemented tailings

***Collected:*** 10/22/2020 ***Lab ID:*** *332019286-0004*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

**Definitions:**

MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

LA Testing Order: 332019287
CustomerID: ENCM42
CustomerPO:
ProjectID:

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Phone: (510) 964-4399
Fax: (510) 295-2656
Received: 10/28/2020 10:25 AM
Analysis Date: 10/30/2020
Collected: 10/22/2020

Project: **Big Blue Mill**

# Test Report: Total Dust by NIOSH 0500

| *Sample* | *Location* | *Volume (L)* | *Sample Weight (mg)* | *Concentration (mg/m³)* | *Reporting Limit (mg/m³)* | *Notes* |
|---|---|---|---|---|---|---|
| BB-D-1.2<br>*332019287-0001* | Near property boundary and walking trail | 450 | <0.050 | <0.11 | 0.11 | |
| BB-D-2.2<br>*332019287-0002* | Near property boundary and walking trail | 450 | <0.050 | <0.11 | 0.11 | |
| BB-D-3.2<br>*332019287-0003* | Near river and cemented tailings | 450 | 0.069 | 0.15 | 0.11 | |
| BB-D-4.2<br>*332019287-0004* | Near river and cemented tailings | 450 | 0.38 | 0.85 | 0.11 | |

Notes: Discernable field blank not submitted with samples.
Results are not field blank corrected.

Analyst(s)
*Christine Do (4)*

Michael Chapman, Laboratory Manager
or other approved signatory



Initial report from 10/30/2020 15:39:01

OrderID: 332019287

# Industrial Hygiene
# Chain of Custody

EMSL Order Number (Lab Use Only): #332019287

| | | |
|---|---|---|
| **Report To Contact Name:** David Allison | **Bill To Company:** ECM Consultants | **Client ID #** |
| **Company Name:** ECM Consultants | **Attention To:** Mona Mansell & David Allison | **# Samples in Shipment:** 12 |
| **Street:** 3525 Hyland Ave, Suite 200 | **Street:** 3525 Hyland Ave, Suite 200 | **Date of Shipment:** 10/26/2020 |
| **City:** Costa Mesa **State/Province:** CA **Zip/Postal Code:** 92626 | **City:** Costa Mesa **State/Province:** CA **Zip/Postal Code:** 92626 | **Sampled By (Signature):** [signature] |
| **Phone :** 208-407-1440 **Fax :** | **Phone:** 714-662-2759 **Fax:** | **Purchase Order:** |
| **Email Results To:** dallison@ecmconsults.com | **Project Name:** Big Blue Mill **U.S. State where Samples Collected:** CA | |

| Turnaround Time (TAT) – Please Check: If No Selection Made, Standard 2 Week TAT Will Apply | | | | | | | Media Type: |
|---|---|---|---|---|---|---|---|
| 2 Week | 1 Week | 4 Day | 3 Day | 2 Day | 1 Day | Other (Call Lab) | Manufacturer/Part #: |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Lot #: |

| Client Sample ID | Location/Description | Analyte / Method | Media | Flow (lpm) | Sample Time On | Sample Time Off | Volume / Area | Sample Type | Sample Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| BB-D-1.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-1.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | |
| BB-D-1.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1230 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.1 | Near property boundary and walking trail | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1300 | 1430 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-2.2 | Near property boundary and walking trail | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ■ Personal | 10/21/2020 | |
| BB-D-2.3 | Near property boundary and walking trail | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1300 | 1500 | 450 L | ☐ Area ■ Personal | 10/21/2020 | Collected with cyclone |
| BB-D-3.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-3.2 | Near river and cemented tailings | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | |
| BB-D-3.3 | Near river and cemented tailings | Respirable Dust NIOSH 7303 Hg | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |
| BB-D-4.1 | Near river and cemented tailings | Respirable Dust NIOSH 0600 + CAM-17 (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ■ Personal | 10/22/2020 | Collected with cyclone |

*Note: Most NIOSH and OSHA methods require field blanks. It is the IH field sampler's responsibility to submit the proper number of field blanks and duplicates.*

| Released By | Date | Received By | Date |
|---|---|---|---|
| Jared Kemper ECM Consultants [signature] | 10/26/2020 | [signature] (FX) | 10/28/20 10:25 |
| | | | |
| | | | |

**Comments:**

# Industrial Hygiene
# Chain of Custody

EMSL Order Number (Lab Use Only):

#332019287

*Additional Pages of the Chain of Custody are only necessary if needed for additional sample information*

| Client Sample ID | Location/Description | Analyte / Method | Media | Flow (lpm) | Sample Time On | Sample Time Off | Volume / Area | Sample Type | Sample Date | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| BB-D-4.2 | Near river and cemented tailings | Total Dust NIOSH 0500 + CAM-17 Metals (minus Hg) | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | |
| BB-D-4.3 | Near river and cemented tailings | Respirable Dust Niosh 7303 Hg | Dust Cassette | 2.5 | 1200 | 1400 | 450 L | ☐ Area ☒ Personal | 10/22/2020 | Collected with cyclone |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |
| | | | | | | | | ☐ Area ☐ Personal | | |

**Comments:**

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone: (714) 828-4999 Fax: (714) 828-4944 Email: gardengrovelab@latesting.com

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

11/10/2020

Phone: (510) 964-4399
Fax: (510) 295-2656

The following analytical report covers the analysis performed on samples submitted to LA Testing on 10/28/2020. The results are tabulated on the attached data pages for the following client designated project:

**Big Blue Mill**

The reference number for these samples is EMSL Order #332019288. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (714) 828-4999.

Approved By:

Michael Chapman, Laboratory Manager

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

| | |
|---|---|
| LA Testing Order: | 332019288 |
| CustomerID: | ENCM42 |
| CustomerPO: | |
| ProjectID: | |

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

| | |
|---|---|
| Phone: | (510) 964-4399 |
| Fax: | (510) 295-2656 |
| Received: | 10/28/2020 10:25 AM |
| Collected: | 10/22/2020 |

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-1.2
Near property boundary and walking trail
***Collected:*** 10/21/2020 ***Lab ID:*** *332019288-0001*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-2.2
Near property boundary and walking trail
***Collected:*** 10/21/2020 ***Lab ID:*** *332019288-0002*

| *Method* | *Parameter* | *Result* | *RL* | *Units* | *Prep Date & Analyst* | | *Analysis Date & Analyst* | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

LA Testing
5431 Industrial Drive, Huntington Beach, CA 92649
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

LA Testing Order: 332019288
CustomerID: ENCM42
CustomerPO:
ProjectID:

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

Phone: (510) 964-4399
Fax: (510) 295-2656
Received: 10/28/2020 10:25 AM
Collected: 10/22/2020

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-2.2 Near property boundary and walking trail — ***Collected:*** 10/21/2020 — ***Lab ID:*** *332019288-0002*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-3.2 Near river and cemented tailings — ***Collected:*** 10/22/2020 — ***Lab ID:*** *332019288-0003*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

***Client Sample Description*** BB-D-4.2 Near river and cemented tailings — ***Collected:*** 10/22/2020 — ***Lab ID:*** *332019288-0004*

| Method | Parameter | Result | RL | Units | Prep Date | Prep Analyst | Analysis Date | Analysis Analyst |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Antimony | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Arsenic | 23 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Barium | <11 | 11 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Beryllium | <0.22 | 0.22 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

**LA Testing**
**5431 Industrial Drive, Huntington Beach, CA 92649**
Phone/Fax: (714) 828-4999 / (714) 828-4944
http://www.LATesting.com gardengrovelab@latesting.com

| | |
|---|---|
| LA Testing Order: | 332019288 |
| CustomerID: | ENCM42 |
| CustomerPO: | |
| ProjectID: | |

Attn: **David Allison**
**Environmental Cost Management, Inc.**
**3525 Hyland Avenue**
**Suite 200**
**Costa Mesa, CA 92626**

| | |
|---|---|
| Phone: | (510) 964-4399 |
| Fax: | (510) 295-2656 |
| Received: | 10/28/2020 10:25 AM |
| Collected: | 10/22/2020 |

Project: **Big Blue Mill**

## Analytical Results

***Client Sample Description*** BB-D-4.2
Near river and cemented tailings

***Collected:*** 10/22/2020 ***Lab ID:*** *332019288-0004*

| Method | Parameter | Result | RL | Units | Prep Date & Analyst | | Analysis Date & Analyst | |
|---|---|---|---|---|---|---|---|---|
| **METALS** | | | | | | | | |
| 7300 Modified | Cadmium | <0.44 | 0.44 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Chromium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Cobalt | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Copper | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Lead | 1.7 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Molybdenum | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Nickel | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Selenium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Silver | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Thallium | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Vanadium | <1.1 | 1.1 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |
| 7300 Modified | Zinc | <2.2 | 2.2 | µg/m³ | 11/9/2020 | TH | 11/9/2020 | TH |

**Definitions:**

MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

Date of Report: 02/18/2021

David Allison

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

| | |
|---|---|
| Client Project: | [none] |
| BCL Project: | USFS- Big Blue Mill |
| BCL Work Order: | 2031364 |
| Invoice ID: | B398025 |

Enclosed are the results of analyses for samples received by the laboratory on 10/23/2020. If you have any questions concerning this report, please feel free to contact me.

Revised Report: This report supercedes Report ID 1001103210

Sincerely,

Contact Person: Tina Green
Client Services

Stuart Buttram
Technical Director

# Table of Contents

# Table of Contents

# Table of Contents

# BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

## Chain of Custody

* Required Fields 20-31364

TEMP: ______

| Client/Company Name *: | Report Attention *: | Phone * #: | FAX * #: |
|---|---|---|---|
| ECM Consultants | David Allison | 208-407-1440 | |
| | | E-mail: dallison@ecmconsults.com | |

| Address * | City * | State * | Zip * |
|---|---|---|---|
| 3525 Hyland Ave. Suite 200 | Costa Mesa | CA | 92626 |

Project Information: USFS Big Blue Mill

PO #:
BCL Quote #:

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

Regulatory Compliance Electronic Data Transfer: Y ☐ N ☐ System No. *

Sampler Name Printed / Signature: Jared Kemper

QC Request: ☑ STD ☐ Level II

Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

Matrix Types: RSW = Raw Surface Water; RGW = Raw Ground Water; CFW = Chlorinated Finished Water; FW = Finished Water; CWW = Chlorinated Waste Water; WW = Waste Water; SW = Storm Water; BW = Bottled Water; DW = Drinking Water; SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Sampled Date | Sampled Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Be, Ba, Cd, Cr, Co, Cu, Pb, Mo, Ni, Ag, V, Zn | 6020-Sb, As, Se, Tl | 7471A-Hg | TCLP-HOLD SAMPLES | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -1 | | 10/22/20 | 1447 | BB-M1-01 | SO | | X | X | X | | | | | | |
| -2 | | 10/22/20 | 1458 | BB-M1-02 | SO | | X | X | X | | | | | | |
| -3 | | 10/22/20 | 1513 | BB-M1-03 | SO | | X | X | X | | | | | | |
| -4 | | 10/22/20 | 1517 | BB-M1-04 | SO | | X | X | X | | | | | | |
| -5 | | 10/22/20 | 1522 | BB-M1-05 | SO | | X | X | X | | | | | | |
| -6 | | 10/22/20 | 1528 | BB-M1-06 | SO | | X | X | X | | | | | | |
| -7 | | 10/22/20 | 1535 | BB-M1-07 | SO | | X | X | X | | | | | | |
| -8 | | 10/22/20 | 1553 | BB-M1-08 | SO | | X | X | X | | | | | | |
| -9 | | 10/22/20 | 1600 | BB-M1-09 | SO | | X | X | X | | | | | | |
| -10 | | 10/22/20 | 1605 | BB-M1-10 | SO | MS/MSD | X | X | X | | | | | | |
| -11 | | 10/22/20 | 1715 | BB-SW-01-Sed | SO | | X | X | X | | | | | | |

CHK BY ✓ DISTRIBUTION ✓ SUB OUT ☐

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| Jared Kemper | ECM | 10/23/20 | 1215 | [signature] | |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
| | | | | Jackson | BCL 102320 1215 |
| Received for Lab by: (Signature and Printed Name) | | Date | Time | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init. | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

## Chain of Custody

* Required Fields 20-31364

TEMP: ______

| Client/Company Name *: | Report Attention *: | Phone * #: 208-407-1440 FAX * #: |
|---|---|---|
| ECM Consultants | David Allison | E-mail: dallison@ecmconsults.com |

Address *: 3525 Hyland Ave. Suite 200 City *: Costa Mesa State *: CA Zip *: 92626

Project Information: USFS Big Blue Mill PO #: BCL Quote #:

How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only

Sampler Name Printed / Signature: Jared Kemper [signature]

QC Request: ☑ STD ☐ Level II

Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day**

Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other:

Regulatory Compliance Electronic Data Transfer: Y ☐ N ☐ System No. *

Matrix Types: RSW = Raw Surface Water CFW = Chlorinated Finished Water CWW = Chlorinated Waste Water BW = Bottled Water RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Date | Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba,Be,Cd,Cr,Co,Cu,Pb,Mo,Ni,Ag,V,Zn | 6020-Sb,As,Se,Tl | 7471A-Hg | ABA Stack | WET | Bioavailability by 1340 Sb,As,Pb,Hg | TCLP-HOLD SAMPLES | 8260 full list VOCs | 8270C SIM SVOCs | 200.8 Total Metals | 245.1 Total Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -12 | | 10/20/20 | 1623 | BB-023 | SO | | X | X | X | X | X | | | | | | |
| -13 | | 10/20/20 | 1628 | BB-022 | SO | VOC only | ~~X~~ | ~~X~~ | JK | | | | | X | X | | |
| -14 | | 10/20/20 | 1715 | RinsateBlank-01 | W | Total Metals only | | | | | | | | | | X | X |
| -15 | | 10/21/20 | 1108 | BB-025 | SO | | X | X | X | | | | | | | | |
| -16 | | 10/21/20 | 1441 | BB-013 | SO | VOC only | ~~X~~ | ~~X~~ | ~~X~~ | JK | | | | X | X | | |
| -17 | | 10/21/20 | 1745 | RinsateBlank-02 | W | Total Metals only | ~~X~~ | ~~X~~ | ~~X~~ | JK | | | | | | X | X |
| -18 | | 10/22/20 | 1213 | BB-023-1 | SO | | X | X | X | X | X | | | | | | |
| -19 | | 10/22/20 | 0908 | BB-025-0.5 | SO | | X | X | X | | | | | | | | |
| -20 | | 10/22/20 | 0845 | BB-097 | SO | | | | | | | | | X | X | | |
| -21 | | 10/22/20 | 1028 | BB-116-SO-01 | SO | | X | X | X | | | | | X | X | | |
| -22 | | 10/22/20 | 1033 | BB-116-SO-01-0.5 | SO | | X | X | X | X | X | X | | | | | |

| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name) | Company |
|---|---|---|---|---|---|
| [signature] Jared Kemper | ECM | 10/23/20 | 1215 | [signature] | |
| Relinquished by: (Signature and Printed Name) | Company | Date | Time | Received by (Signature and Print Name): [signature] Jackson | Company: BCL 10-23-20 1215 |
| Received for Lab by: (Signature and Printed Name) | | Date | Time | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init. | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

SR-FL-0012-00 (Analytical)

**Chain of Custody and Cooler Receipt Form for 2031364 Page 3 of 10**

BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

# Chain of Custody

* Required Fields 20-313364

TEMP: ______

| | | |
|---|---|---|
| Client/Company Name *: ECM Consultants | Report Attention *: David Allison | Phone * #: 208-407-1440 FAX * #: E-mail: dallison@ecmconsults.com |
| Address *: 3525 Hyland Ave. Suite 200 | City *: Costa Mesa State *: CA Zip *: 92626 | Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other: |
| Project Information: USFS Big Blue Mill | PO #: BCL Quote #: | |
| How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only | | Regulatory Compliance Electronic Data Transfer: Y☐ N☐ System No. *: |
| Sampler Name Printed / Signature: Jared Kemper [signature] | QC Request: ☑ STD ☐ Level II | Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day** |

Matrix Types: RSW = Raw Surface Water, RGW = Raw Ground Water, CFW = Clorinated Finished Water, FW = Finished Water, CWW = Chorinated Waste Water, WW = Waste Water, SW = Storm Water, BW = Bottled Water, DW = Drinking Water, SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Sampled Date | Sampled Time | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba, Be, Cd, Co, Cu, Cr, Pb, Mo, Ni, Ag, V, Zn | 6020-As, Sb, Se, Tl | 7471A-Hg | ABA Suite | WET | Bioaccessibility by 1340 Sb, As, Pb, Hg | TCLP-HOLD SAMPLES | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -23 | | 10/19/20 | 1535 | BB-B-Comp-01 | SO | | X | X | X | | | | | | |
| -24 | | 10/20/20 | 1108 | BB-025 | SO | | X | X | X | | | | | | |
| -25 | | 10/20/20 | 1113 | BB-026 | SO | | X | X | X | | | | | | |
| -26 | | 10/20/20 | 1223 | BB-123 | SO | | X | X | X | | | | | | |
| -27 | | 10/20/20 | 1414 | BB-011 | SO | MS/MSD | X | X | X | | | | | | |
| -28 | | 10/20/20 | 1432 | BB-012 | SO | | X | X | X | | | | | | |
| -29 | | 10/20/20 | 1442 | BB-127 | SO | | X | X | X | X | X | X | | | |
| -30 | | 10/20/20 | 1452 | BB-129 | SO | | X | X | X | | | | | | |
| -31 | | 10/20/20 | 1457 | BB-129-0.5 | SO | | X | X | X | | | | | | |
| -32 | | 10/20/20 | 1606 | BB-018 | SO | | X | X | X | | | | | | |
| -33 | | 10/20/20 | 1606 | DUP-02 | SO | | X | X | X | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by: (Signature and Printed Name) [signature] Jared Kemper | Company: ECM | Date: 10/23/20 | Time: 1215 | Received by (Signature and Print Name) [signature] | Company: BC |
| Relinquished by: (Signature and Printed Name) | Company: | Date: | Time: | Received by (Signature and Print Name) [signature] Jackson | Company: BCL 10-23-20 1215 |
| Received for Lab by: (Signature and Printed Name) | | Date: | Time: | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA # Init. | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

**Chain of Custody and Cooler Receipt Form for 2031364 Page 4 of 10**

# BC LABORATORIES

4100 Atlas Court Bakersfield, Ca. 93308
(661) 327-4911 • FAX (661) 327-1918 • www.bclabs.com

## Chain of Custody

* Required Fields 20 - 31364

TEMP: ______

| | | |
|---|---|---|
| Client/Company Name *: ECM Consultants | Report Attention *: David Allison | Phone * #: 208-407-1440 FAX * #: E-mail: dallison@ecmconsults.com |
| Address *: 3525 Hyland Ave. Suite 200 City *: Costa Mesa State *: CA Zip *: 92626 | | Carbon Copies: CDHS ☐ Fresno Co ☐ EPA ☐ Merced Co ☐ Tulare Co ☐ Other: |
| Project Information: USFS Big Blue Mill | PO #: BCL Quote #: | |
| How would you like your completed results sent? ☑ E-Mail ☐ Fax ☐ EDD ☐ Mail Only | | Regulatory Compliance Electronic Data Transfer: Y☐ N☐ System No. * |
| Sampler Name Printed / Signature: Jared Kemper [signature] | QC Request: ☑ STD ☐ Level II | Result Request ** Surcharge: ☑ STD ☐ 5 Day** ☐ 2 Day** ☐ 1 Day** |

Matrix Types: RSW = Raw Surface Water CFW = Chlorinated Finished Water CWW = Chlorinated Waste Water BW = Bottled Water RGW = Raw Ground Water FW = Finished Water WW = Waste Water SW = Storm Water DW = Drinking Water SO = Solid

ANALYSIS REQUESTED

| Sample # | # Bottles | Date Sampled | Time Sampled | Sample Description / Location * | Matrix * | Comments / Station Code | 6010B-Ba,Be,Cd,Cr,Co,Cu,Pb,Mo,Ni,Ag,V,Zn | 6020-Sb,As,Se,Tl | 7471A-Hg | 200.8+245.1 Total/Dissolved | TCLP-HOLD SAMPLES | 8260 | 8270 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -34 | | 10/22/20 | 1330 | BB-SW-02-Sed | SO | | X | X | X | | | | | | |
| -35 | | 10/22/20 | 1545 | BB-SW-03-Sed | SO | | X | X | X | | | | | | |
| -36 | | 10/20/20 | 1715 | BB-SW-01 | W | Lab filter for dissolved metals | | | | X | | | | | |
| -37 | | 10/22/20 | 1330 | BB-SW-02 | W | Lab filter for dissolved metals | | | | X | | | | | |
| -38 | | 10/22/20 | 1545 | BB-SW-03 | W | Lab filter for dissolved metals | | | | X | | | | | |
| -39 | | 10/22/20 | 1335 | DUP-01 | W | Lab filter for dissolved metals | | | | X | | | | | |
| -40 | | 10/22/20 | 1130 | Rinsate Blank-03 | W | Total metals only | | | | X | | | | | |
| -41 | | 10/22/20 | 1200 | Trip Blank | W | 8260 only | | | | | ~~82~~ | X | ~~X~~ | | |

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by: (Signature and Printed Name) [signature] Jared Kemper | Company: ECM | Date: 10/23/20 | Time: 1215 | Received by: (Signature and Print Name) [signature] | Company: |
| Relinquished by: (Signature and Printed Name) | Company: | Date: | Time: | Received by: (Signature and Print Name) [signature] Jackson | Company: BCL 10-23-20 1215 |
| Received for Lab by: (Signature and Printed Name) | | Date: | Time: | Payment Received at Delivery: Date: Amount: Check/Cash/Card PIA #: Init. | |

Shipping Method: CAO UPS GSO WALK-IN SJVC FED EX OTHER

Cooling Method: WET BLUE NONE

Packing Material:

BC LABORATORIES INC. COOLER RECEIPT FORM Page 1 Of 5

Submission #: 20-31364

**SHIPPING INFORMATION**
Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☒
BC Lab Field Service ☐ Other ☐ (Specify)________

**SHIPPING CONTAINER**
Ice Chest ☒ None ☐ Box ☐
Other ☐ (Specify)________

**FREE LIQUID**
YES ☐ NO ☐
W / S

Refrigerant: Ice ☒ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ | Containers ☐ Intact? Yes ☐ No ☐ | None ☒ Comments:

All samples received? Yes ☒ No ☐ All samples containers intact? Yes ☒ No ☐ Description(s) match COC? Yes ☒ No ☐

COC Received ☒ YES ☐ NO

Emissivity: .97 Container: VOA Thermometer ID: 274 Date/Time 10-23-20 1215

Temperature: (A) 3.1 °C / (C) 2.9 °C Analyst Init TKJ

| SAMPLE CONTAINERS | SAMPLE NUMBERS 1 | 2 | 3 | 4 | 5 | 6 | ~~7~~ 11 | ~~8~~ 13 | ~~9~~ 15 | ~~10~~ 19 |
|---|---|---|---|---|---|---|---|---|---|---|
| QT PE UNPRES | | | | | | | | | | |
| 4oz / 8oz / 16oz PE UNPRES | | | | | | | | | | |
| 2oz Cr+6 | | | | | | | | | | |
| QT INORGANIC CHEMICAL METALS | | | | | | | | | | |
| INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz | | | | | | | | | | |
| PT CYANIDE | | | | | | | | | | |
| PT NITROGEN FORMS | | | | | | | | | | |
| PT TOTAL SULFIDE | | | | | | | | | | |
| 2oz. NITRATE / NITRITE | | | | | | | | | | |
| PT TOTAL ORGANIC CARBON | | | | | | | | | | |
| PT CHEMICAL OXYGEN DEMAND | | | | | | | | | | |
| PtA PHENOLICS | | | | | | | | | | |
| 40ml VOA VIAL TRAVEL BLANK | | | | | | | | | | |
| 40ml VOA VIAL | | | | | | | | | | |
| QT EPA 1664 | | | | | | | | | | |
| PT ODOR | | | | | | | | | | |
| RADIOLOGICAL | | | | | | | | | | |
| BACTERIOLOGICAL | | | | | | | | | | |
| 40 ml VOA VIAL- 504 | | | | | | | | | | |
| QT EPA 508/608/8080 | | | | | | | | | | |
| QT EPA 515.1/8150 | | | | | | | | | | |
| QT EPA 525 | | | | | | | | | | |
| QT EPA 525 TRAVEL BLANK | | | | | | | | | | |
| 40ml EPA 547 | | | | | | | | | | |
| 40ml EPA 531.1 | | | | | | | | | | |
| 8oz EPA 548 | | | | | | | | | | |
| QT EPA 549 | | | | | | | | | | |
| QT EPA 8015M | | | | | | | | | | |
| QT EPA 8270 | | | | | | | | | | |
| 8oz / 16oz / 32oz AMBER | | | | | | | | | | |
| 8oz / 16oz / 32oz JAR | A | A | A | A | A | A | A | E | A | A |
| SOIL SLEEVE | | | | | | | | | | |
| PCB VIAL | | | | | | | | | | |
| PLASTIC BAG | | | | | | | | | | |
| TEDLAR BAG | | | | | | | | | | |
| FERROUS IRON | | | | | | | | | | |
| ENCORE | | | | | | | | | | |
| SMART KIT 0% | | | | | | | | A-D | | |
| SUMMA CANISTER | | | | | | | | | | |

Comments:
Sample Numbering Completed By: CMB Date/Time: 10/20/20 1414
A = Actual / C = Corrected

Rev 21 05/23/2016
[S:\WPDocs\WordPerfect\LAB_DOCS\FORMS\SAMREC rev 20]

## Chain of Custody and Cooler Receipt Form for 2031364 Page 6 of 10

BC LABORATORIES INC. — COOLER RECEIPT FORM — Page 2 Of 5

Submission #: 20-31364

**SHIPPING INFORMATION**
Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☒
BC Lab Field Service ☐ Other ☐ (Specify)______

**SHIPPING CONTAINER**
Ice Chest ☒ None ☐ Box ☐
Other ☐ (Specify)______

**FREE LIQUID**
YES ☐ NO ☐
W / S

Refrigerant: Ice ☒ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ | Containers ☐ Intact? Yes ☐ No ☐ | None ☒ Comments:

All samples received? Yes ☐ No ☒ All samples containers intact? Yes ☒ No ☐ Description(s) match COC? Yes ☐ No ☒

COC Received ☒ YES ☐ NO

Emissivity: .97 Container: VOA Thermometer ID: 274 Date/Time 10-23-20 1215
Temperature: (A) 3.1 °C / (C) 2.9 °C Analyst Init TKJ

| SAMPLE CONTAINERS | 1 (20) | 2 (21) | 3 (26) | 4 (29) | 5 (30) | 6 (31) | 7 (33) | 8 (34) | 9 (35) | 10 (24) |
|---|---|---|---|---|---|---|---|---|---|---|
| QT PE UNPRES | | | | | | | | | | |
| 4oz / 8oz / 16oz PE UNPRES | | | | | | | | | | |
| 2oz Cr+6 | | | | | | | | | | |
| QT INORGANIC CHEMICAL METALS | | | | | | | | | | |
| INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz | | | | | | | | | | |
| PT CYANIDE | | | | | | | | | | |
| PT NITROGEN FORMS | | | | | | | | | | |
| PT TOTAL SULFIDE | | | | | | | | | | |
| 2oz. NITRATE / NITRITE | | | | | | | | | | |
| PT TOTAL ORGANIC CARBON | | | | | | | | | | |
| PT CHEMICAL OXYGEN DEMAND | | | | | | | | | | |
| PtA PHENOLICS | | | | | | | | | | |
| 40ml VOA VIAL TRAVEL BLANK | | | | | | | | | | |
| 40ml VOA VIAL | | | | | | | | | | |
| QT EPA 1664 | | | | | | | | | | |
| PT ODOR | | | | | | | | | | |
| RADIOLOGICAL | | | | | | | | | | |
| BACTERIOLOGICAL | | | | | | | | | | |
| 40 ml VOA VIAL- 504 | | | | | | | | | | |
| QT EPA 508/608/8080 | | | | | | | | | | |
| QT EPA 515.1/8150 | | | | | | | | | | |
| QT EPA 525 | | | | | | | | | | |
| QT EPA 525 TRAVEL BLANK | | | | | | | | | | |
| 40ml EPA 547 | | | | | | | | | | |
| 40ml EPA 531.1 | | | | | | | | | | |
| 8oz EPA 548 | | | | | | | | | | |
| QT EPA 549 | | | | | | | | | | |
| QT EPA 8015M | | | | | | | | | | |
| QT EPA 8270 | | | | | | | | | | |
| 8oz / 16oz / 32oz AMBER | | | | | | | | | | |
| 8oz / 16oz / 32oz JAR | E | EF | A | AB | A | A | A | A | A | A |
| SOIL SLEEVE | | | | | | | | | | |
| PCB VIAL | | | | | | | | | | |
| PLASTIC BAG | | | | | | | | | | |
| TEDLAR BAG | | | | | | | | | | |
| FERROUS IRON | | | | | | | | | | |
| ENCORE | | | | | | | | | | |
| SMART KIT | A-D | A-D | | | | | | | | |
| SUMMA CANISTER | | | | | | | | | | |

Comments: (-24 sample not received / dup. on chain as "BB-025") (Received smart kit with no descriptions)
Sample Numbering Completed By: CAB Date/Time: 10/20/20 1414
A = Actual / C = Corrected

Rev 21 05/23/2016
[S:\WPDoc\WordPerfect\LAB_DOCS\FORMS\SAMREC rev 21]

**Chain of Custody and Cooler Receipt Form for 2031364 Page 7 of 10**

BC LABORATORIES INC. COOLER RECEIPT FORM Page 3 Of 5

Submission #: 20-31364

**SHIPPING INFORMATION**
Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☒
BC Lab Field Service ☐ Other ☐ (Specify)

**SHIPPING CONTAINER**
Ice Chest ☒ None ☐ Box ☐
Other ☐ (Specify)

**FREE LIQUID**
YES ☐ NO ☐
W / S

Refrigerant: Ice ☒ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ Containers ☐ Intact? Yes ☐ No ☐ None ☒ Comments:

All samples received? Yes ☒ No ☐ All samples containers intact? Yes ☒ No ☐ Description(s) match COC? Yes ☒ No ☐

COC Received ☒ YES ☐ NO

Emissivity: .95 Container: glass Thermometer ID: 274 Date/Time 10-23-20 1215

Temperature: (A) 0.5 °C / (C) 0.1 °C Analyst Init TKJ

| SAMPLE CONTAINERS | 7 | 8 | 9 | 10 | 12 | 18 | 22 | 23 | 25 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| QT PE UNPRES | | | | | | | | | | |
| 4oz / 8oz / 16oz PE UNPRES | | | | | | | | | | |
| 2oz Cr+6 | | | | | | | | | | |
| QT INORGANIC CHEMICAL METALS | | | | | | | | | | |
| INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz | | | | | | | | | | |
| PT CYANIDE | | | | | | | | | | |
| PT NITROGEN FORMS | | | | | | | | | | |
| PT TOTAL SULFIDE | | | | | | | | | | |
| 2oz. NITRATE / NITRITE | | | | | | | | | | |
| PT TOTAL ORGANIC CARBON | | | | | | | | | | |
| PT CHEMICAL OXYGEN DEMAND | | | | | | | | | | |
| PtA PHENOLICS | | | | | | | | | | |
| 40ml VOA VIAL TRAVEL BLANK | | | | | | | | | | |
| 40ml VOA VIAL | | | | | | | | | | |
| QT EPA 1664 | | | | | | | | | | |
| PT ODOR | | | | | | | | | | |
| RADIOLOGICAL | | | | | | | | | | |
| BACTERIOLOGICAL | | | | | | | | | | |
| 40 ml VOA VIAL- 504 | | | | | | | | | | |
| QT EPA 508/608/8080 | | | | | | | | | | |
| QT EPA 515.1/8150 | | | | | | | | | | |
| QT EPA 525 | | | | | | | | | | |
| QT EPA 525 TRAVEL BLANK | | | | | | | | | | |
| 40ml EPA 547 | | | | | | | | | | |
| 40ml EPA 531.1 | | | | | | | | | | |
| 8oz EPA 548 | | | | | | | | | | |
| QT EPA 549 | | | | | | | | | | |
| QT EPA 8015M | | | | | | | | | | |
| QT EPA 8270 | | | | | | | | | | |
| 8oz / 16oz / 32oz AMBER | | | | | | | | | | |
| 8oz / 16oz / 32oz JAR | A | A | A | AB | AB | AB | AB | A | A | AB |
| SOIL SLEEVE | | | | | | | | | | |
| PCB VIAL | | | | | | | | | | |
| PLASTIC BAG | | | | | | | | | | |
| TEDLAR BAG | | | | | | | | | | |
| FERROUS IRON | | | | | | | | | | |
| ENCORE | | | | | | | | | | |
| SMART KIT | | | | | | | | | | |
| SUMMA CANISTER | | | | | | | | | | |

Comments:
Sample Numbering Completed By: [signature] Date/Time: 10/26/20 1414
A = Actual / C = Corrected

Rev 21 05/23/2016

BC LABORATORIES INC. COOLER RECEIPT FORM Page 4 Of 5

Submission #: 20-313604

**SHIPPING INFORMATION**
Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☑
BC Lab Field Service ☐ Other ☐ (Specify)______

**SHIPPING CONTAINER**
Ice Chest ☑ None ☐ Box ☐
Other ☐ (Specify)______

**FREE LIQUID**
YES ☐ NO ☐
W / S

Refrigerant: Ice ☑ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ | Containers ☐ Intact? Yes ☐ No ☐ | None ☑ Comments:

All samples received? Yes ☑ No ☐ All samples containers intact? Yes ☑ No ☐ Description(s) match COC? Yes ☑ No ☐

COC Received ☒ YES ☐ NO

Emissivity: .95 Container: 91055 Thermometer ID: 274 Date/Time 10-23-20 1215
Temperature: (A) 0.5 °C / (C) 0.1 °C Analyst Init JKJ

| SAMPLE CONTAINERS | 1 (28) | 2 (32) | 3 (16) | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| QT PE UNPRES | | | | | | | | | | |
| 4oz / 8oz / 16oz PE UNPRES | | | | | | | | | | |
| 2oz Cr+6 | | | | | | | | | | |
| QT INORGANIC CHEMICAL METALS | | | | | | | | | | |
| INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz | | | | | | | | | | |
| PT CYANIDE | | | | | | | | | | |
| PT NITROGEN FORMS | | | | | | | | | | |
| PT TOTAL SULFIDE | | | | | | | | | | |
| 2oz. NITRATE / NITRITE | | | | | | | | | | |
| PT TOTAL ORGANIC CARBON | | | | | | | | | | |
| PT CHEMICAL OXYGEN DEMAND | | | | | | | | | | |
| PtA PHENOLICS | | | | | | | | | | |
| 40ml VOA VIAL TRAVEL BLANK | | | | | | | | | | |
| 40ml VOA VIAL | | | | | | | | | | |
| QT EPA 1664 | | | | | | | | | | |
| PT ODOR | | | | | | | | | | |
| RADIOLOGICAL | | | | | | | | | | |
| BACTERIOLOGICAL | | | | | | | | | | |
| 40 ml VOA VIAL- 504 | | | | | | | | | | |
| QT EPA 508/608/8080 | | | | | | | | | | |
| QT EPA 515.1/8150 | | | | | | | | | | |
| QT EPA 525 | | | | | | | | | | |
| QT EPA 525 TRAVEL BLANK | | | | | | | | | | |
| 40ml EPA 547 | | | | | | | | | | |
| 40ml EPA 531.1 | | | | | | | | | | |
| 8oz EPA 548 | | | | | | | | | | |
| QT EPA 549 | | | | | | | | | | |
| QT EPA 8015M | | | | | | | | | | |
| QT EPA 8270 | | | | | | | | | | |
| 8oz / 16oz / 32oz AMBER | | | | | | | | | | |
| 8oz / 16oz / 32oz JAR | A | A | A | | | | | | | |
| SOIL SLEEVE | | | | | | | | | | |
| PCB VIAL | | | | | | | | | | |
| PLASTIC BAG | | | | | | | | | | |
| TEDLAR BAG | | | | | | | | | | |
| FERROUS IRON | | | | | | | | | | |
| ENCORE | | | | | | | | | | |
| SMART KIT | | | | | | | | | | |
| SUMMA CANISTER | | | | | | | | | | |

Comments:
Sample Numbering Completed By: [signature] Date/Time: 10/26/20 1414
A = Actual / C = Corrected

Rev 21 08/23/2016
[S:\WP\Doc\WordPerfect\LAB_DOCS\FORMS\SAMREC rev 20]

BC LABORATORIES INC. COOLER RECEIPT FORM Page 5 Of 5

Submission #: 20-31364

| SHIPPING INFORMATION | SHIPPING CONTAINER | FREE LIQUID |
|---|---|---|
| Fed Ex ☐ UPS ☐ Ontrac ☐ Hand Delivery ☒<br>BC Lab Field Service ☐ Other ☐ (Specify)______ | Ice Chest ☒ None ☐ Box ☐<br>Other ☐ (Specify)______ | YES ☐ NO ☐<br>W / S |

Refrigerant: Ice ☒ Blue Ice ☐ None ☐ Other ☐ Comments:

Custody Seals: Ice Chest ☐ Intact? Yes ☐ No ☐ | Containers ☐ Intact? Yes ☐ No ☐ | None ☒ Comments:

All samples received? Yes ☒ No ☐ All samples containers intact? Yes ☒ No ☐ Description(s) match COC? Yes ☒ No ☐

COC Received ☒ YES ☐ NO

Emissivity: .97 Container: PE Thermometer ID: 274 Date/Time 10-23-20 1215

Temperature: (A) 4.0 °C / (C) 3.8 °C Analyst Init JKJ

| SAMPLE CONTAINERS | 1 (14) | 2 (17) | 3 (36) | 4 (37) | 5 (38) | 6 (39) | 7 (40) | 8 (41) | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| QT PE UNPRES | | | A | A | A | A | | | | |
| 4oz / 8oz / 16oz PE UNPRES | | | | | | | | | | |
| 2oz Cr+6 | | | | | | | | | | |
| QT INORGANIC CHEMICAL METALS MUS | A | A | B | B | B | B | A | | | |
| INORGANIC CHEMICAL METALS 4oz / 8oz / 16oz | | | | | | | | | | |
| PT CYANIDE | | | | | | | | | | |
| PT NITROGEN FORMS | | | | | | | | | | |
| PT TOTAL SULFIDE | | | | | | | | | | |
| 2oz. NITRATE / NITRITE | | | | | | | | | | |
| PT TOTAL ORGANIC CARBON | | | | | | | | | | |
| PT CHEMICAL OXYGEN DEMAND | | | | | | | | | | |
| PIA PHENOLICS | | | | | | | | | | |
| 40ml VOA VIAL TRAVEL BLANK D92 | | | | | | | | A | | |
| 40ml VOA VIAL | | | | | | | | | | |
| QT EPA 1664 | | | | | | | | | | |
| PT ODOR | | | | | | | | | | |
| RADIOLOGICAL | | | | | | | | | | |
| BACTERIOLOGICAL | | | | | | | | | | |
| 40 ml VOA VIAL- 504 | | | | | | | | | | |
| QT EPA 508/608/8080 | | | | | | | | | | |
| QT EPA 515.1/8150 | | | | | | | | | | |
| QT EPA 525 | | | | | | | | | | |
| QT EPA 525 TRAVEL BLANK | | | | | | | | | | |
| 40ml EPA 547 | | | | | | | | | | |
| 40ml EPA 531.1 | | | | | | | | | | |
| 8oz EPA 548 | | | | | | | | | | |
| QT EPA 549 | | | | | | | | | | |
| QT EPA 8015M | | | | | | | | | | |
| QT EPA 8270 | | | | | | | | | | |
| 8oz / 16oz / 32oz AMBER | | | | | | | | | | |
| 8oz / 16oz / 32oz JAR | | | | | | | | | | |
| SOIL SLEEVE | | | | | | | | | | |
| PCB VIAL | | | | | | | | | | |
| PLASTIC BAG | | | | | | | | | | |
| TEDLAR BAG | | | | | | | | | | |
| FERROUS IRON | | | | | | | | | | |
| ENCORE | | | | | | | | | | |
| SMART KIT | | | | | | | | | | |
| SUMMA CANISTER | | | | | | | | | | |

Comments:

Sample Numbering Completed By: CAB Date/Time: 10/26/20 1414

A = Actual / C = Corrected

Rev 21 05/23/2016

[S:\WPDoc\WordPerfect\LAB_DOCS\FORMS\SAMREC rev 21]

ECM Consultants 10/23/20

20-313164 Big Blue Mill Sampled: Jared Kemper PM: David Allison

Report metals totals before running TCLP ~~+ Bioavailability~~
Lab to filter water samples for dissolved metals
Run 6010B for barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, silver, vanadium, zinc
Run 6020 for antimony, arsenic, selenium, thallium
Run Bioavailability ~~at~~ for antimony, arsenic, lead, mercury

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-01** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 14:47 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-01 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-02** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 14:58 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-02 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-03** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 15:13 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-03 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-04** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 15:17 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-04 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-05** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 15:22 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-05 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-06** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 15:28 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-06 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |
| **2031364-07** | **COC Number:** --- | | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** --- | | **Sampling Date:** | 10/22/2020 15:35 |
| | **Sampling Location:** --- | | **Sample Depth:** | --- |
| | **Sampling Point:** BB-M1-07 | | **Lab Matrix:** | Solids |
| | **Sampled By:** Jared Kemper | | **Sample Type:** | Soil |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-08** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 15:53 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-M1-08 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-09** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 16:00 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-M1-09 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-10** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 16:05 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-M1-10 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-11** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 17:15 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-01-Sed | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-12** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 16:23 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-023 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-13** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 16:28 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-022 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-14** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 17:15 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | RinseateBlank-01 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-15** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/21/2020 11:08 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-025 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-16** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/21/2020 14:41 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-043 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-17** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/21/2020 17:45 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | RinseateBlank-02 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| **2031364-18** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 12:13 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-023-1 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-19** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 09:08 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-025-0.5 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-20** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 08:45 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-097 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-21** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 10:28 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-116-SO-01 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-22** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 10:33 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-116-SO-01-0.5 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-23** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/19/2020 15:35 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-B-Comp-01 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-24** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 11:08 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-025 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-25** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 11:13 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-020 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-26** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 12:23 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-123 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-27** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 14:14 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-011 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-28** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 14:32 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-012 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-29** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 14:42 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-127 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-30** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 14:52 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-129 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-31** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 14:57 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-129-0.5 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-32** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 16:06 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-018 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-33** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 16:06 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | DUP-02 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-34** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 13:30 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-02-Sed | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-35** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 15:45 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-03-Sed | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-36** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 17:15 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-01 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| | | | Metal Analysis: 2-Lab Filtered and Acidified past 15 minute holding time | |
| **2031364-37** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 13:30 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-02 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| | | | Metal Analysis: 2-Lab Filtered and Acidified past 15 minute holding time | |
| **2031364-38** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 15:45 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-SW-03 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| | | | Metal Analysis: 2-Lab Filtered and Acidified past 15 minute holding time | |
| **2031364-39** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 13:35 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | DUP-01 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| | | | Metal Analysis: 2-Lab Filtered and Acidified past 15 minute holding time | |
| **2031364-40** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 11:30 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | Rinseate-Blank-03 | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Water |
| **2031364-41** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 12:00 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | Trip Blank | **Lab Matrix:** | Water |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Trip Blank |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Laboratory / Client Sample Cross Reference

| Laboratory | Client Sample Information | | | |
|---|---|---|---|---|
| **2031364-42** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/20/2020 12:31 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-123.05 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |
| **2031364-43** | **COC Number:** | --- | **Receive Date:** | 10/23/2020 12:15 |
| | **Project Number:** | --- | **Sampling Date:** | 10/22/2020 15:10 |
| | **Sampling Location:** | --- | **Sample Depth:** | --- |
| | **Sampling Point:** | BB-M1-SED-01 | **Lab Matrix:** | Solids |
| | **Sampled By:** | Jared Kemper | **Sample Type:** | Soil |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-01 | **Client Sample Name:** BB-M1-01, 10/22/2020 2:47:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **8.8** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **34** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **9.1** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.2** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **6.1** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.022** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.4** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **32** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **24** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **J,A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:15 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:55 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:24 | TMT | CETAC3 | 0.962 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-02 | **Client Sample Name:** BB-M1-02, 10/22/2020 2:58:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **4.2** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Barium** | **52** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **5.8** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **4.8** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **6.3** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.028** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **3.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **28** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **27** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:17 | ARD | PE-EL4 | 9.615 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:57 | AS1 | PE-OP3 | 9.615 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:26 | TMT | CETAC3 | 0.977 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-03 | **Client Sample Name:** BB-M1-03, 10/22/2020 3:13:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **4.2** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Barium** | **56** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **3.9** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Cobalt** | **4.2** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **7.5** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **4.3** | **mg/kg** | **0.80** | **0.080** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **3.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **19** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **32** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:19 | ARD | PE-EL4 | 9.901 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:59 | AS1 | PE-OP3 | 9.901 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:58 | TMT | CETAC3 | 5.040 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-04 | **Client Sample Name:** BB-M1-04, 10/22/2020 3:17:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **6.4** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **93** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| **Beryllium** | **0.62** | **mg/kg** | **5.0** | **0.47** | **EPA-6010B** | 75 | **J,A07** | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **11** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **7.9** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **13** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.058** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **6.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **53** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **51** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:22 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:01 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:34 | TMT | CETAC3 | 0.962 | B091357 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-05 | **Client Sample Name:** BB-M1-05, 10/22/2020 3:22:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **7.1** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **60** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **8.4** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **6.0** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **7.2** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.066** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **5.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **37** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **39** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:24 | ARD | PE-EL4 | 9.346 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:03 | AS1 | PE-OP3 | 9.346 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:37 | TMT | CETAC3 | 1.008 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-06 | **Client Sample Name:** BB-M1-06, 10/22/2020 3:28:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **13** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **68** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **12** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **7.0** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **7.8** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| Mercury | ND | mg/kg | 0.16 | 0.016 | EPA-7471A | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **5.2** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **65** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **38** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:26 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:04 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:39 | TMT | CETAC3 | 0.962 | B091357 | EPA 7471A |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-07 | **Client Sample Name:** BB-M1-07, 10/22/2020 3:35:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **9.6** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **52** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **10** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.6** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **6.9** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| Mercury | ND | mg/kg | 0.16 | 0.016 | EPA-7471A | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **9.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 2 |
| **Selenium** | **1.8** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **28** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **26** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:29 | ARD | PE-EL4 | 9.259 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:06 | AS1 | PE-OP3 | 9.259 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:41 | TMT | CETAC3 | 1.025 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-08 | **Client Sample Name:** BB-M1-08, 10/22/2020 3:53:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **7.1** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **53** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **7.4** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.9** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **7.0** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| Mercury | ND | mg/kg | 0.16 | 0.016 | EPA-7471A | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.2** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **1.6** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **32** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **35** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:31 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:12 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 08:43 | TMT | CETAC3 | 0.962 | B091357 | EPA 7471A |

**BC Laboratories, Inc.**
Environmental Testing Laboratory Since 1949

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-09 **Client Sample Name:** BB-M1-09, 10/22/2020 4:00:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **17** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **36** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **9.3** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.3** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **13** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| Mercury | ND | mg/kg | 0.16 | 0.016 | EPA-7471A | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.1** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **44** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **26** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:56 | ARD | PE-EL4 | 9.091 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:13 | AS1 | PE-OP3 | 9.091 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 09:39 | TMT | CETAC3 | 0.962 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-10 **Client Sample Name:** BB-M1-10, 10/22/2020 4:05:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| Arsenic | ND | mg/kg | 5.0 | 1.7 | EPA-6020 | 500 | A07 | 1 |
| **Barium** | **56** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **12** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **6.1** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **6.9** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.020** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.8** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **2.5** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **62** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **32** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 22:10 | ARD | PE-EL4 | 10 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:41 | AS1 | PE-OP3 | 10 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 07:37 | TMT | CETAC3 | 0.992 | B091357 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-11 | **Client Sample Name:** BB-SW-01-Sed, 10/22/2020 5:15:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **2.7** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Barium** | **52** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **9.2** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.3** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **5.4** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| Mercury | ND | mg/kg | 0.16 | 0.016 | EPA-7471A | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **3.9** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **57** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **30** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 18:58 | ARD | PE-EL4 | 10 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:15 | AS1 | PE-OP3 | 10 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 09:41 | TMT | CETAC3 | 0.992 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-12 | **Client Sample Name:** BB-023, 10/20/2020 4:23:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **21** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **30000** | **mg/kg** | **10** | **3.4** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **45** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **210** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **4.4** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Cobalt** | **1.4** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **28** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **2200** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **72** | **mg/kg** | **16** | **1.6** | **EPA-7471A** | 20 | **A07** | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **1.8** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **30** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **8.8** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **120** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 20:49 | ARD | PE-EL4 | 9.709 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:12 | ARD | PE-EL4 | 19.417 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:17 | AS1 | PE-OP3 | 9.709 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 09:54 | TMT | CETAC3 | 96.154 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-13 **Client Sample Name:** BB-022, 10/20/2020 4:28:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Benzene** | **0.0011** | **mg/kg** | **0.0055** | **0.00074** | **EPA-8260B** | | **J,S08,Z1** | 1 |
| Bromobenzene | ND | mg/kg | 0.0055 | 0.00096 | EPA-8260B | | S08,Z1 | 1 |
| Bromochloromethane | ND | mg/kg | 0.0055 | 0.00089 | EPA-8260B | | S08,Z1 | 1 |
| Bromodichloromethane | ND | mg/kg | 0.0055 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| Bromoform | ND | mg/kg | 0.0055 | 0.00077 | EPA-8260B | | S08,Z1 | 1 |
| Bromomethane | ND | mg/kg | 0.0055 | 0.0019 | EPA-8260B | | S08,Z1 | 1 |
| n-Butylbenzene | ND | mg/kg | 0.0055 | 0.00084 | EPA-8260B | | S08,Z1 | 1 |
| sec-Butylbenzene | ND | mg/kg | 0.0055 | 0.00078 | EPA-8260B | | S08,Z1 | 1 |
| tert-Butylbenzene | ND | mg/kg | 0.0055 | 0.00094 | EPA-8260B | | S08,Z1 | 1 |
| Carbon tetrachloride | ND | mg/kg | 0.0055 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| Chlorobenzene | ND | mg/kg | 0.0055 | 0.00085 | EPA-8260B | | S08,Z1 | 1 |
| Chloroethane | ND | mg/kg | 0.0055 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| Chloroform | ND | mg/kg | 0.0055 | 0.00099 | EPA-8260B | | S08,Z1 | 1 |
| Chloromethane | ND | mg/kg | 0.0055 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| 2-Chlorotoluene | ND | mg/kg | 0.0055 | 0.00096 | EPA-8260B | | S08,Z1 | 1 |
| 4-Chlorotoluene | ND | mg/kg | 0.0055 | 0.00077 | EPA-8260B | | S08,Z1 | 1 |
| Dibromochloromethane | ND | mg/kg | 0.0055 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dibromo-3-chloropropane | ND | mg/kg | 0.0055 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dibromoethane | ND | mg/kg | 0.0055 | 0.00090 | EPA-8260B | | S08,Z1 | 1 |
| Dibromomethane | ND | mg/kg | 0.0055 | 0.0015 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichlorobenzene | ND | mg/kg | 0.0055 | 0.00087 | EPA-8260B | | S08,Z1 | 1 |
| 1,3-Dichlorobenzene | ND | mg/kg | 0.0055 | 0.00080 | EPA-8260B | | S08,Z1 | 1 |
| 1,4-Dichlorobenzene | ND | mg/kg | 0.0055 | 0.00080 | EPA-8260B | | S08,Z1 | 1 |
| Dichlorodifluoromethane | ND | mg/kg | 0.0055 | 0.00087 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloroethane | ND | mg/kg | 0.0055 | 0.00070 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloroethane | ND | mg/kg | 0.0055 | 0.00080 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloroethene | ND | mg/kg | 0.0055 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| cis-1,2-Dichloroethene | ND | mg/kg | 0.0055 | 0.00059 | EPA-8260B | | S08,Z1 | 1 |
| trans-1,2-Dichloroethene | ND | mg/kg | 0.0055 | 0.0041 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloropropane | ND | mg/kg | 0.0055 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| 1,3-Dichloropropane | ND | mg/kg | 0.0055 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |
| 2,2-Dichloropropane | ND | mg/kg | 0.0055 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloropropene | ND | mg/kg | 0.0055 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-13 | **Client Sample Name:** BB-022, 10/20/2020 4:28:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| cis-1,3-Dichloropropene | ND | mg/kg | 0.0055 | 0.00064 | EPA-8260B | | S08,Z1 | 1 |
| trans-1,3-Dichloropropene | ND | mg/kg | 0.0055 | 0.00073 | EPA-8260B | | S08,Z1 | 1 |
| Ethylbenzene | ND | mg/kg | 0.0055 | 0.00076 | EPA-8260B | | S08,Z1 | 1 |
| Hexachlorobutadiene | ND | mg/kg | 0.0055 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |
| Isopropylbenzene | ND | mg/kg | 0.0055 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| p-Isopropyltoluene | ND | mg/kg | 0.0055 | 0.00065 | EPA-8260B | | S08,Z1 | 1 |
| Methylene chloride | ND | mg/kg | 0.011 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| Methyl t-butyl ether | ND | mg/kg | 0.0055 | 0.00062 | EPA-8260B | | S08,Z1 | 1 |
| Naphthalene | ND | mg/kg | 0.0055 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| n-Propylbenzene | ND | mg/kg | 0.0055 | 0.00078 | EPA-8260B | | S08,Z1 | 1 |
| Styrene | ND | mg/kg | 0.0055 | 0.00068 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,1,2-Tetrachloroethane | ND | mg/kg | 0.0055 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2,2-Tetrachloroethane | ND | mg/kg | 0.0055 | 0.00093 | EPA-8260B | | S08,Z1 | 1 |
| Tetrachloroethene | ND | mg/kg | 0.0055 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| **Toluene** | **0.0012** | **mg/kg** | **0.0055** | **0.00076** | **EPA-8260B** | | **J,S08,Z1** | 1 |
| 1,2,3-Trichlorobenzene | ND | mg/kg | 0.0055 | 0.0017 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,4-Trichlorobenzene | ND | mg/kg | 0.0055 | 0.0015 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,1-Trichloroethane | ND | mg/kg | 0.0055 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2-Trichloroethane | ND | mg/kg | 0.0055 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| Trichloroethene | ND | mg/kg | 0.0055 | 0.00081 | EPA-8260B | 2040 | S08,Z1 | 1 |
| Trichlorofluoromethane | ND | mg/kg | 0.0055 | 0.0017 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,3-Trichloropropane | ND | mg/kg | 0.0055 | 0.0021 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | mg/kg | 0.0055 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,4-Trimethylbenzene | ND | mg/kg | 0.0055 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| 1,3,5-Trimethylbenzene | ND | mg/kg | 0.0055 | 0.00073 | EPA-8260B | | S08,Z1 | 1 |
| Vinyl chloride | ND | mg/kg | 0.0055 | 0.00065 | EPA-8260B | | S08,Z1 | 1 |
| Total Xylenes | ND | mg/kg | 0.011 | 0.0028 | EPA-8260B | | S08,Z1 | 1 |
| p- & m-Xylenes | ND | mg/kg | 0.0055 | 0.0017 | EPA-8260B | | S08,Z1 | 1 |
| o-Xylene | ND | mg/kg | 0.0055 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloroethane-d4 (Surrogate) | 114 | % | 70 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |
| Toluene-d8 (Surrogate) | 99.1 | % | 81 - 117 (LCL - UCL) | | EPA-8260B | | | 1 |
| 4-Bromofluorobenzene (Surrogate) | 93.3 | % | 74 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

| **BCL Sample ID:** | 2031364-13 | **Client Sample Name:** | BB-022, 10/20/2020 4:28:00PM, Jared Kemper |
|---|---|---|---|

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8260B | 10/28/20 09:02 | 10/30/20 02:11 | BYM | MS-V3 | 1.101 | B091020 | EPA 5035 Soil MS |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

**BCL Sample ID:** 2031364-13 **Client Sample Name:** BB-022, 10/20/2020 4:28:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | mg/kg | 0.0030 | 0.00052 | EPA-8270C-SIM | ND | | 1 |
| **Acenaphthylene** | **0.0012** | **mg/kg** | **0.0030** | **0.00047** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Anthracene** | **0.00077** | **mg/kg** | **0.0030** | **0.00073** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Benzo[a]anthracene** | **0.0056** | **mg/kg** | **0.0030** | **0.00053** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[b]fluoranthene** | **0.0087** | **mg/kg** | **0.0030** | **0.00056** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[k]fluoranthene** | **0.0037** | **mg/kg** | **0.0030** | **0.00073** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[a]pyrene** | **0.0085** | **mg/kg** | **0.0030** | **0.00034** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[g,h,i]perylene** | **0.0026** | **mg/kg** | **0.0030** | **0.00068** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Chrysene** | **0.0064** | **mg/kg** | **0.0030** | **0.00038** | **EPA-8270C-SIM** | ND | | 1 |
| **Dibenzo[a,h]anthracene** | **0.0049** | **mg/kg** | **0.0030** | **0.00057** | **EPA-8270C-SIM** | ND | | 1 |
| **Fluoranthene** | **0.0097** | **mg/kg** | **0.0030** | **0.00057** | **EPA-8270C-SIM** | ND | | 1 |
| Fluorene | ND | mg/kg | 0.0030 | 0.00037 | EPA-8270C-SIM | ND | | 1 |
| **Indeno[1,2,3-cd]pyrene** | **0.0055** | **mg/kg** | **0.0030** | **0.00055** | **EPA-8270C-SIM** | ND | | 1 |
| Naphthalene | ND | mg/kg | 0.0030 | 0.00049 | EPA-8270C-SIM | ND | | 1 |
| **Phenanthrene** | **0.0013** | **mg/kg** | **0.0030** | **0.00049** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Pyrene** | **0.0082** | **mg/kg** | **0.0030** | **0.00058** | **EPA-8270C-SIM** | ND | | 1 |
| Nitrobenzene-d5 (Surrogate) | 69.1 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| 2-Fluorobiphenyl (Surrogate) | 84.1 | % | 40 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| p-Terphenyl-d14 (Surrogate) | 86.2 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8270C-SIM | 10/29/20 17:20 | 10/30/20 10:21 | OLH | MS-B7 | 0.967 | B091256 | EPA 3550B |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

**BCL Sample ID:** 2031364-14 **Client Sample Name:** RinseateBlank-01, 10/20/2020 5:15:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Total Recoverable Antimony** | **0.18** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 1 |
| Total Recoverable Arsenic | ND | ug/L | 2.0 | 0.70 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Barium** | **0.44** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | **J** | 1 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 1 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Chromium** | **0.82** | **ug/L** | **3.0** | **0.50** | **EPA-200.8** | 0.54 | **J** | 1 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Copper** | **0.38** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 1 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Mercury** | **0.26** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | | 2 |
| **Total Recoverable Molybdenum** | **0.61** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | **J** | 1 |
| Total Recoverable Nickel | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 1 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 3 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 1 |
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:19 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 14:41 | TMT | CETAC3 | 1 | B091992 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 17:46 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-15 **Client Sample Name:** BB-025, 10/21/2020 11:08:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **120** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **7100** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **94** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **51** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **7.1** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **4.5** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **17** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Lead** | **610** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **3.0** | **mg/kg** | **0.32** | **0.032** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.9** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **11** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **21** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **360** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 19:03 | ARD | PE-EL4 | 9.615 | B091174 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:21 | AS1 | PE-OP3 | 9.615 | B091174 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:34 | TMT | CETAC3 | 1.923 | B091358 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-16 **Client Sample Name:** BB-043, 10/21/2020 2:41:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Benzene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| Bromobenzene | ND | mg/kg | 0.0050 | 0.00087 | EPA-8260B | | | 1 |
| Bromochloromethane | ND | mg/kg | 0.0050 | 0.00081 | EPA-8260B | | | 1 |
| Bromodichloromethane | ND | mg/kg | 0.0050 | 0.00078 | EPA-8260B | | | 1 |
| Bromoform | ND | mg/kg | 0.0050 | 0.00070 | EPA-8260B | | | 1 |
| Bromomethane | ND | mg/kg | 0.0050 | 0.0017 | EPA-8260B | | | 1 |
| n-Butylbenzene | ND | mg/kg | 0.0050 | 0.00076 | EPA-8260B | | | 1 |
| sec-Butylbenzene | ND | mg/kg | 0.0050 | 0.00071 | EPA-8260B | | | 1 |
| tert-Butylbenzene | ND | mg/kg | 0.0050 | 0.00085 | EPA-8260B | | | 1 |
| Carbon tetrachloride | ND | mg/kg | 0.0050 | 0.00078 | EPA-8260B | | | 1 |
| Chlorobenzene | ND | mg/kg | 0.0050 | 0.00077 | EPA-8260B | | | 1 |
| Chloroethane | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| Chloroform | ND | mg/kg | 0.0050 | 0.00090 | EPA-8260B | | | 1 |
| Chloromethane | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| 2-Chlorotoluene | ND | mg/kg | 0.0050 | 0.00087 | EPA-8260B | | | 1 |
| 4-Chlorotoluene | ND | mg/kg | 0.0050 | 0.00070 | EPA-8260B | | | 1 |
| Dibromochloromethane | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,2-Dibromo-3-chloropropane | ND | mg/kg | 0.0050 | 0.00096 | EPA-8260B | | | 1 |
| 1,2-Dibromoethane | ND | mg/kg | 0.0050 | 0.00082 | EPA-8260B | | | 1 |
| Dibromomethane | ND | mg/kg | 0.0050 | 0.0014 | EPA-8260B | | | 1 |
| 1,2-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00079 | EPA-8260B | | | 1 |
| 1,3-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| 1,4-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| Dichlorodifluoromethane | ND | mg/kg | 0.0050 | 0.00079 | EPA-8260B | | | 1 |
| 1,1-Dichloroethane | ND | mg/kg | 0.0050 | 0.00064 | EPA-8260B | | | 1 |
| 1,2-Dichloroethane | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| 1,1-Dichloroethene | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| cis-1,2-Dichloroethene | ND | mg/kg | 0.0050 | 0.00054 | EPA-8260B | | | 1 |
| trans-1,2-Dichloroethene | ND | mg/kg | 0.0050 | 0.0037 | EPA-8260B | | | 1 |
| 1,2-Dichloropropane | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,3-Dichloropropane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 2,2-Dichloropropane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 1,1-Dichloropropene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |

| ECM Consultants - Costa Mesa | Reported: | 02/18/2021 9:27 |
|---|---|---|
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-16 **Client Sample Name:** BB-043, 10/21/2020 2:41:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| cis-1,3-Dichloropropene | ND | mg/kg | 0.0050 | 0.00058 | EPA-8260B | | | 1 |
| trans-1,3-Dichloropropene | ND | mg/kg | 0.0050 | 0.00066 | EPA-8260B | | | 1 |
| Ethylbenzene | ND | mg/kg | 0.0050 | 0.00069 | EPA-8260B | | | 1 |
| Hexachlorobutadiene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| Isopropylbenzene | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| p-Isopropyltoluene | ND | mg/kg | 0.0050 | 0.00059 | EPA-8260B | | | 1 |
| Methylene chloride | ND | mg/kg | 0.010 | 0.0011 | EPA-8260B | | | 1 |
| Methyl t-butyl ether | ND | mg/kg | 0.0050 | 0.00056 | EPA-8260B | | | 1 |
| Naphthalene | ND | mg/kg | 0.0050 | 0.00099 | EPA-8260B | | | 1 |
| n-Propylbenzene | ND | mg/kg | 0.0050 | 0.00071 | EPA-8260B | | | 1 |
| Styrene | ND | mg/kg | 0.0050 | 0.00062 | EPA-8260B | | | 1 |
| 1,1,1,2-Tetrachloroethane | ND | mg/kg | 0.0050 | 0.00095 | EPA-8260B | | | 1 |
| 1,1,2,2-Tetrachloroethane | ND | mg/kg | 0.0050 | 0.00084 | EPA-8260B | | | 1 |
| Tetrachloroethene | ND | mg/kg | 0.0050 | 0.00097 | EPA-8260B | | | 1 |
| **Toluene** | **0.0014** | **mg/kg** | **0.0050** | **0.00069** | **EPA-8260B** | | **J** | 1 |
| 1,2,3-Trichlorobenzene | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| 1,2,4-Trichlorobenzene | ND | mg/kg | 0.0050 | 0.0014 | EPA-8260B | | | 1 |
| 1,1,1-Trichloroethane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 1,1,2-Trichloroethane | ND | mg/kg | 0.0050 | 0.00094 | EPA-8260B | | | 1 |
| Trichloroethene | ND | mg/kg | 0.0050 | 0.00074 | EPA-8260B | 2040 | | 1 |
| Trichlorofluoromethane | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| 1,2,3-Trichloropropane | ND | mg/kg | 0.0050 | 0.0019 | EPA-8260B | | | 1 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | mg/kg | 0.0050 | 0.0010 | EPA-8260B | | | 1 |
| 1,2,4-Trimethylbenzene | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,3,5-Trimethylbenzene | ND | mg/kg | 0.0050 | 0.00066 | EPA-8260B | | | 1 |
| Vinyl chloride | ND | mg/kg | 0.0050 | 0.00059 | EPA-8260B | | | 1 |
| Total Xylenes | ND | mg/kg | 0.010 | 0.0025 | EPA-8260B | | | 1 |
| p- & m-Xylenes | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| o-Xylene | ND | mg/kg | 0.0050 | 0.00093 | EPA-8260B | | | 1 |
| 1,2-Dichloroethane-d4 (Surrogate) | 104 | % | 70 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |
| Toluene-d8 (Surrogate) | 96.1 | % | 81 - 117 (LCL - UCL) | | EPA-8260B | | | 1 |
| 4-Bromofluorobenzene (Surrogate) | 85.6 | % | 74 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-16 | **Client Sample Name:** BB-043, 10/21/2020 2:41:00PM, Jared Kemper

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8260B | 10/29/20 13:44 | 10/30/20 18:17 | BYM | MS-V3 | 1 | B091175 | EPA 5030 Soil MS |

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

**BCL Sample ID:** 2031364-16 **Client Sample Name:** BB-043, 10/21/2020 2:41:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | mg/kg | 0.015 | 0.0026 | EPA-8270C-SIM | ND | A01 | 1 |
| Acenaphthylene | ND | mg/kg | 0.015 | 0.0024 | EPA-8270C-SIM | ND | A01 | 1 |
| Anthracene | ND | mg/kg | 0.015 | 0.0036 | EPA-8270C-SIM | ND | A01 | 1 |
| **Benzo[a]anthracene** | **0.0056** | **mg/kg** | **0.015** | **0.0026** | **EPA-8270C-SIM** | ND | **J,A01** | 1 |
| **Benzo[b]fluoranthene** | **0.021** | **mg/kg** | **0.015** | **0.0028** | **EPA-8270C-SIM** | ND | **A01** | 1 |
| **Benzo[k]fluoranthene** | **0.013** | **mg/kg** | **0.015** | **0.0036** | **EPA-8270C-SIM** | ND | **J,A01** | 1 |
| **Benzo[a]pyrene** | **0.025** | **mg/kg** | **0.015** | **0.0017** | **EPA-8270C-SIM** | ND | **A01** | 1 |
| Benzo[g,h,i]perylene | ND | mg/kg | 0.015 | 0.0034 | EPA-8270C-SIM | ND | A01 | 1 |
| **Chrysene** | **0.0042** | **mg/kg** | **0.015** | **0.0019** | **EPA-8270C-SIM** | ND | **J,A01** | 1 |
| Dibenzo[a,h]anthracene | ND | mg/kg | 0.015 | 0.0028 | EPA-8270C-SIM | ND | A01 | 1 |
| **Fluoranthene** | **0.0056** | **mg/kg** | **0.015** | **0.0028** | **EPA-8270C-SIM** | ND | **J,A01** | 1 |
| Fluorene | ND | mg/kg | 0.015 | 0.0018 | EPA-8270C-SIM | ND | A01 | 1 |
| Indeno[1,2,3-cd]pyrene | ND | mg/kg | 0.015 | 0.0028 | EPA-8270C-SIM | ND | A01 | 1 |
| Naphthalene | ND | mg/kg | 0.015 | 0.0024 | EPA-8270C-SIM | ND | A01 | 1 |
| Phenanthrene | ND | mg/kg | 0.015 | 0.0024 | EPA-8270C-SIM | ND | A01 | 1 |
| **Pyrene** | **0.0046** | **mg/kg** | **0.015** | **0.0029** | **EPA-8270C-SIM** | ND | **J,A01** | 1 |
| Nitrobenzene-d5 (Surrogate) | 72.9 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | A01 | 1 |
| 2-Fluorobiphenyl (Surrogate) | 55.2 | % | 40 - 130 (LCL - UCL) | | EPA-8270C-SIM | | A01 | 1 |
| p-Terphenyl-d14 (Surrogate) | 53.8 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | A01 | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8270C-SIM | 10/29/20 17:20 | 10/30/20 10:43 | OLH | MS-B7 | 5.085 | B091256 | EPA 3550B |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-17 **Client Sample Name:** RinseateBlank-02, 10/21/2020 5:45:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Total Recoverable Antimony** | **0.67** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 1 |
| Total Recoverable Arsenic | ND | ug/L | 2.0 | 0.70 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Barium** | **0.28** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | **J** | 1 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 1 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Chromium** | **1.7** | **ug/L** | **3.0** | **0.50** | **EPA-200.8** | 0.54 | **J** | 1 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Copper** | **0.32** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 1 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Mercury** | **0.029** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | **J** | 2 |
| Total Recoverable Molybdenum | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Nickel** | **0.23** | **ug/L** | **2.0** | **0.19** | **EPA-200.8** | ND | **J** | 1 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 3 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 1 |
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:43 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 14:47 | TMT | CETAC3 | 1 | B091992 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:06 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Modified WET Test (STLC)

**BCL Sample ID:** 2031364-18 **Client Sample Name:** BB-023-1, 10/22/2020 12:13:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Arsenic** | **3.2** | **mg/L** | **0.050** | **0.0092** | **EPA-6010B** | ND | | 1 |
| **Cadmium** | **0.041** | **mg/L** | **0.010** | **0.0011** | **EPA-6010B** | ND | | 1 |
| Lead | ND | mg/L | 0.050 | 0.0035 | EPA-6010B | ND | | 1 |
| Mercury | ND | mg/L | 0.0020 | 0.00022 | EPA-7470A | ND | | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6010B | 02/07/21 14:00 | 02/08/21 14:35 | JCC | PE-OP3 | 1 | B099464 | EPA 3005A |
| 2 | EPA-7470A | 02/16/21 14:40 | 02/17/21 11:56 | TMT | CETAC3 | 1 | B100161 | EPA 7470A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-18 | **Client Sample Name:** BB-023-1, 10/22/2020 12:13:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **38** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **52000** | **mg/kg** | **10** | **3.4** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **41** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **350** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **2.3** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Cobalt** | **5.8** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **35** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **2300** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **21** | **mg/kg** | **3.2** | **0.32** | **EPA-7471A** | 20 | **A07** | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **4.8** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **18** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **6.7** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **480** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 20:52 | ARD | PE-EL4 | 10 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:14 | ARD | PE-EL4 | 20 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:26 | AS1 | PE-OP3 | 10 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:36 | TMT | CETAC3 | 20.161 | B091358 | EPA 7471A |

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Modified WET Test (STLC)

**BCL Sample ID:** 2031364-19 **Client Sample Name:** BB-025-0.5, 10/22/2020 9:08:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Arsenic** | **3.8** | **mg/L** | **0.050** | **0.0092** | **EPA-6010B** | ND | | 1 |
| **Cadmium** | **0.045** | **mg/L** | **0.010** | **0.0011** | **EPA-6010B** | ND | | 1 |
| **Lead** | **0.0095** | **mg/L** | **0.050** | **0.0035** | **EPA-6010B** | ND | **J** | 1 |
| **Mercury** | **0.020** | **mg/L** | **0.0020** | **0.00022** | **EPA-7470A** | ND | | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6010B | 02/07/21 14:00 | 02/08/21 14:36 | JCC | PE-OP3 | 1 | B099464 | EPA 3005A |
| 2 | EPA-7470A | 02/16/21 14:40 | 02/17/21 12:02 | TMT | CETAC3 | 1 | B100161 | EPA 7470A |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-19 **Client Sample Name:** BB-025-0.5, 10/22/2020 9:08:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **58** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **26000** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **210** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **160** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **6.2** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Cobalt** | **2.2** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **8.1** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Lead** | **1800** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **7.5** | **mg/kg** | **1.6** | **0.16** | **EPA-7471A** | 20 | **A07** | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **2.7** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **36** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **14** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **51** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 20:54 | ARD | PE-EL4 | 9.615 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:16 | ARD | PE-EL4 | 9.615 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:28 | AS1 | PE-OP3 | 9.615 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:38 | TMT | CETAC3 | 9.766 | B091358 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-20 **Client Sample Name:** BB-097, 10/22/2020 8:45:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Benzene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| Bromobenzene | ND | mg/kg | 0.0050 | 0.00087 | EPA-8260B | | | 1 |
| Bromochloromethane | ND | mg/kg | 0.0050 | 0.00081 | EPA-8260B | | | 1 |
| Bromodichloromethane | ND | mg/kg | 0.0050 | 0.00078 | EPA-8260B | | | 1 |
| Bromoform | ND | mg/kg | 0.0050 | 0.00070 | EPA-8260B | | | 1 |
| Bromomethane | ND | mg/kg | 0.0050 | 0.0017 | EPA-8260B | | | 1 |
| n-Butylbenzene | ND | mg/kg | 0.0050 | 0.00076 | EPA-8260B | | | 1 |
| sec-Butylbenzene | ND | mg/kg | 0.0050 | 0.00071 | EPA-8260B | | | 1 |
| tert-Butylbenzene | ND | mg/kg | 0.0050 | 0.00085 | EPA-8260B | | | 1 |
| Carbon tetrachloride | ND | mg/kg | 0.0050 | 0.00078 | EPA-8260B | | | 1 |
| Chlorobenzene | ND | mg/kg | 0.0050 | 0.00077 | EPA-8260B | | | 1 |
| Chloroethane | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| Chloroform | ND | mg/kg | 0.0050 | 0.00090 | EPA-8260B | | | 1 |
| Chloromethane | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| 2-Chlorotoluene | ND | mg/kg | 0.0050 | 0.00087 | EPA-8260B | | | 1 |
| 4-Chlorotoluene | ND | mg/kg | 0.0050 | 0.00070 | EPA-8260B | | | 1 |
| Dibromochloromethane | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,2-Dibromo-3-chloropropane | ND | mg/kg | 0.0050 | 0.00096 | EPA-8260B | | | 1 |
| 1,2-Dibromoethane | ND | mg/kg | 0.0050 | 0.00082 | EPA-8260B | | | 1 |
| Dibromomethane | ND | mg/kg | 0.0050 | 0.0014 | EPA-8260B | | | 1 |
| 1,2-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00079 | EPA-8260B | | | 1 |
| 1,3-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| 1,4-Dichlorobenzene | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| Dichlorodifluoromethane | ND | mg/kg | 0.0050 | 0.00079 | EPA-8260B | | | 1 |
| 1,1-Dichloroethane | ND | mg/kg | 0.0050 | 0.00064 | EPA-8260B | | | 1 |
| 1,2-Dichloroethane | ND | mg/kg | 0.0050 | 0.00073 | EPA-8260B | | | 1 |
| 1,1-Dichloroethene | ND | mg/kg | 0.0050 | 0.0011 | EPA-8260B | | | 1 |
| cis-1,2-Dichloroethene | ND | mg/kg | 0.0050 | 0.00054 | EPA-8260B | | | 1 |
| trans-1,2-Dichloroethene | ND | mg/kg | 0.0050 | 0.0037 | EPA-8260B | | | 1 |
| 1,2-Dichloropropane | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,3-Dichloropropane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 2,2-Dichloropropane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 1,1-Dichloropropene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-20 | **Client Sample Name:** BB-097, 10/22/2020 8:45:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| cis-1,3-Dichloropropene | ND | mg/kg | 0.0050 | 0.00058 | EPA-8260B | | | 1 |
| trans-1,3-Dichloropropene | ND | mg/kg | 0.0050 | 0.00066 | EPA-8260B | | | 1 |
| Ethylbenzene | ND | mg/kg | 0.0050 | 0.00069 | EPA-8260B | | | 1 |
| Hexachlorobutadiene | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| Isopropylbenzene | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| p-Isopropyltoluene | ND | mg/kg | 0.0050 | 0.00059 | EPA-8260B | | | 1 |
| Methylene chloride | ND | mg/kg | 0.010 | 0.0011 | EPA-8260B | | | 1 |
| Methyl t-butyl ether | ND | mg/kg | 0.0050 | 0.00056 | EPA-8260B | | | 1 |
| Naphthalene | ND | mg/kg | 0.0050 | 0.00099 | EPA-8260B | | | 1 |
| n-Propylbenzene | ND | mg/kg | 0.0050 | 0.00071 | EPA-8260B | | | 1 |
| Styrene | ND | mg/kg | 0.0050 | 0.00062 | EPA-8260B | | | 1 |
| 1,1,1,2-Tetrachloroethane | ND | mg/kg | 0.0050 | 0.00095 | EPA-8260B | | | 1 |
| 1,1,2,2-Tetrachloroethane | ND | mg/kg | 0.0050 | 0.00084 | EPA-8260B | | | 1 |
| Tetrachloroethene | ND | mg/kg | 0.0050 | 0.00097 | EPA-8260B | | | 1 |
| Toluene | ND | mg/kg | 0.0050 | 0.00069 | EPA-8260B | | | 1 |
| 1,2,3-Trichlorobenzene | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| 1,2,4-Trichlorobenzene | ND | mg/kg | 0.0050 | 0.0014 | EPA-8260B | | | 1 |
| 1,1,1-Trichloroethane | ND | mg/kg | 0.0050 | 0.00067 | EPA-8260B | | | 1 |
| 1,1,2-Trichloroethane | ND | mg/kg | 0.0050 | 0.00094 | EPA-8260B | | | 1 |
| Trichloroethene | ND | mg/kg | 0.0050 | 0.00074 | EPA-8260B | 2040 | | 1 |
| Trichlorofluoromethane | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| 1,2,3-Trichloropropane | ND | mg/kg | 0.0050 | 0.0019 | EPA-8260B | | | 1 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | mg/kg | 0.0050 | 0.0010 | EPA-8260B | | | 1 |
| 1,2,4-Trimethylbenzene | ND | mg/kg | 0.0050 | 0.00080 | EPA-8260B | | | 1 |
| 1,3,5-Trimethylbenzene | ND | mg/kg | 0.0050 | 0.00066 | EPA-8260B | | | 1 |
| Vinyl chloride | ND | mg/kg | 0.0050 | 0.00059 | EPA-8260B | | | 1 |
| Total Xylenes | ND | mg/kg | 0.010 | 0.0025 | EPA-8260B | | | 1 |
| p- & m-Xylenes | ND | mg/kg | 0.0050 | 0.0015 | EPA-8260B | | | 1 |
| o-Xylene | ND | mg/kg | 0.0050 | 0.00093 | EPA-8260B | | | 1 |
| 1,2-Dichloroethane-d4 (Surrogate) | 110 | % | 70 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |
| Toluene-d8 (Surrogate) | 101 | % | 81 - 117 (LCL - UCL) | | EPA-8260B | | | 1 |
| 4-Bromofluorobenzene (Surrogate) | 101 | % | 74 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-20 **Client Sample Name:** BB-097, 10/22/2020 8:45:00AM, Jared Kemper

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8260B | 10/28/20 09:02 | 10/28/20 18:52 | BYM | MS-V3 | 0.982 | B091020 | EPA 5035 Soil MS |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

**BCL Sample ID:** 2031364-20 **Client Sample Name:** BB-097, 10/22/2020 8:45:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | mg/kg | 0.0030 | 0.00052 | EPA-8270C-SIM | ND | | 1 |
| Acenaphthylene | ND | mg/kg | 0.0030 | 0.00047 | EPA-8270C-SIM | ND | | 1 |
| Anthracene | ND | mg/kg | 0.0030 | 0.00073 | EPA-8270C-SIM | ND | | 1 |
| **Benzo[a]anthracene** | **0.00070** | **mg/kg** | **0.0030** | **0.00053** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Benzo[b]fluoranthene** | **0.0033** | **mg/kg** | **0.0030** | **0.00056** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[k]fluoranthene** | **0.0023** | **mg/kg** | **0.0030** | **0.00073** | **EPA-8270C-SIM** | ND | **J** | 1 |
| **Benzo[a]pyrene** | **0.0042** | **mg/kg** | **0.0030** | **0.00034** | **EPA-8270C-SIM** | ND | | 1 |
| Benzo[g,h,i]perylene | ND | mg/kg | 0.0030 | 0.00068 | EPA-8270C-SIM | ND | | 1 |
| **Chrysene** | **0.00042** | **mg/kg** | **0.0030** | **0.00038** | **EPA-8270C-SIM** | ND | **J** | 1 |
| Dibenzo[a,h]anthracene | ND | mg/kg | 0.0030 | 0.00057 | EPA-8270C-SIM | ND | | 1 |
| **Fluoranthene** | **0.00061** | **mg/kg** | **0.0030** | **0.00057** | **EPA-8270C-SIM** | ND | **J** | 1 |
| Fluorene | ND | mg/kg | 0.0030 | 0.00037 | EPA-8270C-SIM | ND | | 1 |
| Indeno[1,2,3-cd]pyrene | ND | mg/kg | 0.0030 | 0.00055 | EPA-8270C-SIM | ND | | 1 |
| Naphthalene | ND | mg/kg | 0.0030 | 0.00049 | EPA-8270C-SIM | ND | | 1 |
| Phenanthrene | ND | mg/kg | 0.0030 | 0.00049 | EPA-8270C-SIM | ND | | 1 |
| **Pyrene** | **0.00061** | **mg/kg** | **0.0030** | **0.00058** | **EPA-8270C-SIM** | ND | **J** | 1 |
| Nitrobenzene-d5 (Surrogate) | 66.5 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| 2-Fluorobiphenyl (Surrogate) | 81.3 | % | 40 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| p-Terphenyl-d14 (Surrogate) | 92.8 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8270C-SIM | 10/29/20 17:20 | 10/30/20 09:36 | OLH | MS-B7 | 0.970 | B091256 | EPA 3550B |

| ECM Consultants - Costa Mesa | Reported: | 02/18/2021 9:27 |
|---|---|---|
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-21 **Client Sample Name:** BB-116-SO-01, 10/22/2020 10:28:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Benzene | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| Bromobenzene | ND | mg/kg | 0.0064 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| Bromochloromethane | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| Bromodichloromethane | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| Bromoform | ND | mg/kg | 0.0064 | 0.00090 | EPA-8260B | | S08,Z1 | 1 |
| Bromomethane | ND | mg/kg | 0.0064 | 0.0022 | EPA-8260B | | S08,Z1 | 1 |
| n-Butylbenzene | ND | mg/kg | 0.0064 | 0.00097 | EPA-8260B | | S08,Z1 | 1 |
| sec-Butylbenzene | ND | mg/kg | 0.0064 | 0.00091 | EPA-8260B | | S08,Z1 | 1 |
| tert-Butylbenzene | ND | mg/kg | 0.0064 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| Carbon tetrachloride | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| Chlorobenzene | ND | mg/kg | 0.0064 | 0.00099 | EPA-8260B | | S08,Z1 | 1 |
| Chloroethane | ND | mg/kg | 0.0064 | 0.0014 | EPA-8260B | | S08,Z1 | 1 |
| Chloroform | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| Chloromethane | ND | mg/kg | 0.0064 | 0.0014 | EPA-8260B | | S08,Z1 | 1 |
| 2-Chlorotoluene | ND | mg/kg | 0.0064 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| 4-Chlorotoluene | ND | mg/kg | 0.0064 | 0.00090 | EPA-8260B | | S08,Z1 | 1 |
| Dibromochloromethane | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dibromo-3-chloropropane | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dibromoethane | ND | mg/kg | 0.0064 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| Dibromomethane | ND | mg/kg | 0.0064 | 0.0018 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichlorobenzene | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,3-Dichlorobenzene | ND | mg/kg | 0.0064 | 0.00094 | EPA-8260B | | S08,Z1 | 1 |
| 1,4-Dichlorobenzene | ND | mg/kg | 0.0064 | 0.00094 | EPA-8260B | | S08,Z1 | 1 |
| Dichlorodifluoromethane | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloroethane | ND | mg/kg | 0.0064 | 0.00082 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloroethane | ND | mg/kg | 0.0064 | 0.00094 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloroethene | ND | mg/kg | 0.0064 | 0.0014 | EPA-8260B | | S08,Z1 | 1 |
| cis-1,2-Dichloroethene | ND | mg/kg | 0.0064 | 0.00069 | EPA-8260B | | S08,Z1 | 1 |
| trans-1,2-Dichloroethene | ND | mg/kg | 0.0064 | 0.0047 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloropropane | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,3-Dichloropropane | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| 2,2-Dichloropropane | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| 1,1-Dichloropropene | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-21 **Client Sample Name:** BB-116-SO-01, 10/22/2020 10:28:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| cis-1,3-Dichloropropene | ND | mg/kg | 0.0064 | 0.00074 | EPA-8260B | | S08,Z1 | 1 |
| trans-1,3-Dichloropropene | ND | mg/kg | 0.0064 | 0.00085 | EPA-8260B | | S08,Z1 | 1 |
| Ethylbenzene | ND | mg/kg | 0.0064 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| Hexachlorobutadiene | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| Isopropylbenzene | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| p-Isopropyltoluene | ND | mg/kg | 0.0064 | 0.00076 | EPA-8260B | | S08,Z1 | 1 |
| Methylene chloride | ND | mg/kg | 0.013 | 0.0014 | EPA-8260B | | S08,Z1 | 1 |
| Methyl t-butyl ether | ND | mg/kg | 0.0064 | 0.00072 | EPA-8260B | | S08,Z1 | 1 |
| Naphthalene | ND | mg/kg | 0.0064 | 0.0013 | EPA-8260B | | S08,Z1 | 1 |
| n-Propylbenzene | ND | mg/kg | 0.0064 | 0.00091 | EPA-8260B | | S08,Z1 | 1 |
| Styrene | ND | mg/kg | 0.0064 | 0.00079 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,1,2-Tetrachloroethane | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2,2-Tetrachloroethane | ND | mg/kg | 0.0064 | 0.0011 | EPA-8260B | | S08,Z1 | 1 |
| Tetrachloroethene | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| Toluene | ND | mg/kg | 0.0064 | 0.00088 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,3-Trichlorobenzene | ND | mg/kg | 0.0064 | 0.0019 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,4-Trichlorobenzene | ND | mg/kg | 0.0064 | 0.0018 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,1-Trichloroethane | ND | mg/kg | 0.0064 | 0.00086 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2-Trichloroethane | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| Trichloroethene | ND | mg/kg | 0.0064 | 0.00095 | EPA-8260B | 2040 | S08,Z1 | 1 |
| Trichlorofluoromethane | ND | mg/kg | 0.0064 | 0.0019 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,3-Trichloropropane | ND | mg/kg | 0.0064 | 0.0024 | EPA-8260B | | S08,Z1 | 1 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | mg/kg | 0.0064 | 0.0013 | EPA-8260B | | S08,Z1 | 1 |
| 1,2,4-Trimethylbenzene | ND | mg/kg | 0.0064 | 0.0010 | EPA-8260B | | S08,Z1 | 1 |
| 1,3,5-Trimethylbenzene | ND | mg/kg | 0.0064 | 0.00085 | EPA-8260B | | S08,Z1 | 1 |
| Vinyl chloride | ND | mg/kg | 0.0064 | 0.00076 | EPA-8260B | | S08,Z1 | 1 |
| Total Xylenes | ND | mg/kg | 0.013 | 0.0032 | EPA-8260B | | S08,Z1 | 1 |
| p- & m-Xylenes | ND | mg/kg | 0.0064 | 0.0019 | EPA-8260B | | S08,Z1 | 1 |
| o-Xylene | ND | mg/kg | 0.0064 | 0.0012 | EPA-8260B | | S08,Z1 | 1 |
| 1,2-Dichloroethane-d4 (Surrogate) | 108 | % | 70 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |
| Toluene-d8 (Surrogate) | 93.7 | % | 81 - 117 (LCL - UCL) | | EPA-8260B | | | 1 |
| 4-Bromofluorobenzene (Surrogate) | 90.6 | % | 74 - 121 (LCL - UCL) | | EPA-8260B | | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

**BCL Sample ID:** 2031364-21 | **Client Sample Name:** BB-116-SO-01, 10/22/2020 10:28:00AM, Jared Kemper

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8260B | 10/28/20 09:02 | 10/28/20 19:16 | BYM | MS-V3 | 1.282 | B091020 | EPA 5035 Soil MS |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

**BCL Sample ID:** 2031364-21 **Client Sample Name:** BB-116-SO-01, 10/22/2020 10:28:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | mg/kg | 0.0030 | 0.00052 | EPA-8270C-SIM | ND | | 1 |
| Acenaphthylene | ND | mg/kg | 0.0030 | 0.00047 | EPA-8270C-SIM | ND | | 1 |
| Anthracene | ND | mg/kg | 0.0030 | 0.00073 | EPA-8270C-SIM | ND | | 1 |
| **Benzo[a]anthracene** | **0.0011** | **mg/kg** | **0.0030** | **0.00053** | **EPA-8270C-SIM** | ND | J | 1 |
| **Benzo[b]fluoranthene** | **0.0051** | **mg/kg** | **0.0030** | **0.00056** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[k]fluoranthene** | **0.0028** | **mg/kg** | **0.0030** | **0.00073** | **EPA-8270C-SIM** | ND | J | 1 |
| **Benzo[a]pyrene** | **0.0053** | **mg/kg** | **0.0030** | **0.00034** | **EPA-8270C-SIM** | ND | | 1 |
| **Benzo[g,h,i]perylene** | **0.0015** | **mg/kg** | **0.0030** | **0.00068** | **EPA-8270C-SIM** | ND | J | 1 |
| **Chrysene** | **0.0020** | **mg/kg** | **0.0030** | **0.00038** | **EPA-8270C-SIM** | ND | J | 1 |
| **Dibenzo[a,h]anthracene** | **0.0046** | **mg/kg** | **0.0030** | **0.00057** | **EPA-8270C-SIM** | ND | | 1 |
| **Fluoranthene** | **0.0024** | **mg/kg** | **0.0030** | **0.00057** | **EPA-8270C-SIM** | ND | J | 1 |
| Fluorene | ND | mg/kg | 0.0030 | 0.00037 | EPA-8270C-SIM | ND | | 1 |
| **Indeno[1,2,3-cd]pyrene** | **0.0045** | **mg/kg** | **0.0030** | **0.00055** | **EPA-8270C-SIM** | ND | | 1 |
| Naphthalene | ND | mg/kg | 0.0030 | 0.00049 | EPA-8270C-SIM | ND | | 1 |
| **Phenanthrene** | **0.0011** | **mg/kg** | **0.0030** | **0.00049** | **EPA-8270C-SIM** | ND | J | 1 |
| **Pyrene** | **0.0020** | **mg/kg** | **0.0030** | **0.00058** | **EPA-8270C-SIM** | ND | J | 1 |
| Nitrobenzene-d5 (Surrogate) | 55.4 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| 2-Fluorobiphenyl (Surrogate) | 62.1 | % | 40 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |
| p-Terphenyl-d14 (Surrogate) | 63.8 | % | 30 - 130 (LCL - UCL) | | EPA-8270C-SIM | | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8270C-SIM | 10/29/20 17:20 | 10/30/20 09:59 | OLH | MS-B7 | 1.007 | B091256 | EPA 3550B |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-21 | **Client Sample Name:** BB-116-SO-01, 10/22/2020 10:28:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **23** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **13000** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **79** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **91** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **10** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Cobalt** | **6.9** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **20** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **1300** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **8.8** | **mg/kg** | **1.6** | **0.16** | **EPA-7471A** | 20 | **A07** | 4 |
| **Molybdenum** | **4.3** | **mg/kg** | **25** | **0.50** | **EPA-6010B** | 3500 | **J,A07** | 3 |
| **Nickel** | **7.1** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **24** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **28** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **110** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 20:56 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:28 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:30 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:40 | TMT | CETAC3 | 9.766 | B091358 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-22 **Client Sample Name:** BB-116-SO-01-0.5, 10/22/2020 10:33:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **78** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **30000** | **mg/kg** | **10** | **3.4** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **110** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **210** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **34** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Cobalt** | **2.6** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **43** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **2300** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **40** | **mg/kg** | **8.0** | **0.80** | **EPA-7471A** | 20 | **A07** | 4 |
| **Molybdenum** | **0.67** | **mg/kg** | **25** | **0.50** | **EPA-6010B** | 3500 | **J,A07** | 3 |
| **Nickel** | **10** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **69** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **11** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **130** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 20:59 | ARD | PE-EL4 | 9.709 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:31 | ARD | PE-EL4 | 19.417 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:32 | AS1 | PE-OP3 | 9.709 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:42 | TMT | CETAC3 | 49.603 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-23 | **Client Sample Name:** BB-B-Comp-01, 10/19/2020 3:35:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **20** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **82** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 3 |
| **Chromium** | **10** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Cobalt** | **6.3** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **10** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **43** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **0.62** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **4.9** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **30** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **78** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 21:01 | ARD | PE-EL4 | 9.901 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:33 | ARD | PE-EL4 | 9.901 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:33 | AS1 | PE-OP3 | 9.901 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:11 | TMT | CETAC3 | 1.025 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-25 **Client Sample Name:** BB-020, 10/20/2020 11:13:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **160** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **7400** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **98** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **60** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **10** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Cobalt** | **6.7** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **15** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 3 |
| **Lead** | **520** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **2.0** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **8.1** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **8.5** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **28** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **150** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 21:03 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:35 | ARD | PE-EL4 | 9.804 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:35 | AS1 | PE-OP3 | 9.804 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:14 | TMT | CETAC3 | 1.008 | B091358 | EPA 7471A |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Modified WET Test (STLC)

**BCL Sample ID:** 2031364-26 **Client Sample Name:** BB-123, 10/20/2020 12:23:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Arsenic** | **17** | **mg/L** | **0.050** | **0.0092** | **EPA-6010B** | ND | | 1 |
| **Cadmium** | **0.21** | **mg/L** | **0.010** | **0.0011** | **EPA-6010B** | ND | | 1 |
| **Lead** | **0.50** | **mg/L** | **0.050** | **0.0035** | **EPA-6010B** | ND | | 1 |
| **Mercury** | **0.069** | **mg/L** | **0.010** | **0.0011** | **EPA-7470A** | ND | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6010B | 02/07/21 14:00 | 02/08/21 14:38 | JCC | PE-OP3 | 1 | B099464 | EPA 3005A |
| 2 | EPA-7470A | 02/16/21 14:40 | 02/17/21 12:12 | TMT | CETAC3 | 5 | B100161 | EPA 7470A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# TCLP Toxicity

**BCL Sample ID:** 2031364-26 | **Client Sample Name:** BB-123, 10/20/2020 12:23:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TCLP Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Arsenic** | **2.2** | **mg/L** | **0.20** | **0.083** | **EPA-6010B** | 5.0 | | 1 |
| **Cadmium** | **0.034** | **mg/L** | **0.10** | **0.0051** | **EPA-6010B** | 1.0 | **J** | 1 |
| **Lead** | **0.047** | **mg/L** | **0.50** | **0.030** | **EPA-6010B** | 5.0 | **J** | 1 |
| **Mercury** | **0.015** | **mg/L** | **0.0020** | **0.00022** | **EPA-7470A** | 0.2 | | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6010B | 02/09/21 11:00 | 02/09/21 19:30 | JCC | PE-OP3 | 1 | B099577 | EPA 3050B |
| 2 | EPA-7470A | 02/10/21 09:30 | 02/10/21 17:33 | TMT | CETAC3 | 1 | B099674 | EPA 7470A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-26 **Client Sample Name:** BB-123, 10/20/2020 12:23:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **4.5** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **15000** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 2 |
| **Barium** | **41** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **110** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| **Chromium** | **3.7** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Cobalt** | **2.2** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 3 |
| **Copper** | **4.6** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Lead** | **1200** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **350** | **mg/kg** | **32** | **3.2** | **EPA-7471A** | 20 | **A07** | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| **Nickel** | **1.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 3 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 1 |
| **Silver** | **11** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **20** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 3 |
| **Zinc** | **36** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/30/20 21:06 | ARD | PE-EL4 | 9.434 | B091174 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/04/20 02:38 | ARD | PE-EL4 | 9.434 | B091174 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 01:37 | AS1 | PE-OP3 | 9.434 | B091174 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:44 | TMT | CETAC3 | 192.31 | B091358 | EPA 7471A |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-27 | **Client Sample Name:** BB-011, 10/20/2020 2:14:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **110** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **58** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **1.3** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **J,A07** | 2 |
| **Chromium** | **4.6** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Cobalt** | **5.1** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **8.4** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Lead** | **34** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **0.77** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **3.0** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **3.9** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 4 |
| **Silver** | **2.3** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **J,A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **21** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **44** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 02:40 | ARD | PE-EL4 | 10 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:05 | AS1 | PE-OP3 | 10 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 09:25 | TMT | CETAC3 | 1.008 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 20:16 | ARD | PE-EL2 | 10 | B091180 | EPA 3050B |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-28 **Client Sample Name:** BB-012, 10/20/2020 2:32:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **0.83** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **1100** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **57** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **8.5** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **6.8** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **5.1** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **7.4** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Lead** | **66** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **7.1** | **mg/kg** | **0.80** | **0.080** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.7** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **1.6** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 4 |
| **Silver** | **0.85** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **J,A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **28** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **64** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 02:59 | ARD | PE-EL4 | 9.709 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:20 | AS1 | PE-OP3 | 9.709 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 10:46 | TMT | CETAC3 | 5.040 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:16 | ARD | PE-EL2 | 9.709 | B091180 | EPA 3050B |

**BC Laboratories, Inc.**
Environmental Testing Laboratory Since 1949

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-29 | **Client Sample Name:** BB-127, 10/20/2020 2:42:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **74** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **A07** | 1 |
| **Arsenic** | **88000** | **mg/kg** | **25** | **8.5** | **EPA-6020** | 500 | | 2 |
| **Barium** | **18** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 3 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 3 |
| **Cadmium** | **630** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 3 |
| Chromium | ND | mg/kg | 5.0 | 0.50 | EPA-6010B | 2500 | A07 | 3 |
| Cobalt | ND | mg/kg | 25 | 0.98 | EPA-6010B | 8000 | A07 | 3 |
| **Copper** | **7.0** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 3 |
| **Lead** | **2400** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 3 |
| **Mercury** | **270** | **mg/kg** | **32** | **3.2** | **EPA-7471A** | 20 | **A07** | 4 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 3 |
| Nickel | ND | mg/kg | 5.0 | 1.5 | EPA-6010B | 2000 | A07 | 3 |
| Selenium | ND | mg/kg | 25 | 5.5 | EPA-6020 | 100 | A07 | 5 |
| **Silver** | **45** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **A07** | 3 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **3.3** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **J,A07** | 3 |
| **Zinc** | **190** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:01 | ARD | PE-EL4 | 9.804 | B091180 | EPA 3050B |
| 2 | EPA-6020 | 10/29/20 12:00 | 11/06/20 13:25 | ARD | PE-EL4 | 49.020 | B091180 | EPA 3050B |
| 3 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:21 | AS1 | PE-OP3 | 9.804 | B091180 | EPA 3050B |
| 4 | EPA-7471A | 10/30/20 14:30 | 11/02/20 11:37 | TMT | CETAC3 | 195.31 | B091358 | EPA 7471A |
| 5 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:17 | ARD | PE-EL2 | 49.020 | B091180 | EPA 3050B |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-30 **Client Sample Name:** BB-129, 10/20/2020 2:52:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **3.3** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **19000** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **47** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **140** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **4.4** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Cobalt** | **2.3** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **3.0** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Lead** | **990** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **20** | **mg/kg** | **3.2** | **0.32** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| Nickel | ND | mg/kg | 5.0 | 1.5 | EPA-6010B | 2000 | A07 | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 4 |
| **Silver** | **2.2** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **J,A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **24** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **19** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **J,A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:03 | ARD | PE-EL4 | 9.524 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:23 | AS1 | PE-OP3 | 9.524 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 11:39 | TMT | CETAC3 | 19.841 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:19 | ARD | PE-EL2 | 9.524 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-31 **Client Sample Name:** BB-129-0.5, 10/20/2020 2:57:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **1.0** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **11000** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **59** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **86** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **3.7** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Cobalt** | **3.0** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **3.9** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Lead** | **210** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **3.8** | **mg/kg** | **0.32** | **0.032** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **2.0** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 4 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **18** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **26** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:06 | ARD | PE-EL4 | 10 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:25 | AS1 | PE-OP3 | 10 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 11:41 | TMT | CETAC3 | 1.984 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:21 | ARD | PE-EL2 | 10 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-32 **Client Sample Name:** BB-018, 10/20/2020 4:06:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **2.2** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **1900** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **54** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **14** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **8.6** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **4.8** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **87** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Lead** | **13000** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **7.9** | **mg/kg** | **0.80** | **0.080** | **EPA-7471A** | 20 | **A07** | 3 |
| **Molybdenum** | **1.8** | **mg/kg** | **25** | **0.50** | **EPA-6010B** | 3500 | **J,A07** | 2 |
| **Nickel** | **6.3** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 4 |
| **Silver** | **4.6** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **J,A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **25** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **140** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:08 | ARD | PE-EL4 | 9.709 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:27 | AS1 | PE-OP3 | 9.709 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 11:52 | TMT | CETAC3 | 5.040 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:23 | ARD | PE-EL2 | 9.709 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-33 **Client Sample Name:** DUP-02, 10/20/2020 4:06:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **1.6** | **mg/kg** | **5.0** | **0.80** | **EPA-6020** | 500 | **J,A07** | 1 |
| **Arsenic** | **1200** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **41** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| **Cadmium** | **9.1** | **mg/kg** | **5.0** | **0.52** | **EPA-6010B** | 100 | **A07** | 2 |
| **Chromium** | **5.9** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **3.5** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **40** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Lead** | **7100** | **mg/kg** | **25** | **4.1** | **EPA-6010B** | 1000 | **A07** | 2 |
| **Mercury** | **5.7** | **mg/kg** | **0.80** | **0.080** | **EPA-7471A** | 20 | **A07** | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **4.5** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| Selenium | ND | mg/kg | 5.0 | 1.1 | EPA-6020 | 100 | A07 | 4 |
| **Silver** | **4.7** | **mg/kg** | **5.0** | **0.67** | **EPA-6010B** | 500 | **J,A07** | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **17** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **110** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:10 | ARD | PE-EL4 | 9.524 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:29 | AS1 | PE-OP3 | 9.524 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 11:54 | TMT | CETAC3 | 4.960 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:24 | ARD | PE-EL2 | 9.524 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-34 **Client Sample Name:** BB-SW-02-Sed, 10/22/2020 1:30:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **32** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **31** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **5.8** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **A07** | 2 |
| **Cobalt** | **3.4** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **3.8** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.55** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **2.8** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **1.8** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 4 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **31** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **24** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **J,A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:13 | ARD | PE-EL4 | 9.901 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:30 | AS1 | PE-OP3 | 9.901 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 13:34 | TMT | CETAC3 | 0.992 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:26 | ARD | PE-EL2 | 9.901 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-35 **Client Sample Name:** BB-SW-03-Sed, 10/22/2020 3:45:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Antimony | ND | mg/kg | 5.0 | 0.80 | EPA-6020 | 500 | A07 | 1 |
| **Arsenic** | **13** | **mg/kg** | **5.0** | **1.7** | **EPA-6020** | 500 | **A07** | 1 |
| **Barium** | **24** | **mg/kg** | **5.0** | **1.8** | **EPA-6010B** | 10000 | **A07** | 2 |
| Beryllium | ND | mg/kg | 5.0 | 0.47 | EPA-6010B | 75 | A07 | 2 |
| Cadmium | ND | mg/kg | 5.0 | 0.52 | EPA-6010B | 100 | A07 | 2 |
| **Chromium** | **4.4** | **mg/kg** | **5.0** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| **Cobalt** | **2.3** | **mg/kg** | **25** | **0.98** | **EPA-6010B** | 8000 | **J,A07** | 2 |
| **Copper** | **2.8** | **mg/kg** | **10** | **0.50** | **EPA-6010B** | 2500 | **J,A07** | 2 |
| Lead | ND | mg/kg | 25 | 4.1 | EPA-6010B | 1000 | A07 | 2 |
| **Mercury** | **0.17** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | | 3 |
| Molybdenum | ND | mg/kg | 25 | 0.50 | EPA-6010B | 3500 | A07 | 2 |
| **Nickel** | **3.3** | **mg/kg** | **5.0** | **1.5** | **EPA-6010B** | 2000 | **J,A07** | 2 |
| **Selenium** | **1.2** | **mg/kg** | **5.0** | **1.1** | **EPA-6020** | 100 | **J,A07** | 4 |
| Silver | ND | mg/kg | 5.0 | 0.67 | EPA-6010B | 500 | A07 | 2 |
| Thallium | ND | mg/kg | 2.5 | 0.49 | EPA-6020 | 700 | A07 | 1 |
| **Vanadium** | **17** | **mg/kg** | **5.0** | **1.1** | **EPA-6010B** | 2400 | **A07** | 2 |
| **Zinc** | **15** | **mg/kg** | **25** | **0.87** | **EPA-6010B** | 5000 | **J,A07** | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 10/29/20 12:00 | 10/31/20 03:15 | ARD | PE-EL4 | 10 | B091180 | EPA 3050B |
| 2 | EPA-6010B | 10/29/20 12:00 | 11/03/20 00:32 | AS1 | PE-OP3 | 10 | B091180 | EPA 3050B |
| 3 | EPA-7471A | 10/30/20 14:30 | 11/02/20 13:36 | TMT | CETAC3 | 1.008 | B091358 | EPA 7471A |
| 4 | EPA-6020 | 10/29/20 12:00 | 11/05/20 21:28 | ARD | PE-EL2 | 10 | B091180 | EPA 3050B |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-36 **Client Sample Name:** BB-SW-01, 10/22/2020 5:15:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Dissolved Antimony | ND | ug/L | 2.0 | 0.23 | EPA-200.8 | ND | | 1 |
| **Dissolved Arsenic** | **6.4** | **ug/L** | **2.0** | **0.38** | **EPA-200.8** | ND | | 1 |
| **Dissolved Barium** | **18** | **ug/L** | **1.0** | **0.066** | **EPA-200.8** | ND | | 1 |
| Dissolved Beryllium | ND | ug/L | 1.0 | 0.050 | EPA-200.8 | ND | | 1 |
| Dissolved Cadmium | ND | ug/L | 1.0 | 0.034 | EPA-200.8 | ND | | 1 |
| Dissolved Chromium | ND | ug/L | 3.0 | 0.15 | EPA-200.8 | ND | | 1 |
| **Dissolved Cobalt** | **0.059** | **ug/L** | **1.0** | **0.011** | **EPA-200.8** | 0.015 | **J** | 1 |
| Dissolved Copper | ND | ug/L | 2.0 | 0.32 | EPA-200.8 | ND | | 1 |
| Dissolved Lead | ND | ug/L | 1.0 | 0.021 | EPA-200.8 | ND | | 1 |
| **Dissolved Mercury** | **0.12** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | 0.046 | **J** | 2 |
| **Dissolved Molybdenum** | **6.5** | **ug/L** | **1.0** | **0.033** | **EPA-200.8** | ND | | 1 |
| **Dissolved Nickel** | **0.48** | **ug/L** | **2.0** | **0.15** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Selenium | ND | ug/L | 2.0 | 0.25 | EPA-200.8 | ND | | 1 |
| Dissolved Silver | ND | ug/L | 1.0 | 0.015 | EPA-200.8 | ND | | 1 |
| Dissolved Thallium | ND | ug/L | 1.0 | 0.025 | EPA-200.8 | ND | | 1 |
| **Dissolved Vanadium** | **0.67** | **ug/L** | **3.0** | **0.39** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Zinc | ND | ug/L | 5.0 | 2.2 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Antimony** | **0.30** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 3 |
| **Total Recoverable Arsenic** | **5.7** | **ug/L** | **2.0** | **0.70** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Barium** | **18** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | | 3 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 3 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Chromium** | **0.55** | **ug/L** | **3.0** | **0.50** | **EPA-200.8** | 0.54 | **J** | 3 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Copper** | **0.62** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 3 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Mercury** | **0.21** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | | 4 |
| **Total Recoverable Molybdenum** | **7.3** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Nickel** | **0.44** | **ug/L** | **2.0** | **0.19** | **EPA-200.8** | ND | **J** | 3 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 5 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 3 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-36 **Client Sample Name:** BB-SW-01, 10/22/2020 5:15:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 11/02/20 15:53 | 11/05/20 19:48 | ARD | PE-EL2 | 1 | B091493 | EPA 200.8 Dissolved |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 17:14 | TMT | CETAC3 | 1 | B091995 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:45 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 4 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 14:49 | TMT | CETAC3 | 1 | B091992 | EPA 245.1 |
| 5 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:07 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-37 **Client Sample Name:** BB-SW-02, 10/22/2020 1:30:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Dissolved Antimony | ND | ug/L | 2.0 | 0.23 | EPA-200.8 | ND | | 1 |
| **Dissolved Arsenic** | **5.9** | **ug/L** | **2.0** | **0.38** | **EPA-200.8** | ND | | 1 |
| **Dissolved Barium** | **18** | **ug/L** | **1.0** | **0.066** | **EPA-200.8** | ND | | 1 |
| Dissolved Beryllium | ND | ug/L | 1.0 | 0.050 | EPA-200.8 | ND | | 1 |
| Dissolved Cadmium | ND | ug/L | 1.0 | 0.034 | EPA-200.8 | ND | | 1 |
| Dissolved Chromium | ND | ug/L | 3.0 | 0.15 | EPA-200.8 | ND | | 1 |
| **Dissolved Cobalt** | **0.051** | **ug/L** | **1.0** | **0.011** | **EPA-200.8** | 0.015 | **J** | 1 |
| Dissolved Copper | ND | ug/L | 2.0 | 0.32 | EPA-200.8 | ND | | 1 |
| **Dissolved Lead** | **0.024** | **ug/L** | **1.0** | **0.021** | **EPA-200.8** | ND | **J** | 1 |
| **Dissolved Mercury** | **0.25** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | 0.046 | | 2 |
| **Dissolved Molybdenum** | **6.6** | **ug/L** | **1.0** | **0.033** | **EPA-200.8** | ND | | 1 |
| **Dissolved Nickel** | **0.45** | **ug/L** | **2.0** | **0.15** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Selenium | ND | ug/L | 2.0 | 0.25 | EPA-200.8 | ND | | 1 |
| Dissolved Silver | ND | ug/L | 1.0 | 0.015 | EPA-200.8 | ND | | 1 |
| Dissolved Thallium | ND | ug/L | 1.0 | 0.025 | EPA-200.8 | ND | | 1 |
| **Dissolved Vanadium** | **0.66** | **ug/L** | **3.0** | **0.39** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Zinc | ND | ug/L | 5.0 | 2.2 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Antimony** | **0.19** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 3 |
| **Total Recoverable Arsenic** | **6.0** | **ug/L** | **2.0** | **0.70** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Barium** | **17** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | | 3 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 3 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 3 |
| Total Recoverable Chromium | ND | ug/L | 3.0 | 0.50 | EPA-200.8 | 0.54 | | 3 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Copper** | **0.62** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 3 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Mercury** | **0.39** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | | 4 |
| **Total Recoverable Molybdenum** | **7.5** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Nickel** | **0.44** | **ug/L** | **2.0** | **0.19** | **EPA-200.8** | ND | **J** | 3 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 5 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 3 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

**BCL Sample ID:** 2031364-37 **Client Sample Name:** BB-SW-02, 10/22/2020 1:30:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Total Recoverable Zinc** | **1.9** | **ug/L** | **10** | **1.7** | **EPA-200.8** | ND | **J** | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 11/02/20 15:53 | 11/05/20 19:50 | ARD | PE-EL2 | 1 | B091493 | EPA 200.8 Dissolved |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 17:16 | TMT | CETAC3 | 1 | B091995 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:47 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 4 | EPA-245.1 | 11/09/20 10:30 | 11/10/20 13:29 | TMT | CETAC3 | 1 | B090599 | EPA 245.1 |
| 5 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:09 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-38 **Client Sample Name:** BB-SW-03, 10/22/2020 3:45:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Dissolved Antimony | ND | ug/L | 2.0 | 0.23 | EPA-200.8 | ND | | 1 |
| **Dissolved Arsenic** | **7.3** | **ug/L** | **2.0** | **0.38** | **EPA-200.8** | ND | | 1 |
| **Dissolved Barium** | **18** | **ug/L** | **1.0** | **0.066** | **EPA-200.8** | ND | | 1 |
| Dissolved Beryllium | ND | ug/L | 1.0 | 0.050 | EPA-200.8 | ND | | 1 |
| **Dissolved Cadmium** | **0.050** | **ug/L** | **1.0** | **0.034** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Chromium | ND | ug/L | 3.0 | 0.15 | EPA-200.8 | ND | | 1 |
| **Dissolved Cobalt** | **0.046** | **ug/L** | **1.0** | **0.011** | **EPA-200.8** | 0.015 | **J** | 1 |
| **Dissolved Copper** | **0.34** | **ug/L** | **2.0** | **0.32** | **EPA-200.8** | ND | **J** | 1 |
| **Dissolved Lead** | **0.059** | **ug/L** | **1.0** | **0.021** | **EPA-200.8** | ND | **J** | 1 |
| **Dissolved Mercury** | **0.25** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | 0.046 | | 2 |
| **Dissolved Molybdenum** | **6.8** | **ug/L** | **1.0** | **0.033** | **EPA-200.8** | ND | | 1 |
| **Dissolved Nickel** | **0.40** | **ug/L** | **2.0** | **0.15** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Selenium | ND | ug/L | 2.0 | 0.25 | EPA-200.8 | ND | | 1 |
| Dissolved Silver | ND | ug/L | 1.0 | 0.015 | EPA-200.8 | ND | | 1 |
| Dissolved Thallium | ND | ug/L | 1.0 | 0.025 | EPA-200.8 | ND | | 1 |
| **Dissolved Vanadium** | **0.66** | **ug/L** | **3.0** | **0.39** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Zinc | ND | ug/L | 5.0 | 2.2 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Antimony** | **0.13** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 3 |
| **Total Recoverable Arsenic** | **6.7** | **ug/L** | **2.0** | **0.70** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Barium** | **18** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | | 3 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 3 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 3 |
| Total Recoverable Chromium | ND | ug/L | 3.0 | 0.50 | EPA-200.8 | 0.54 | | 3 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Copper** | **0.53** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 3 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Mercury** | **0.16** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | **J** | 4 |
| **Total Recoverable Molybdenum** | **7.9** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Nickel** | **0.46** | **ug/L** | **2.0** | **0.19** | **EPA-200.8** | ND | **J** | 3 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 5 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 3 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-38 | **Client Sample Name:** BB-SW-03, 10/22/2020 3:45:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 11/02/20 15:53 | 11/05/20 19:51 | ARD | PE-EL2 | 1 | B091493 | EPA 200.8 Dissolved |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 17:22 | TMT | CETAC3 | 1 | B091995 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:50 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 4 | EPA-245.1 | 11/09/20 10:30 | 11/10/20 13:31 | TMT | CETAC3 | 1 | B090599 | EPA 245.1 |
| 5 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:11 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

**BCL Sample ID:** 2031364-39 | **Client Sample Name:** DUP-01, 10/22/2020 1:35:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Dissolved Antimony | ND | ug/L | 2.0 | 0.23 | EPA-200.8 | ND | | 1 |
| **Dissolved Arsenic** | **6.5** | **ug/L** | **2.0** | **0.38** | **EPA-200.8** | ND | | 1 |
| **Dissolved Barium** | **18** | **ug/L** | **1.0** | **0.066** | **EPA-200.8** | ND | | 1 |
| Dissolved Beryllium | ND | ug/L | 1.0 | 0.050 | EPA-200.8 | ND | | 1 |
| **Dissolved Cadmium** | **0.034** | **ug/L** | **1.0** | **0.034** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Chromium | ND | ug/L | 3.0 | 0.15 | EPA-200.8 | ND | | 1 |
| **Dissolved Cobalt** | **0.047** | **ug/L** | **1.0** | **0.011** | **EPA-200.8** | 0.015 | **J** | 1 |
| Dissolved Copper | ND | ug/L | 2.0 | 0.32 | EPA-200.8 | ND | | 1 |
| Dissolved Lead | ND | ug/L | 1.0 | 0.021 | EPA-200.8 | ND | | 1 |
| **Dissolved Mercury** | **0.24** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | 0.046 | | 2 |
| **Dissolved Molybdenum** | **6.6** | **ug/L** | **1.0** | **0.033** | **EPA-200.8** | ND | | 1 |
| **Dissolved Nickel** | **0.35** | **ug/L** | **2.0** | **0.15** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Selenium | ND | ug/L | 2.0 | 0.25 | EPA-200.8 | ND | | 1 |
| Dissolved Silver | ND | ug/L | 1.0 | 0.015 | EPA-200.8 | ND | | 1 |
| Dissolved Thallium | ND | ug/L | 1.0 | 0.025 | EPA-200.8 | ND | | 1 |
| **Dissolved Vanadium** | **0.56** | **ug/L** | **3.0** | **0.39** | **EPA-200.8** | ND | **J** | 1 |
| Dissolved Zinc | ND | ug/L | 5.0 | 2.2 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Antimony** | **0.11** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 3 |
| **Total Recoverable Arsenic** | **5.9** | **ug/L** | **2.0** | **0.70** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Barium** | **18** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | | 3 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 3 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 3 |
| Total Recoverable Chromium | ND | ug/L | 3.0 | 0.50 | EPA-200.8 | 0.54 | | 3 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Copper** | **0.66** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 3 |
| Total Recoverable Lead | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| **Total Recoverable Mercury** | **0.22** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | | 4 |
| **Total Recoverable Molybdenum** | **7.8** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | | 3 |
| **Total Recoverable Nickel** | **0.48** | **ug/L** | **2.0** | **0.19** | **EPA-200.8** | ND | **J** | 3 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 5 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 3 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 3 |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Metals Analysis

**BCL Sample ID:** 2031364-39 **Client Sample Name:** DUP-01, 10/22/2020 1:35:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 3 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 11/02/20 15:53 | 11/05/20 19:53 | ARD | PE-EL2 | 1 | B091493 | EPA 200.8 Dissolved |
| 2 | EPA-245.1 | 11/07/20 14:00 | 11/08/20 17:24 | TMT | CETAC3 | 1 | B091995 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:52 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 4 | EPA-245.1 | 11/09/20 10:30 | 11/10/20 13:33 | TMT | CETAC3 | 1 | B090599 | EPA 245.1 |
| 5 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:13 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

**BCL Sample ID:** 2031364-40 **Client Sample Name:** Rinseate-Blank-03, 10/22/2020 11:30:00AM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Total Recoverable Antimony** | **0.12** | **ug/L** | **2.0** | **0.11** | **EPA-200.8** | 0.20 | **J** | 1 |
| **Total Recoverable Arsenic** | **4.0** | **ug/L** | **2.0** | **0.70** | **EPA-200.8** | ND | | 1 |
| **Total Recoverable Barium** | **2.1** | **ug/L** | **1.0** | **0.21** | **EPA-200.8** | 0.44 | | 1 |
| Total Recoverable Beryllium | ND | ug/L | 1.0 | 0.14 | EPA-200.8 | ND | | 1 |
| Total Recoverable Cadmium | ND | ug/L | 1.0 | 0.11 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Chromium** | **0.55** | **ug/L** | **3.0** | **0.50** | **EPA-200.8** | 0.54 | **J** | 1 |
| Total Recoverable Cobalt | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| **Total Recoverable Copper** | **0.43** | **ug/L** | **2.0** | **0.22** | **EPA-200.8** | 0.27 | **J** | 1 |
| **Total Recoverable Lead** | **1.0** | **ug/L** | **1.0** | **0.10** | **EPA-200.8** | ND | | 1 |
| **Total Recoverable Mercury** | **0.21** | **ug/L** | **0.20** | **0.022** | **EPA-245.1** | ND | | 2 |
| **Total Recoverable Molybdenum** | **0.20** | **ug/L** | **1.0** | **0.11** | **EPA-200.8** | ND | **J** | 1 |
| Total Recoverable Nickel | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 1 |
| Total Recoverable Selenium | ND | ug/L | 2.0 | 0.19 | EPA-200.8 | ND | | 3 |
| Total Recoverable Silver | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Thallium | ND | ug/L | 1.0 | 0.10 | EPA-200.8 | ND | | 1 |
| Total Recoverable Vanadium | ND | ug/L | 3.0 | 0.78 | EPA-200.8 | ND | | 1 |
| Total Recoverable Zinc | ND | ug/L | 10 | 1.7 | EPA-200.8 | ND | | 1 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-200.8 | 10/29/20 19:50 | 10/31/20 05:54 | ARD | PE-EL4 | 1 | B091231 | EPA 200.2 |
| 2 | EPA-245.1 | 11/09/20 10:30 | 11/10/20 13:41 | TMT | CETAC3 | 1 | B090599 | EPA 245.1 |
| 3 | EPA-200.8 | 10/29/20 19:50 | 11/05/20 18:14 | ARD | PE-EL2 | 1 | B091231 | EPA 200.2 |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-41 | **Client Sample Name:** Trip Blank, 10/22/2020 12:00:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| Benzene | ND | ug/L | 0.50 | 0.083 | EPA-8260B | ND | | 1 |
| Bromobenzene | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| Bromochloromethane | ND | ug/L | 0.50 | 0.24 | EPA-8260B | ND | | 1 |
| Bromodichloromethane | ND | ug/L | 0.50 | 0.14 | EPA-8260B | ND | | 1 |
| Bromoform | ND | ug/L | 0.50 | 0.27 | EPA-8260B | ND | | 1 |
| Bromomethane | ND | ug/L | 1.0 | 0.25 | EPA-8260B | ND | | 1 |
| n-Butylbenzene | ND | ug/L | 0.50 | 0.11 | EPA-8260B | ND | | 1 |
| sec-Butylbenzene | ND | ug/L | 0.50 | 0.15 | EPA-8260B | ND | | 1 |
| tert-Butylbenzene | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| Carbon tetrachloride | ND | ug/L | 0.50 | 0.18 | EPA-8260B | ND | | 1 |
| Chlorobenzene | ND | ug/L | 0.50 | 0.093 | EPA-8260B | ND | | 1 |
| Chloroethane | ND | ug/L | 0.50 | 0.14 | EPA-8260B | ND | | 1 |
| Chloroform | ND | ug/L | 0.50 | 0.12 | EPA-8260B | ND | | 1 |
| Chloromethane | ND | ug/L | 0.50 | 0.14 | EPA-8260B | ND | | 1 |
| 2-Chlorotoluene | ND | ug/L | 0.50 | 0.20 | EPA-8260B | ND | | 1 |
| 4-Chlorotoluene | ND | ug/L | 0.50 | 0.15 | EPA-8260B | ND | | 1 |
| Dibromochloromethane | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| 1,2-Dibromo-3-chloropropane | ND | ug/L | 1.0 | 0.44 | EPA-8260B | ND | | 1 |
| 1,2-Dibromoethane | ND | ug/L | 0.50 | 0.16 | EPA-8260B | ND | | 1 |
| Dibromomethane | ND | ug/L | 0.50 | 0.24 | EPA-8260B | ND | | 1 |
| 1,2-Dichlorobenzene | ND | ug/L | 0.50 | 0.072 | EPA-8260B | ND | | 1 |
| 1,3-Dichlorobenzene | ND | ug/L | 0.50 | 0.15 | EPA-8260B | ND | | 1 |
| 1,4-Dichlorobenzene | ND | ug/L | 0.50 | 0.062 | EPA-8260B | ND | | 1 |
| Dichlorodifluoromethane | ND | ug/L | 0.50 | 0.099 | EPA-8260B | ND | | 1 |
| 1,1-Dichloroethane | ND | ug/L | 0.50 | 0.11 | EPA-8260B | ND | | 1 |
| 1,2-Dichloroethane | ND | ug/L | 0.50 | 0.17 | EPA-8260B | ND | | 1 |
| 1,1-Dichloroethene | ND | ug/L | 0.50 | 0.18 | EPA-8260B | ND | | 1 |
| cis-1,2-Dichloroethene | ND | ug/L | 0.50 | 0.085 | EPA-8260B | ND | | 1 |
| trans-1,2-Dichloroethene | ND | ug/L | 0.50 | 0.15 | EPA-8260B | ND | | 1 |
| 1,2-Dichloropropane | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| 1,3-Dichloropropane | ND | ug/L | 0.50 | 0.086 | EPA-8260B | ND | | 1 |
| 2,2-Dichloropropane | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| 1,1-Dichloropropene | ND | ug/L | 0.50 | 0.085 | EPA-8260B | ND | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-41 **Client Sample Name:** Trip Blank, 10/22/2020 12:00:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | MB Bias | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| cis-1,3-Dichloropropene | ND | ug/L | 0.50 | 0.14 | EPA-8260B | ND | | 1 |
| trans-1,3-Dichloropropene | ND | ug/L | 0.50 | 0.079 | EPA-8260B | ND | | 1 |
| Ethylbenzene | ND | ug/L | 0.50 | 0.098 | EPA-8260B | ND | | 1 |
| Hexachlorobutadiene | ND | ug/L | 0.50 | 0.17 | EPA-8260B | ND | | 1 |
| Isopropylbenzene | ND | ug/L | 0.50 | 0.14 | EPA-8260B | ND | | 1 |
| p-Isopropyltoluene | ND | ug/L | 0.50 | 0.12 | EPA-8260B | ND | | 1 |
| Methylene chloride | ND | ug/L | 1.0 | 0.48 | EPA-8260B | ND | | 1 |
| Methyl t-butyl ether | ND | ug/L | 0.50 | 0.11 | EPA-8260B | ND | | 1 |
| Naphthalene | ND | ug/L | 0.50 | 0.36 | EPA-8260B | ND | | 1 |
| n-Propylbenzene | ND | ug/L | 0.50 | 0.11 | EPA-8260B | ND | | 1 |
| Styrene | ND | ug/L | 0.50 | 0.068 | EPA-8260B | ND | | 1 |
| 1,1,1,2-Tetrachloroethane | ND | ug/L | 0.50 | 0.18 | EPA-8260B | ND | | 1 |
| 1,1,2,2-Tetrachloroethane | ND | ug/L | 0.50 | 0.17 | EPA-8260B | ND | | 1 |
| Tetrachloroethene | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| Toluene | ND | ug/L | 0.50 | 0.093 | EPA-8260B | ND | | 1 |
| 1,2,3-Trichlorobenzene | ND | ug/L | 0.50 | 0.16 | EPA-8260B | ND | | 1 |
| 1,2,4-Trichlorobenzene | ND | ug/L | 0.50 | 0.19 | EPA-8260B | ND | | 1 |
| 1,1,1-Trichloroethane | ND | ug/L | 0.50 | 0.11 | EPA-8260B | ND | | 1 |
| 1,1,2-Trichloroethane | ND | ug/L | 0.50 | 0.16 | EPA-8260B | ND | | 1 |
| Trichloroethene | ND | ug/L | 0.50 | 0.085 | EPA-8260B | ND | | 1 |
| Trichlorofluoromethane | ND | ug/L | 0.50 | 0.13 | EPA-8260B | ND | | 1 |
| 1,2,3-Trichloropropane | ND | ug/L | 1.0 | 0.24 | EPA-8260B | ND | | 1 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | ug/L | 0.50 | 0.15 | EPA-8260B | ND | | 1 |
| 1,2,4-Trimethylbenzene | ND | ug/L | 0.50 | 0.12 | EPA-8260B | ND | | 1 |
| 1,3,5-Trimethylbenzene | ND | ug/L | 0.50 | 0.12 | EPA-8260B | ND | | 1 |
| Vinyl chloride | ND | ug/L | 0.50 | 0.12 | EPA-8260B | ND | | 1 |
| Total Xylenes | ND | ug/L | 1.0 | 0.36 | EPA-8260B | ND | | 1 |
| p- & m-Xylenes | ND | ug/L | 0.50 | 0.28 | EPA-8260B | ND | | 1 |
| o-Xylene | ND | ug/L | 0.50 | 0.082 | EPA-8260B | ND | | 1 |
| 1,2-Dichloroethane-d4 (Surrogate) | 101 | % | 75 - 125 (LCL - UCL) | | EPA-8260B | | | 1 |
| Toluene-d8 (Surrogate) | 94.6 | % | 80 - 120 (LCL - UCL) | | EPA-8260B | | | 1 |
| 4-Bromofluorobenzene (Surrogate) | 102 | % | 80 - 120 (LCL - UCL) | | EPA-8260B | | | 1 |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

**BCL Sample ID:** 2031364-41 | **Client Sample Name:** Trip Blank, 10/22/2020 12:00:00PM, Jared Kemper

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-8260B | 10/28/20 16:00 | 10/30/20 09:40 | RCC | MS-V14 | 1 | B091080 | EPA 5030 Water MS |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-42 **Client Sample Name:** BB-123.05, 10/20/2020 12:31:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **3.1** | **mg/kg** | **2.5** | **0.40** | **EPA-6020** | 500 | | 1 |
| **Arsenic** | **6300** | **mg/kg** | **2.5** | **0.85** | **EPA-6020** | 500 | | 1 |
| **Barium** | **32** | **mg/kg** | **0.50** | **0.18** | **EPA-6010B** | 10000 | | 2 |
| **Beryllium** | **0.19** | **mg/kg** | **0.50** | **0.047** | **EPA-6010B** | 75 | **J** | 2 |
| **Cadmium** | **84** | **mg/kg** | **0.50** | **0.052** | **EPA-6010B** | 100 | | 2 |
| **Chromium** | **5.3** | **mg/kg** | **0.50** | **0.050** | **EPA-6010B** | 2500 | | 2 |
| **Cobalt** | **1.8** | **mg/kg** | **2.5** | **0.098** | **EPA-6010B** | 8000 | **J** | 2 |
| **Copper** | **8.1** | **mg/kg** | **1.0** | **0.050** | **EPA-6010B** | 2500 | | 2 |
| **Lead** | **820** | **mg/kg** | **2.5** | **0.41** | **EPA-6010B** | 1000 | | 2 |
| **Mercury** | **0.064** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 2.5 | 0.050 | EPA-6010B | 3500 | | 2 |
| **Nickel** | **1.7** | **mg/kg** | **0.50** | **0.15** | **EPA-6010B** | 2000 | | 2 |
| Selenium | ND | mg/kg | 2.5 | 0.55 | EPA-6020 | 100 | | 1 |
| **Silver** | **7.0** | **mg/kg** | **0.50** | **0.067** | **EPA-6010B** | 500 | | 2 |
| Thallium | ND | mg/kg | 1.2 | 0.24 | EPA-6020 | 700 | | 1 |
| **Vanadium** | **18** | **mg/kg** | **0.50** | **0.11** | **EPA-6010B** | 2400 | | 2 |
| **Zinc** | **60** | **mg/kg** | **2.5** | **0.087** | **EPA-6010B** | 5000 | | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 11/05/20 11:00 | 11/06/20 14:49 | ARD | PE-EL2 | 4.950 | B091813 | EPA 3050B |
| 2 | EPA-6010B | 11/05/20 14:45 | 11/06/20 13:07 | JCC | PE-OP3 | 1 | B091765 | EPA 3050B |
| 3 | EPA-7471A | 11/05/20 11:00 | 11/05/20 13:12 | TMT | CETAC3 | 0.992 | B091770 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

**BCL Sample ID:** 2031364-43 | **Client Sample Name:** BB-M1-SED-01, 10/22/2020 3:10:00PM, Jared Kemper

| Constituent | Result | Units | PQL | MDL | Method | TTLC Limits | Lab Quals | Run # |
|---|---|---|---|---|---|---|---|---|
| **Antimony** | **0.13** | **mg/kg** | **0.50** | **0.080** | **EPA-6020** | 500 | **J** | 1 |
| **Arsenic** | **22** | **mg/kg** | **0.50** | **0.17** | **EPA-6020** | 500 | | 1 |
| **Barium** | **21** | **mg/kg** | **0.50** | **0.18** | **EPA-6010B** | 10000 | | 2 |
| **Beryllium** | **0.22** | **mg/kg** | **0.50** | **0.047** | **EPA-6010B** | 75 | **J** | 2 |
| **Cadmium** | **0.31** | **mg/kg** | **0.50** | **0.052** | **EPA-6010B** | 100 | **J** | 2 |
| **Chromium** | **7.2** | **mg/kg** | **0.50** | **0.050** | **EPA-6010B** | 2500 | | 2 |
| **Cobalt** | **3.0** | **mg/kg** | **2.5** | **0.098** | **EPA-6010B** | 8000 | | 2 |
| **Copper** | **3.0** | **mg/kg** | **1.0** | **0.050** | **EPA-6010B** | 2500 | | 2 |
| **Lead** | **2.6** | **mg/kg** | **2.5** | **0.41** | **EPA-6010B** | 1000 | | 2 |
| **Mercury** | **0.080** | **mg/kg** | **0.16** | **0.016** | **EPA-7471A** | 20 | **J** | 3 |
| Molybdenum | ND | mg/kg | 2.5 | 0.050 | EPA-6010B | 3500 | | 2 |
| **Nickel** | **2.2** | **mg/kg** | **0.50** | **0.15** | **EPA-6010B** | 2000 | | 2 |
| Selenium | ND | mg/kg | 0.50 | 0.11 | EPA-6020 | 100 | | 1 |
| Silver | ND | mg/kg | 0.50 | 0.067 | EPA-6010B | 500 | | 2 |
| **Thallium** | **0.10** | **mg/kg** | **0.25** | **0.049** | **EPA-6020** | 700 | **J** | 1 |
| **Vanadium** | **35** | **mg/kg** | **0.50** | **0.11** | **EPA-6010B** | 2400 | | 2 |
| **Zinc** | **16** | **mg/kg** | **2.5** | **0.087** | **EPA-6010B** | 5000 | | 2 |

| Run # | Method | Prep Date | Run Date/Time | Analyst | Instrument | Dilution | QC Batch ID | Prep Method |
|---|---|---|---|---|---|---|---|---|
| 1 | EPA-6020 | 11/05/20 11:00 | 11/06/20 14:41 | ARD | PE-EL2 | 0.990 | B091813 | EPA 3050B |
| 2 | EPA-6010B | 11/05/20 14:45 | 11/06/20 13:09 | JCC | PE-OP3 | 0.909 | B091765 | EPA 3050B |
| 3 | EPA-7471A | 11/05/20 11:00 | 11/05/20 13:14 | TMT | CETAC3 | 0.977 | B091770 | EPA 7471A |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091080** | | | | | | |
| Benzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.083 | |
| Bromobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| Bromochloromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.24 | |
| Bromodichloromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.14 | |
| Bromoform | B091080-BLK1 | ND | ug/L | 0.50 | 0.27 | |
| Bromomethane | B091080-BLK1 | ND | ug/L | 1.0 | 0.25 | |
| n-Butylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.11 | |
| sec-Butylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.15 | |
| tert-Butylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| Carbon tetrachloride | B091080-BLK1 | ND | ug/L | 0.50 | 0.18 | |
| Chlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.093 | |
| Chloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.14 | |
| Chloroform | B091080-BLK1 | ND | ug/L | 0.50 | 0.12 | |
| Chloromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.14 | |
| 2-Chlorotoluene | B091080-BLK1 | ND | ug/L | 0.50 | 0.20 | |
| 4-Chlorotoluene | B091080-BLK1 | ND | ug/L | 0.50 | 0.15 | |
| Dibromochloromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| 1,2-Dibromo-3-chloropropane | B091080-BLK1 | ND | ug/L | 1.0 | 0.44 | |
| 1,2-Dibromoethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.16 | |
| Dibromomethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.24 | |
| 1,2-Dichlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.072 | |
| 1,3-Dichlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.15 | |
| 1,4-Dichlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.062 | |
| Dichlorodifluoromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.099 | |
| 1,1-Dichloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.11 | |
| 1,2-Dichloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.17 | |
| 1,1-Dichloroethene | B091080-BLK1 | ND | ug/L | 0.50 | 0.18 | |
| cis-1,2-Dichloroethene | B091080-BLK1 | ND | ug/L | 0.50 | 0.085 | |
| trans-1,2-Dichloroethene | B091080-BLK1 | ND | ug/L | 0.50 | 0.15 | |
| 1,2-Dichloropropane | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| 1,3-Dichloropropane | B091080-BLK1 | ND | ug/L | 0.50 | 0.086 | |
| 2,2-Dichloropropane | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| 1,1-Dichloropropene | B091080-BLK1 | ND | ug/L | 0.50 | 0.085 | |
| cis-1,3-Dichloropropene | B091080-BLK1 | ND | ug/L | 0.50 | 0.14 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091080** | | | | | | |
| trans-1,3-Dichloropropene | B091080-BLK1 | ND | ug/L | 0.50 | 0.079 | |
| Ethylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.098 | |
| Hexachlorobutadiene | B091080-BLK1 | ND | ug/L | 0.50 | 0.17 | |
| Isopropylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.14 | |
| p-Isopropyltoluene | B091080-BLK1 | ND | ug/L | 0.50 | 0.12 | |
| Methylene chloride | B091080-BLK1 | ND | ug/L | 1.0 | 0.48 | |
| Methyl t-butyl ether | B091080-BLK1 | ND | ug/L | 0.50 | 0.11 | |
| Naphthalene | B091080-BLK1 | ND | ug/L | 0.50 | 0.36 | |
| n-Propylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.11 | |
| Styrene | B091080-BLK1 | ND | ug/L | 0.50 | 0.068 | |
| 1,1,1,2-Tetrachloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.18 | |
| 1,1,2,2-Tetrachloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.17 | |
| Tetrachloroethene | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| Toluene | B091080-BLK1 | ND | ug/L | 0.50 | 0.093 | |
| 1,2,3-Trichlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.16 | |
| 1,2,4-Trichlorobenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.19 | |
| 1,1,1-Trichloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.11 | |
| 1,1,2-Trichloroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.16 | |
| Trichloroethene | B091080-BLK1 | ND | ug/L | 0.50 | 0.085 | |
| Trichlorofluoromethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.13 | |
| 1,2,3-Trichloropropane | B091080-BLK1 | ND | ug/L | 1.0 | 0.24 | |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | B091080-BLK1 | ND | ug/L | 0.50 | 0.15 | |
| 1,2,4-Trimethylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.12 | |
| 1,3,5-Trimethylbenzene | B091080-BLK1 | ND | ug/L | 0.50 | 0.12 | |
| Vinyl chloride | B091080-BLK1 | ND | ug/L | 0.50 | 0.12 | |
| Total Xylenes | B091080-BLK1 | ND | ug/L | 1.0 | 0.36 | |
| p- & m-Xylenes | B091080-BLK1 | ND | ug/L | 0.50 | 0.28 | |
| o-Xylene | B091080-BLK1 | ND | ug/L | 0.50 | 0.082 | |
| **1,2-Dichloroethane-d4 (Surrogate)** | **B091080-BLK1** | **107** | % | **75 - 125 (LCL - UCL)** | | |
| **Toluene-d8 (Surrogate)** | **B091080-BLK1** | **97.4** | % | **80 - 120 (LCL - UCL)** | | |
| **4-Bromofluorobenzene (Surrogate)** | **B091080-BLK1** | **98.6** | % | **80 - 120 (LCL - UCL)** | | |
| **QC Batch ID: B091175** | | | | | | |
| Benzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091175** | | | | | | |
| Bromobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00087 | |
| Bromochloromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00081 | |
| Bromodichloromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00078 | |
| Bromoform | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00070 | |
| Bromomethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0017 | |
| n-Butylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00076 | |
| sec-Butylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00071 | |
| tert-Butylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00085 | |
| Carbon tetrachloride | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00078 | |
| Chlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00077 | |
| Chloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| Chloroform | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00090 | |
| Chloromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| 2-Chlorotoluene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00087 | |
| 4-Chlorotoluene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00070 | |
| Dibromochloromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,2-Dibromo-3-chloropropane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00096 | |
| 1,2-Dibromoethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00082 | |
| Dibromomethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0014 | |
| 1,2-Dichlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00079 | |
| 1,3-Dichlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| 1,4-Dichlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| Dichlorodifluoromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00079 | |
| 1,1-Dichloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00064 | |
| 1,2-Dichloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| 1,1-Dichloroethene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| cis-1,2-Dichloroethene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00054 | |
| trans-1,2-Dichloroethene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0037 | |
| 1,2-Dichloropropane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,3-Dichloropropane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 2,2-Dichloropropane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 1,1-Dichloropropene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| cis-1,3-Dichloropropene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00058 | |
| trans-1,3-Dichloropropene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00066 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091175** | | | | | | |
| Ethylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00069 | |
| Hexachlorobutadiene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| Isopropylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| p-Isopropyltoluene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00059 | |
| Methylene chloride | B091175-BLK1 | ND | mg/kg | 0.010 | 0.0011 | |
| Methyl t-butyl ether | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00056 | |
| Naphthalene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00099 | |
| n-Propylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00071 | |
| Styrene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00062 | |
| 1,1,1,2-Tetrachloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00095 | |
| 1,1,2,2-Tetrachloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00084 | |
| Tetrachloroethene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00097 | |
| Toluene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00069 | |
| 1,2,3-Trichlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| 1,2,4-Trichlorobenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0014 | |
| 1,1,1-Trichloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 1,1,2-Trichloroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00094 | |
| Trichloroethene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00074 | |
| Trichlorofluoromethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| 1,2,3-Trichloropropane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0019 | |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0010 | |
| 1,2,4-Trimethylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,3,5-Trimethylbenzene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00066 | |
| Vinyl chloride | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00059 | |
| Total Xylenes | B091175-BLK1 | ND | mg/kg | 0.010 | 0.0025 | |
| p- & m-Xylenes | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| o-Xylene | B091175-BLK1 | ND | mg/kg | 0.0050 | 0.00093 | |
| **1,2-Dichloroethane-d4 (Surrogate)** | **B091175-BLK1** | **96.6** | % | **70 - 121 (LCL - UCL)** | | |
| **Toluene-d8 (Surrogate)** | **B091175-BLK1** | **101** | % | **81 - 117 (LCL - UCL)** | | |
| **4-Bromofluorobenzene (Surrogate)** | **B091175-BLK1** | **96.0** | % | **74 - 121 (LCL - UCL)** | | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091080** | | | | | | | | | | |
| Benzene | B091080-BS1 | LCS | 25.975 | 25.000 | ug/L | 104 | | 70 - 130 | | |
| Bromodichloromethane | B091080-BS1 | LCS | 27.299 | 25.000 | ug/L | 109 | | 70 - 130 | | |
| Chlorobenzene | B091080-BS1 | LCS | 25.182 | 25.000 | ug/L | 101 | | 70 - 130 | | |
| Chloroethane | B091080-BS1 | LCS | 29.426 | 25.000 | ug/L | 118 | | 70 - 130 | | |
| 1,4-Dichlorobenzene | B091080-BS1 | LCS | 25.532 | 25.000 | ug/L | 102 | | 70 - 130 | | |
| 1,1-Dichloroethane | B091080-BS1 | LCS | 24.914 | 25.000 | ug/L | 99.7 | | 70 - 130 | | |
| 1,1-Dichloroethene | B091080-BS1 | LCS | 27.836 | 25.000 | ug/L | 111 | | 70 - 130 | | |
| Toluene | B091080-BS1 | LCS | 27.188 | 25.000 | ug/L | 109 | | 70 - 130 | | |
| Trichloroethene | B091080-BS1 | LCS | 28.248 | 25.000 | ug/L | 113 | | 70 - 130 | | |
| 1,2-Dichloroethane-d4 (Surrogate) | B091080-BS1 | LCS | 9.6900 | 10.000 | ug/L | 96.9 | | 75 - 125 | | |
| Toluene-d8 (Surrogate) | B091080-BS1 | LCS | 10.200 | 10.000 | ug/L | 102 | | 80 - 120 | | |
| 4-Bromofluorobenzene (Surrogate) | B091080-BS1 | LCS | 10.210 | 10.000 | ug/L | 102 | | 80 - 120 | | |
| **QC Batch ID: B091175** | | | | | | | | | | |
| Benzene | B091175-BS1 | LCS | 0.14267 | 0.12500 | mg/kg | 114 | | 70 - 130 | | |
| Bromodichloromethane | B091175-BS1 | LCS | 0.12408 | 0.12500 | mg/kg | 99.3 | | 70 - 130 | | |
| Chlorobenzene | B091175-BS1 | LCS | 0.12822 | 0.12500 | mg/kg | 103 | | 70 - 130 | | |
| Chloroethane | B091175-BS1 | LCS | 0.11504 | 0.12500 | mg/kg | 92.0 | | 70 - 130 | | |
| 1,4-Dichlorobenzene | B091175-BS1 | LCS | 0.12224 | 0.12500 | mg/kg | 97.8 | | 70 - 130 | | |
| 1,1-Dichloroethane | B091175-BS1 | LCS | 0.14328 | 0.12500 | mg/kg | 115 | | 70 - 130 | | |
| 1,1-Dichloroethene | B091175-BS1 | LCS | 0.12431 | 0.12500 | mg/kg | 99.4 | | 70 - 130 | | |
| Toluene | B091175-BS1 | LCS | 0.13384 | 0.12500 | mg/kg | 107 | | 70 - 130 | | |
| Trichloroethene | B091175-BS1 | LCS | 0.12384 | 0.12500 | mg/kg | 99.1 | | 70 - 130 | | |
| 1,2-Dichloroethane-d4 (Surrogate) | B091175-BS1 | LCS | 0.049970 | 0.050000 | mg/kg | 99.9 | | 70 - 121 | | |
| Toluene-d8 (Surrogate) | B091175-BS1 | LCS | 0.051610 | 0.050000 | mg/kg | 103 | | 81 - 117 | | |
| 4-Bromofluorobenzene (Surrogate) | B091175-BS1 | LCS | 0.049830 | 0.050000 | mg/kg | 99.7 | | 74 - 121 | | |

| ECM Consultants - Costa Mesa | Reported: | 02/18/2021 9:27 |
|---|---|---|
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091080** | Used client sample: N | | | | | | | | | | |
| Benzene | MS | 2030363-23 | ND | 26.046 | 25.000 | ug/L | | 104 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 24.724 | 25.000 | ug/L | 5.2 | 98.9 | 20 | 70 - 130 | |
| Bromodichloromethane | MS | 2030363-23 | ND | 26.621 | 25.000 | ug/L | | 106 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 25.157 | 25.000 | ug/L | 5.7 | 101 | 20 | 70 - 130 | |
| Chlorobenzene | MS | 2030363-23 | ND | 24.394 | 25.000 | ug/L | | 97.6 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 23.262 | 25.000 | ug/L | 4.8 | 93.0 | 20 | 70 - 130 | |
| **Chloroethane** | MS | **2030363-23** | **ND** | **34.391** | **25.000** | **ug/L** | | **138** | | **70 - 130** | **Q03** |
| | MSD | **2030363-23** | **ND** | **26.758** | **25.000** | **ug/L** | **25.0** | **107** | **20** | **70 - 130** | **Q02** |
| 1,4-Dichlorobenzene | MS | 2030363-23 | ND | 22.951 | 25.000 | ug/L | | 91.8 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 24.010 | 25.000 | ug/L | 4.5 | 96.0 | 20 | 70 - 130 | |
| 1,1-Dichloroethane | MS | 2030363-23 | ND | 25.253 | 25.000 | ug/L | | 101 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 23.464 | 25.000 | ug/L | 7.3 | 93.9 | 20 | 70 - 130 | |
| 1,1-Dichloroethene | MS | 2030363-23 | ND | 27.696 | 25.000 | ug/L | | 111 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 25.533 | 25.000 | ug/L | 8.1 | 102 | 20 | 70 - 130 | |
| Toluene | MS | 2030363-23 | ND | 24.998 | 25.000 | ug/L | | 100 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 25.276 | 25.000 | ug/L | 1.1 | 101 | 20 | 70 - 130 | |
| Trichloroethene | MS | 2030363-23 | ND | 26.508 | 25.000 | ug/L | | 106 | | 70 - 130 | |
| | MSD | 2030363-23 | ND | 26.243 | 25.000 | ug/L | 1.0 | 105 | 20 | 70 - 130 | |
| 1,2-Dichloroethane-d4 (Surrogate) | MS | 2030363-23 | ND | 10.450 | 10.000 | ug/L | | 104 | | 75 - 125 | |
| | MSD | 2030363-23 | ND | 9.9500 | 10.000 | ug/L | 4.9 | 99.5 | | 75 - 125 | |
| Toluene-d8 (Surrogate) | MS | 2030363-23 | ND | 10.160 | 10.000 | ug/L | | 102 | | 80 - 120 | |
| | MSD | 2030363-23 | ND | 10.220 | 10.000 | ug/L | 0.6 | 102 | | 80 - 120 | |
| 4-Bromofluorobenzene (Surrogate) | MS | 2030363-23 | ND | 9.4200 | 10.000 | ug/L | | 94.2 | | 80 - 120 | |
| | MSD | 2030363-23 | ND | 10.100 | 10.000 | ug/L | 7.0 | 101 | | 80 - 120 | |
| **QC Batch ID: B091175** | Used client sample: N | | | | | | | | | | |
| Benzene | MS | 2030363-46 | ND | 0.14756 | 0.12500 | mg/kg | | 118 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.14016 | 0.12500 | mg/kg | 5.1 | 112 | 20 | 70 - 130 | |
| Bromodichloromethane | MS | 2030363-46 | ND | 0.12388 | 0.12500 | mg/kg | | 99.1 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.12653 | 0.12500 | mg/kg | 2.1 | 101 | 20 | 70 - 130 | |
| Chlorobenzene | MS | 2030363-46 | ND | 0.12605 | 0.12500 | mg/kg | | 101 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.12557 | 0.12500 | mg/kg | 0.4 | 100 | 20 | 70 - 130 | |
| **Chloroethane** | MS | **2030363-46** | **ND** | **0.12759** | **0.12500** | **mg/kg** | | **102** | | **70 - 130** | |
| | MSD | **2030363-46** | **ND** | **0.099070** | **0.12500** | **mg/kg** | **25.2** | **79.3** | **20** | **70 - 130** | **Q02** |
| 1,4-Dichlorobenzene | MS | 2030363-46 | ND | 0.12452 | 0.12500 | mg/kg | | 99.6 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.11834 | 0.12500 | mg/kg | 5.1 | 94.7 | 20 | 70 - 130 | |
| 1,1-Dichloroethane | MS | 2030363-46 | ND | 0.15049 | 0.12500 | mg/kg | | 120 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.14130 | 0.12500 | mg/kg | 6.3 | 113 | 20 | 70 - 130 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B)

## Quality Control Report - Precision & Accuracy

**QC Batch ID: B091175** Used client sample: N

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1-Dichloroethene | MS | 2030363-46 | ND | 0.13031 | 0.12500 | mg/kg | | 104 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.12117 | 0.12500 | mg/kg | 7.3 | 96.9 | 20 | 70 - 130 | |
| Toluene | MS | 2030363-46 | ND | 0.12950 | 0.12500 | mg/kg | | 104 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.13228 | 0.12500 | mg/kg | 2.1 | 106 | 20 | 70 - 130 | |
| Trichloroethene | MS | 2030363-46 | ND | 0.12134 | 0.12500 | mg/kg | | 97.1 | | 70 - 130 | |
| | MSD | 2030363-46 | ND | 0.12410 | 0.12500 | mg/kg | 2.2 | 99.3 | 20 | 70 - 130 | |
| 1,2-Dichloroethane-d4 (Surrogate) | MS | 2030363-46 | ND | 0.052500 | 0.050000 | mg/kg | | 105 | | 70 - 121 | |
| | MSD | 2030363-46 | ND | 0.049390 | 0.050000 | mg/kg | 6.1 | 98.8 | | 70 - 121 | |
| Toluene-d8 (Surrogate) | MS | 2030363-46 | ND | 0.050850 | 0.050000 | mg/kg | | 102 | | 81 - 117 | |
| | MSD | 2030363-46 | ND | 0.052450 | 0.050000 | mg/kg | 3.1 | 105 | | 81 - 117 | |
| 4-Bromofluorobenzene (Surrogate) | MS | 2030363-46 | ND | 0.049160 | 0.050000 | mg/kg | | 98.3 | | 74 - 121 | |
| | MSD | 2030363-46 | ND | 0.048330 | 0.050000 | mg/kg | 1.7 | 96.7 | | 74 - 121 | |

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091020** | | | | | | |
| Benzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| Bromobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00087 | |
| Bromochloromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00081 | |
| Bromodichloromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00078 | |
| Bromoform | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00070 | |
| Bromomethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0017 | |
| n-Butylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00076 | |
| sec-Butylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00071 | |
| tert-Butylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00085 | |
| Carbon tetrachloride | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00078 | |
| Chlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00077 | |
| Chloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| Chloroform | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00090 | |
| Chloromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| 2-Chlorotoluene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00087 | |
| 4-Chlorotoluene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00070 | |
| Dibromochloromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,2-Dibromo-3-chloropropane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00096 | |
| 1,2-Dibromoethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00082 | |
| Dibromomethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0014 | |
| 1,2-Dichlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00079 | |
| 1,3-Dichlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| 1,4-Dichlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| Dichlorodifluoromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00079 | |
| 1,1-Dichloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00064 | |
| 1,2-Dichloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00073 | |
| 1,1-Dichloroethene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0011 | |
| cis-1,2-Dichloroethene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00054 | |
| trans-1,2-Dichloroethene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0037 | |
| 1,2-Dichloropropane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,3-Dichloropropane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 2,2-Dichloropropane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 1,1-Dichloropropene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| cis-1,3-Dichloropropene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00058 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Volatile Organic Analysis (EPA Method 8260B/5035)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091020** | | | | | | |
| trans-1,3-Dichloropropene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00066 | |
| Ethylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00069 | |
| Hexachlorobutadiene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| Isopropylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| p-Isopropyltoluene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00059 | |
| Methylene chloride | B091020-BLK1 | ND | mg/kg | 0.010 | 0.0011 | |
| Methyl t-butyl ether | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00056 | |
| Naphthalene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00099 | |
| n-Propylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00071 | |
| Styrene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00062 | |
| 1,1,1,2-Tetrachloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00095 | |
| 1,1,2,2-Tetrachloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00084 | |
| Tetrachloroethene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00097 | |
| Toluene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00069 | |
| 1,2,3-Trichlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| 1,2,4-Trichlorobenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0014 | |
| 1,1,1-Trichloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00067 | |
| 1,1,2-Trichloroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00094 | |
| Trichloroethene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00074 | |
| Trichlorofluoromethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| 1,2,3-Trichloropropane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0019 | |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0010 | |
| 1,2,4-Trimethylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00080 | |
| 1,3,5-Trimethylbenzene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00066 | |
| Vinyl chloride | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00059 | |
| Total Xylenes | B091020-BLK1 | ND | mg/kg | 0.010 | 0.0025 | |
| p- & m-Xylenes | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.0015 | |
| o-Xylene | B091020-BLK1 | ND | mg/kg | 0.0050 | 0.00093 | |
| **1,2-Dichloroethane-d4 (Surrogate)** | **B091020-BLK1** | **90.3** | % | **70 - 121 (LCL - UCL)** | | |
| **Toluene-d8 (Surrogate)** | **B091020-BLK1** | **98.4** | % | **81 - 117 (LCL - UCL)** | | |
| **4-Bromofluorobenzene (Surrogate)** | **B091020-BLK1** | **96.2** | % | **74 - 121 (LCL - UCL)** | | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091020** | | | | | | | | | | |
| Benzene | B091020-BS1 | LCS | 0.14041 | 0.12500 | mg/kg | 112 | | 70 - 130 | | |
| Bromodichloromethane | B091020-BS1 | LCS | 0.12228 | 0.12500 | mg/kg | 97.8 | | 70 - 130 | | |
| Chlorobenzene | B091020-BS1 | LCS | 0.13119 | 0.12500 | mg/kg | 105 | | 70 - 130 | | |
| Chloroethane | B091020-BS1 | LCS | 0.13255 | 0.12500 | mg/kg | 106 | | 70 - 130 | | |
| 1,4-Dichlorobenzene | B091020-BS1 | LCS | 0.13522 | 0.12500 | mg/kg | 108 | | 70 - 130 | | |
| 1,1-Dichloroethane | B091020-BS1 | LCS | 0.13192 | 0.12500 | mg/kg | 106 | | 70 - 130 | | |
| 1,1-Dichloroethene | B091020-BS1 | LCS | 0.12592 | 0.12500 | mg/kg | 101 | | 70 - 130 | | |
| Toluene | B091020-BS1 | LCS | 0.13410 | 0.12500 | mg/kg | 107 | | 70 - 130 | | |
| Trichloroethene | B091020-BS1 | LCS | 0.12808 | 0.12500 | mg/kg | 102 | | 70 - 130 | | |
| 1,2-Dichloroethane-d4 (Surrogate) | B091020-BS1 | LCS | 0.045190 | 0.050000 | mg/kg | 90.4 | | 70 - 121 | | |
| Toluene-d8 (Surrogate) | B091020-BS1 | LCS | 0.050370 | 0.050000 | mg/kg | 101 | | 81 - 117 | | |
| 4-Bromofluorobenzene (Surrogate) | B091020-BS1 | LCS | 0.049700 | 0.050000 | mg/kg | 99.4 | | 74 - 121 | | |

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Volatile Organic Analysis (EPA Method 8260B/5035)

## Quality Control Report - Precision & Accuracy

**QC Batch ID: B091020** Used client sample: N

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzene | MS | 2030363-32 | ND | 0.15068 | 0.12500 | mg/kg | | 121 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.14035 | 0.12500 | mg/kg | 7.1 | 112 | 20 | 70 - 130 | |
| Bromodichloromethane | MS | 2030363-32 | ND | 0.13453 | 0.12500 | mg/kg | | 108 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.12910 | 0.12500 | mg/kg | 4.1 | 103 | 20 | 70 - 130 | |
| Chlorobenzene | MS | 2030363-32 | ND | 0.13895 | 0.12500 | mg/kg | | 111 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.13333 | 0.12500 | mg/kg | 4.1 | 107 | 20 | 70 - 130 | |
| Chloroethane | MS | 2030363-32 | ND | 0.13987 | 0.12500 | mg/kg | | 112 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.13870 | 0.12500 | mg/kg | 0.8 | 111 | 20 | 70 - 130 | |
| 1,4-Dichlorobenzene | MS | 2030363-32 | ND | 0.14305 | 0.12500 | mg/kg | | 114 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.14033 | 0.12500 | mg/kg | 1.9 | 112 | 20 | 70 - 130 | |
| 1,1-Dichloroethane | MS | 2030363-32 | ND | 0.14397 | 0.12500 | mg/kg | | 115 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.13390 | 0.12500 | mg/kg | 7.2 | 107 | 20 | 70 - 130 | |
| 1,1-Dichloroethene | MS | 2030363-32 | ND | 0.12952 | 0.12500 | mg/kg | | 104 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.12132 | 0.12500 | mg/kg | 6.5 | 97.1 | 20 | 70 - 130 | |
| Toluene | MS | 2030363-32 | ND | 0.14264 | 0.12500 | mg/kg | | 114 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.13418 | 0.12500 | mg/kg | 6.1 | 107 | 20 | 70 - 130 | |
| Trichloroethene | MS | 2030363-32 | ND | 0.13361 | 0.12500 | mg/kg | | 107 | | 70 - 130 | |
| | MSD | 2030363-32 | ND | 0.12798 | 0.12500 | mg/kg | 4.3 | 102 | 20 | 70 - 130 | |
| 1,2-Dichloroethane-d4 (Surrogate) | MS | 2030363-32 | ND | 0.050330 | 0.050000 | mg/kg | | 101 | | 70 - 121 | |
| | MSD | 2030363-32 | ND | 0.047770 | 0.050000 | mg/kg | 5.2 | 95.5 | | 70 - 121 | |
| Toluene-d8 (Surrogate) | MS | 2030363-32 | ND | 0.051370 | 0.050000 | mg/kg | | 103 | | 81 - 117 | |
| | MSD | 2030363-32 | ND | 0.049660 | 0.050000 | mg/kg | 3.4 | 99.3 | | 81 - 117 | |
| 4-Bromofluorobenzene (Surrogate) | MS | 2030363-32 | ND | 0.050390 | 0.050000 | mg/kg | | 101 | | 74 - 121 | |
| | MSD | 2030363-32 | ND | 0.049650 | 0.050000 | mg/kg | 1.5 | 99.3 | | 74 - 121 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091256** | | | | | | |
| Acenaphthene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00052 | |
| Acenaphthylene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00047 | |
| Anthracene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00073 | |
| Benzo[a]anthracene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00053 | |
| Benzo[b]fluoranthene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00056 | |
| Benzo[k]fluoranthene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00073 | |
| Benzo[a]pyrene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00034 | |
| Benzo[g,h,i]perylene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00068 | |
| Chrysene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00038 | |
| Dibenzo[a,h]anthracene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00057 | |
| Fluoranthene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00057 | |
| Fluorene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00037 | |
| Indeno[1,2,3-cd]pyrene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00055 | |
| Naphthalene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00049 | |
| Phenanthrene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00049 | |
| Pyrene | B091256-BLK1 | ND | mg/kg | 0.0030 | 0.00058 | |
| **Nitrobenzene-d5 (Surrogate)** | **B091256-BLK1** | **73.1** | % | **30 - 130 (LCL - UCL)** | | |
| **2-Fluorobiphenyl (Surrogate)** | **B091256-BLK1** | **86.7** | % | **40 - 130 (LCL - UCL)** | | |
| **p-Terphenyl-d14 (Surrogate)** | **B091256-BLK1** | **102** | % | **30 - 130 (LCL - UCL)** | | |

| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
|---|---|
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091256** | | | | | | | | | | |
| Acenaphthene | B091256-BS1 | LCS | 0.029034 | 0.033113 | mg/kg | 87.7 | | 60 - 130 | | |
| Acenaphthylene | B091256-BS1 | LCS | 0.031580 | 0.033113 | mg/kg | 95.4 | | 60 - 130 | | |
| Anthracene | B091256-BS1 | LCS | 0.032511 | 0.033113 | mg/kg | 98.2 | | 60 - 130 | | |
| Benzo[a]anthracene | B091256-BS1 | LCS | 0.029167 | 0.033113 | mg/kg | 88.1 | | 60 - 130 | | |
| Benzo[b]fluoranthene | B091256-BS1 | LCS | 0.027957 | 0.033113 | mg/kg | 84.4 | | 50 - 130 | | |
| Benzo[k]fluoranthene | B091256-BS1 | LCS | 0.033953 | 0.033113 | mg/kg | 103 | | 60 - 130 | | |
| Benzo[a]pyrene | B091256-BS1 | LCS | 0.033320 | 0.033113 | mg/kg | 101 | | 60 - 130 | | |
| Benzo[g,h,i]perylene | B091256-BS1 | LCS | 0.027395 | 0.033113 | mg/kg | 82.7 | | 50 - 130 | | |
| Chrysene | B091256-BS1 | LCS | 0.032511 | 0.033113 | mg/kg | 98.2 | | 50 - 130 | | |
| Dibenzo[a,h]anthracene | B091256-BS1 | LCS | 0.037127 | 0.033113 | mg/kg | 112 | | 50 - 130 | | |
| Fluoranthene | B091256-BS1 | LCS | 0.031756 | 0.033113 | mg/kg | 95.9 | | 60 - 130 | | |
| Fluorene | B091256-BS1 | LCS | 0.032134 | 0.033113 | mg/kg | 97.0 | | 50 - 130 | | |
| Indeno[1,2,3-cd]pyrene | B091256-BS1 | LCS | 0.030556 | 0.033113 | mg/kg | 92.3 | | 50 - 130 | | |
| Naphthalene | B091256-BS1 | LCS | 0.027552 | 0.033113 | mg/kg | 83.2 | | 50 - 130 | | |
| Phenanthrene | B091256-BS1 | LCS | 0.026229 | 0.033113 | mg/kg | 79.2 | | 50 - 130 | | |
| Pyrene | B091256-BS1 | LCS | 0.029242 | 0.033113 | mg/kg | 88.3 | | 50 - 130 | | |
| Nitrobenzene-d5 (Surrogate) | B091256-BS1 | LCS | 0.093575 | 0.13245 | mg/kg | 70.6 | | 30 - 130 | | |
| 2-Fluorobiphenyl (Surrogate) | B091256-BS1 | LCS | 0.11393 | 0.13245 | mg/kg | 86.0 | | 40 - 130 | | |
| p-Terphenyl-d14 (Surrogate) | B091256-BS1 | LCS | 0.12791 | 0.13245 | mg/kg | 96.6 | | 30 - 130 | | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

## Quality Control Report - Precision & Accuracy

| | | | | | | | | | Control Limits | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | RPD | Percent Recovery | Lab Quals |
| **QC Batch ID: B091256** | Used client sample: N | | | | | | | | | | |
| Acenaphthene | MS | 2030363-84 | ND | 0.031171 | 0.033445 | mg/kg | | 93.2 | | 50 - 130 | |
| | MSD | 2030363-84 | ND | 0.031200 | 0.033557 | mg/kg | 0.1 | 93.0 | 30 | 50 - 130 | |
| Acenaphthylene | MS | 2030363-84 | ND | 0.034864 | 0.033445 | mg/kg | | 104 | | 50 - 130 | |
| | MSD | 2030363-84 | ND | 0.034034 | 0.033557 | mg/kg | 2.4 | 101 | 30 | 50 - 130 | |
| Anthracene | MS | 2030363-84 | ND | 0.034656 | 0.033445 | mg/kg | | 104 | | 50 - 130 | |
| | MSD | 2030363-84 | ND | 0.034128 | 0.033557 | mg/kg | 1.5 | 102 | 30 | 50 - 130 | |
| Benzo[a]anthracene | MS | 2030363-84 | ND | 0.032445 | 0.033445 | mg/kg | | 97.0 | | 50 - 130 | |
| | MSD | 2030363-84 | ND | 0.031522 | 0.033557 | mg/kg | 2.9 | 93.9 | 30 | 50 - 130 | |
| Benzo[b]fluoranthene | MS | 2030363-84 | ND | 0.031915 | 0.033445 | mg/kg | | 95.4 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.030651 | 0.033557 | mg/kg | 4.0 | 91.3 | 30 | 40 - 130 | |
| Benzo[k]fluoranthene | MS | 2030363-84 | ND | 0.034082 | 0.033445 | mg/kg | | 102 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.033427 | 0.033557 | mg/kg | 1.9 | 99.6 | 30 | 40 - 130 | |
| Benzo[a]pyrene | MS | 2030363-84 | ND | 0.035903 | 0.033445 | mg/kg | | 107 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.035688 | 0.033557 | mg/kg | 0.6 | 106 | 30 | 40 - 130 | |
| Benzo[g,h,i]perylene | MS | 2030363-84 | ND | 0.028054 | 0.033445 | mg/kg | | 83.9 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.027206 | 0.033557 | mg/kg | 3.1 | 81.1 | 30 | 40 - 130 | |
| Chrysene | MS | 2030363-84 | ND | 0.033188 | 0.033445 | mg/kg | | 99.2 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.033440 | 0.033557 | mg/kg | 0.8 | 99.7 | 30 | 40 - 130 | |
| Dibenzo[a,h]anthracene | MS | 2030363-84 | ND | 0.039122 | 0.033445 | mg/kg | | 117 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.037437 | 0.033557 | mg/kg | 4.4 | 112 | 30 | 40 - 130 | |
| Fluoranthene | MS | 2030363-84 | ND | 0.033994 | 0.033445 | mg/kg | | 102 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.033592 | 0.033557 | mg/kg | 1.2 | 100 | 30 | 40 - 130 | |
| Fluorene | MS | 2030363-84 | ND | 0.035106 | 0.033445 | mg/kg | | 105 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.035064 | 0.033557 | mg/kg | 0.1 | 104 | 30 | 40 - 130 | |
| Indeno[1,2,3-cd]pyrene | MS | 2030363-84 | ND | 0.032376 | 0.033445 | mg/kg | | 96.8 | | 30 - 130 | |
| | MSD | 2030363-84 | ND | 0.031348 | 0.033557 | mg/kg | 3.2 | 93.4 | 30 | 30 - 130 | |
| Naphthalene | MS | 2030363-84 | ND | 0.029695 | 0.033445 | mg/kg | | 88.8 | | 50 - 130 | |
| | MSD | 2030363-84 | ND | 0.029636 | 0.033557 | mg/kg | 0.2 | 88.3 | 30 | 50 - 130 | |
| Phenanthrene | MS | 2030363-84 | ND | 0.028846 | 0.033445 | mg/kg | | 86.2 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.028699 | 0.033557 | mg/kg | 0.5 | 85.5 | 30 | 40 - 130 | |
| Pyrene | MS | 2030363-84 | ND | 0.030694 | 0.033445 | mg/kg | | 91.8 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.031497 | 0.033557 | mg/kg | 2.6 | 93.9 | 30 | 40 - 130 | |
| Nitrobenzene-d5 (Surrogate) | MS | 2030363-84 | ND | 0.10293 | 0.13378 | mg/kg | | 76.9 | | 30 - 130 | |
| | MSD | 2030363-84 | ND | 0.10033 | 0.13423 | mg/kg | 2.6 | 74.7 | | 30 - 130 | |
| 2-Fluorobiphenyl (Surrogate) | MS | 2030363-84 | ND | 0.12429 | 0.13378 | mg/kg | | 92.9 | | 40 - 130 | |
| | MSD | 2030363-84 | ND | 0.12224 | 0.13423 | mg/kg | 1.7 | 91.1 | | 40 - 130 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Polynuclear Aromatic Hydrocarbons (EPA Method 8270C-SIM)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091256** | Used client sample: N | | | | | | | | | | |
| p-Terphenyl-d14 (Surrogate) | MS | 2030363-84 | ND | 0.13509 | 0.13378 | mg/kg | | 101 | | 30 - 130 | |
| | MSD | 2030363-84 | ND | 0.13722 | 0.13423 | mg/kg | 1.6 | 102 | | 30 - 130 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Modified WET Test (STLC)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B099464** | | | | | | |
| Arsenic | B099464-BLK1 | ND | mg/L | 0.050 | 0.0092 | |
| Cadmium | B099464-BLK1 | ND | mg/L | 0.010 | 0.0011 | |
| Lead | B099464-BLK1 | ND | mg/L | 0.050 | 0.0035 | |
| **QC Batch ID: B100161** | | | | | | |
| Mercury | B100161-BLK1 | ND | mg/L | 0.0020 | 0.00022 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Modified WET Test (STLC)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B099464** | | | | | | | | | | |
| Arsenic | B099464-BS1 | LCS | 0.34597 | 0.40000 | mg/L | 86.5 | | 85 - 115 | | |
| Cadmium | B099464-BS1 | LCS | 0.19089 | 0.20000 | mg/L | 95.4 | | 85 - 115 | | |
| Lead | B099464-BS1 | LCS | 2.0632 | 2.0000 | mg/L | 103 | | 85 - 115 | | |
| **QC Batch ID: B100161** | | | | | | | | | | |
| Mercury | B100161-BS1 | LCS | 0.0093250 | 0.010000 | mg/L | 93.2 | | 85 - 115 | | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Modified WET Test (STLC)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B099464** | Used client sample: N | | | | | | | | | | |
| **Arsenic** | DUP | **2103665-01** | **0.010949** | **0.015899** | | **mg/L** | **36.9** | | **20** | | **J,A02** |
| | MS | **2103665-01** | **0.010949** | **0.36825** | **0.40816** | **mg/L** | | **87.5** | | **75 - 125** | |
| | MSD | **2103665-01** | **0.010949** | **0.36174** | **0.40816** | **mg/L** | **1.8** | **85.9** | **20** | **75 - 125** | |
| Cadmium | DUP | 2103665-01 | ND | ND | | mg/L | | | 20 | | |
| | MS | 2103665-01 | ND | 0.20197 | 0.20408 | mg/L | | 99.0 | | 75 - 125 | |
| | MSD | 2103665-01 | ND | 0.20104 | 0.20408 | mg/L | 0.5 | 98.5 | 20 | 75 - 125 | |
| Lead | DUP | 2103665-01 | ND | ND | | mg/L | | | 20 | | |
| | MS | 2103665-01 | ND | 2.1602 | 2.0408 | mg/L | | 106 | | 75 - 125 | |
| | MSD | 2103665-01 | ND | 2.1348 | 2.0408 | mg/L | 1.2 | 105 | 20 | 75 - 125 | |
| **QC Batch ID: B100161** | Used client sample: N | | | | | | | | | | |
| Mercury | DUP | 2103665-01 | ND | ND | | mg/L | | | 20 | | |
| | MS | 2103665-01 | ND | 0.0099000 | 0.010000 | mg/L | | 99.0 | | 70 - 130 | |
| | MSD | 2103665-01 | ND | 0.0095750 | 0.010000 | mg/L | 3.3 | 95.8 | 20 | 70 - 130 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# TCLP Toxicity

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B099577** | | | | | | |
| Arsenic | B099577-BLK1 | ND | mg/L | 0.20 | 0.083 | |
| Cadmium | B099577-BLK1 | ND | mg/L | 0.10 | 0.0051 | |
| **Lead** | **B099577-BLK1** | **0.085374** | **mg/L** | **0.50** | **0.030** | **J** |
| **QC Batch ID: B099674** | | | | | | |
| Mercury | B099674-BLK1 | ND | mg/L | 0.0020 | 0.00022 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# TCLP Toxicity

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B099577** | | | | | | | | | | |
| Arsenic | B099577-BS1 | LCS | 3.6567 | 4.0000 | mg/L | 91.4 | | 85 - 115 | | |
| Cadmium | B099577-BS1 | LCS | 2.0349 | 2.0000 | mg/L | 102 | | 85 - 115 | | |
| Lead | B099577-BS1 | LCS | 20.754 | 20.000 | mg/L | 104 | | 85 - 115 | | |
| **QC Batch ID: B099674** | | | | | | | | | | |
| Mercury | B099674-BS1 | LCS | 0.010400 | 0.010000 | mg/L | 104 | | 85 - 115 | | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# TCLP Toxicity

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B099577** | Used client sample: N | | | | | | | | | | |
| Arsenic | DUP | 2103307-01 | ND | ND | | mg/L | | | 20 | | |
| | MS | 2103307-01 | ND | 3.7242 | 4.0000 | mg/L | | 93.1 | | 75 - 125 | |
| | MSD | 2103307-01 | ND | 3.8209 | 4.0000 | mg/L | 2.6 | 95.5 | 20 | 75 - 125 | |
| Cadmium | DUP | 2103307-01 | ND | 0.0063262 | | mg/L | | | 20 | | J |
| | MS | 2103307-01 | ND | 2.0687 | 2.0000 | mg/L | | 103 | | 75 - 125 | |
| | MSD | 2103307-01 | ND | 2.0675 | 2.0000 | mg/L | 0.1 | 103 | 20 | 75 - 125 | |
| Lead | DUP | 2103307-01 | 0.066669 | 0.072389 | | mg/L | 8.2 | | 20 | | J |
| | MS | 2103307-01 | 0.066669 | 21.014 | 20.000 | mg/L | | 105 | | 75 - 125 | |
| | MSD | 2103307-01 | 0.066669 | 21.038 | 20.000 | mg/L | 0.1 | 105 | 20 | 75 - 125 | |
| **QC Batch ID: B099674** | Used client sample: N | | | | | | | | | | |
| Mercury | DUP | 2103307-01 | ND | ND | | mg/L | | | 20 | | |
| | MS | 2103307-01 | ND | 0.010700 | 0.010000 | mg/L | | 107 | | 70 - 130 | |
| | MSD | 2103307-01 | ND | 0.011025 | 0.010000 | mg/L | 3.0 | 110 | 20 | 70 - 130 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa<br>3525 Hyland Ave<br>Costa Mesa, CA 92626 | **Reported:** 02/18/2021 9:27<br>Project: USFS- Big Blue Mill<br>Project Number: [none]<br>Project Manager: David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091174** | | | | | | |
| Antimony | B091174-BLK1 | ND | mg/kg | 0.50 | 0.080 | |
| Arsenic | B091174-BLK1 | ND | mg/kg | 0.50 | 0.17 | |
| Barium | B091174-BLK3 | ND | mg/kg | 0.50 | 0.18 | |
| Beryllium | B091174-BLK3 | ND | mg/kg | 0.50 | 0.047 | |
| Cadmium | B091174-BLK3 | ND | mg/kg | 0.50 | 0.052 | |
| Chromium | B091174-BLK3 | ND | mg/kg | 0.50 | 0.050 | |
| Cobalt | B091174-BLK3 | ND | mg/kg | 2.5 | 0.098 | |
| Copper | B091174-BLK3 | ND | mg/kg | 1.0 | 0.050 | |
| Lead | B091174-BLK3 | ND | mg/kg | 2.5 | 0.41 | |
| Molybdenum | B091174-BLK3 | ND | mg/kg | 2.5 | 0.050 | |
| Nickel | B091174-BLK3 | ND | mg/kg | 0.50 | 0.15 | |
| Selenium | B091174-BLK1 | ND | mg/kg | 0.50 | 0.11 | |
| Silver | B091174-BLK3 | ND | mg/kg | 0.50 | 0.067 | |
| Thallium | B091174-BLK1 | ND | mg/kg | 0.25 | 0.049 | |
| Vanadium | B091174-BLK3 | ND | mg/kg | 0.50 | 0.11 | |
| **Zinc** | **B091174-BLK3** | **0.43851** | **mg/kg** | **2.5** | **0.087** | **J** |
| **QC Batch ID: B091180** | | | | | | |
| Antimony | B091180-BLK1 | ND | mg/kg | 0.50 | 0.080 | |
| **Arsenic** | **B091180-BLK1** | **0.17175** | **mg/kg** | **0.50** | **0.17** | **J** |
| Barium | B091180-BLK3 | ND | mg/kg | 0.50 | 0.18 | |
| Beryllium | B091180-BLK3 | ND | mg/kg | 0.50 | 0.047 | |
| Cadmium | B091180-BLK3 | ND | mg/kg | 0.50 | 0.052 | |
| Chromium | B091180-BLK3 | ND | mg/kg | 0.50 | 0.050 | |
| Cobalt | B091180-BLK3 | ND | mg/kg | 2.5 | 0.098 | |
| Copper | B091180-BLK3 | ND | mg/kg | 1.0 | 0.050 | |
| Lead | B091180-BLK3 | ND | mg/kg | 2.5 | 0.41 | |
| Molybdenum | B091180-BLK3 | ND | mg/kg | 2.5 | 0.050 | |
| Nickel | B091180-BLK3 | ND | mg/kg | 0.50 | 0.15 | |
| Selenium | B091180-BLK2 | ND | mg/kg | 0.50 | 0.11 | |
| Silver | B091180-BLK3 | ND | mg/kg | 0.50 | 0.067 | |
| Thallium | B091180-BLK1 | ND | mg/kg | 0.25 | 0.049 | |
| Vanadium | B091180-BLK3 | ND | mg/kg | 0.50 | 0.11 | |
| **Zinc** | **B091180-BLK3** | **0.17918** | **mg/kg** | **2.5** | **0.087** | **J** |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091357** | | | | | | |
| Mercury | B091357-BLK1 | ND | mg/kg | 0.16 | 0.016 | |
| **QC Batch ID: B091358** | | | | | | |
| Mercury | B091358-BLK1 | ND | mg/kg | 0.16 | 0.016 | |
| **QC Batch ID: B091765** | | | | | | |
| Barium | B091765-BLK1 | ND | mg/kg | 0.50 | 0.18 | |
| Beryllium | B091765-BLK1 | ND | mg/kg | 0.50 | 0.047 | |
| Cadmium | B091765-BLK1 | ND | mg/kg | 0.50 | 0.052 | |
| **Chromium** | **B091765-BLK1** | **0.059982** | **mg/kg** | **0.50** | **0.050** | **J** |
| Cobalt | B091765-BLK1 | ND | mg/kg | 2.5 | 0.098 | |
| Copper | B091765-BLK1 | ND | mg/kg | 1.0 | 0.050 | |
| Lead | B091765-BLK1 | ND | mg/kg | 2.5 | 0.41 | |
| Molybdenum | B091765-BLK1 | ND | mg/kg | 2.5 | 0.050 | |
| Nickel | B091765-BLK1 | ND | mg/kg | 0.50 | 0.15 | |
| Silver | B091765-BLK1 | ND | mg/kg | 0.50 | 0.067 | |
| Vanadium | B091765-BLK1 | ND | mg/kg | 0.50 | 0.11 | |
| **Zinc** | **B091765-BLK1** | **0.16309** | **mg/kg** | **2.5** | **0.087** | **J** |
| **QC Batch ID: B091770** | | | | | | |
| **Mercury** | **B091770-BLK1** | **0.042880** | **mg/kg** | **0.16** | **0.016** | **J** |
| **QC Batch ID: B091813** | | | | | | |
| Antimony | B091813-BLK1 | ND | mg/kg | 0.50 | 0.080 | |
| **Arsenic** | **B091813-BLK1** | **0.20350** | **mg/kg** | **0.50** | **0.17** | **J** |
| Selenium | B091813-BLK1 | ND | mg/kg | 0.50 | 0.11 | |
| Thallium | B091813-BLK1 | ND | mg/kg | 0.25 | 0.049 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091174** | | | | | | | | | | |
| Antimony | B091174-BS1 | LCS | 9.9435 | 10.000 | mg/kg | 99.4 | | 75 - 125 | | |
| Arsenic | B091174-BS1 | LCS | 26.102 | 25.000 | mg/kg | 104 | | 75 - 125 | | |
| Barium | B091174-BS3 | LCS | 102.79 | 100.00 | mg/kg | 103 | | 75 - 125 | | |
| Beryllium | B091174-BS3 | LCS | 9.9975 | 10.000 | mg/kg | 100 | | 75 - 125 | | |
| Cadmium | B091174-BS3 | LCS | 9.7818 | 10.000 | mg/kg | 97.8 | | 75 - 125 | | |
| Chromium | B091174-BS3 | LCS | 98.991 | 100.00 | mg/kg | 99.0 | | 75 - 125 | | |
| Cobalt | B091174-BS3 | LCS | 99.415 | 100.00 | mg/kg | 99.4 | | 75 - 125 | | |
| Copper | B091174-BS3 | LCS | 94.459 | 100.00 | mg/kg | 94.5 | | 75 - 125 | | |
| Lead | B091174-BS3 | LCS | 104.59 | 100.00 | mg/kg | 105 | | 75 - 125 | | |
| Molybdenum | B091174-BS3 | LCS | 96.968 | 100.00 | mg/kg | 97.0 | | 75 - 125 | | |
| Nickel | B091174-BS3 | LCS | 98.146 | 100.00 | mg/kg | 98.1 | | 75 - 125 | | |
| Selenium | B091174-BS1 | LCS | 26.703 | 25.000 | mg/kg | 107 | | 75 - 125 | | |
| Silver | B091174-BS3 | LCS | 9.4860 | 10.000 | mg/kg | 94.9 | | 75 - 125 | | |
| Thallium | B091174-BS1 | LCS | 10.546 | 10.000 | mg/kg | 105 | | 75 - 125 | | |
| Vanadium | B091174-BS3 | LCS | 97.664 | 100.00 | mg/kg | 97.7 | | 75 - 125 | | |
| Zinc | B091174-BS3 | LCS | 98.682 | 100.00 | mg/kg | 98.7 | | 75 - 125 | | |
| **QC Batch ID: B091180** | | | | | | | | | | |
| Antimony | B091180-BS1 | LCS | 10.657 | 10.000 | mg/kg | 107 | | 75 - 125 | | |
| Arsenic | B091180-BS1 | LCS | 26.294 | 25.000 | mg/kg | 105 | | 75 - 125 | | |
| Barium | B091180-BS3 | LCS | 105.34 | 100.00 | mg/kg | 105 | | 75 - 125 | | |
| Beryllium | B091180-BS3 | LCS | 10.547 | 10.000 | mg/kg | 105 | | 75 - 125 | | |
| Cadmium | B091180-BS3 | LCS | 10.234 | 10.000 | mg/kg | 102 | | 75 - 125 | | |
| Chromium | B091180-BS3 | LCS | 105.12 | 100.00 | mg/kg | 105 | | 75 - 125 | | |
| Cobalt | B091180-BS3 | LCS | 105.24 | 100.00 | mg/kg | 105 | | 75 - 125 | | |
| Copper | B091180-BS3 | LCS | 100.73 | 100.00 | mg/kg | 101 | | 75 - 125 | | |
| Lead | B091180-BS3 | LCS | 109.76 | 100.00 | mg/kg | 110 | | 75 - 125 | | |
| Molybdenum | B091180-BS3 | LCS | 103.10 | 100.00 | mg/kg | 103 | | 75 - 125 | | |
| Nickel | B091180-BS3 | LCS | 103.78 | 100.00 | mg/kg | 104 | | 75 - 125 | | |
| Selenium | B091180-BS2 | LCS | 26.618 | 25.000 | mg/kg | 106 | | 75 - 125 | | |
| Silver | B091180-BS3 | LCS | 10.085 | 10.000 | mg/kg | 101 | | 75 - 125 | | |
| Thallium | B091180-BS1 | LCS | 11.034 | 10.000 | mg/kg | 110 | | 75 - 125 | | |
| Vanadium | B091180-BS3 | LCS | 103.75 | 100.00 | mg/kg | 104 | | 75 - 125 | | |
| Zinc | B091180-BS3 | LCS | 103.86 | 100.00 | mg/kg | 104 | | 75 - 125 | | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091357** | | | | | | | | | | |
| Mercury | B091357-BS1 | LCS | 0.76160 | 0.80000 | mg/kg | 95.2 | | 80 - 120 | | |
| **QC Batch ID: B091358** | | | | | | | | | | |
| Mercury | B091358-BS1 | LCS | 0.81440 | 0.80000 | mg/kg | 102 | | 80 - 120 | | |
| **QC Batch ID: B091765** | | | | | | | | | | |
| Barium | B091765-BS1 | LCS | 107.68 | 100.00 | mg/kg | 108 | | 75 - 125 | | |
| Beryllium | B091765-BS1 | LCS | 10.759 | 10.000 | mg/kg | 108 | | 75 - 125 | | |
| Cadmium | B091765-BS1 | LCS | 10.982 | 10.000 | mg/kg | 110 | | 75 - 125 | | |
| Chromium | B091765-BS1 | LCS | 111.89 | 100.00 | mg/kg | 112 | | 75 - 125 | | |
| Cobalt | B091765-BS1 | LCS | 109.12 | 100.00 | mg/kg | 109 | | 75 - 125 | | |
| Copper | B091765-BS1 | LCS | 104.52 | 100.00 | mg/kg | 105 | | 75 - 125 | | |
| Lead | B091765-BS1 | LCS | 109.90 | 100.00 | mg/kg | 110 | | 75 - 125 | | |
| Molybdenum | B091765-BS1 | LCS | 107.70 | 100.00 | mg/kg | 108 | | 75 - 125 | | |
| Nickel | B091765-BS1 | LCS | 115.58 | 100.00 | mg/kg | 116 | | 75 - 125 | | |
| Silver | B091765-BS1 | LCS | 10.592 | 10.000 | mg/kg | 106 | | 75 - 125 | | |
| Vanadium | B091765-BS1 | LCS | 106.12 | 100.00 | mg/kg | 106 | | 75 - 125 | | |
| Zinc | B091765-BS1 | LCS | 108.59 | 100.00 | mg/kg | 109 | | 75 - 125 | | |
| **QC Batch ID: B091770** | | | | | | | | | | |
| Mercury | B091770-BS1 | LCS | 0.78080 | 0.80000 | mg/kg | 97.6 | | 80 - 120 | | |
| **QC Batch ID: B091813** | | | | | | | | | | |
| Antimony | B091813-BS1 | LCS | 11.279 | 10.000 | mg/kg | 113 | | 75 - 125 | | |
| Arsenic | B091813-BS1 | LCS | 27.706 | 25.000 | mg/kg | 111 | | 75 - 125 | | |
| Selenium | B091813-BS1 | LCS | 29.360 | 25.000 | mg/kg | 117 | | 75 - 125 | | |
| Thallium | B091813-BS1 | LCS | 11.330 | 10.000 | mg/kg | 113 | | 75 - 125 | | |

| | | |
|---|---|---|
| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Precision & Accuracy

**QC Batch ID: B091174** Used client sample: Y - Description: BB-M1-10, 10/22/2020 16:05

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 3.1075 | 10.000 | mg/kg | | 31.1 | | 16 - 119 | J |
| | MSD | 2031364-10 | ND | 3.5550 | 10.000 | mg/kg | 13.4 | 35.6 | 20 | 16 - 119 | J |
| Arsenic | DUP | 2031364-10 | ND | 1.8550 | | mg/kg | | | 20 | | J |
| | MS | 2031364-10 | ND | 24.065 | 25.000 | mg/kg | | 96.3 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 29.110 | 25.000 | mg/kg | 19.0 | 116 | 20 | 75 - 125 | |
| Barium | DUP | 2031364-10 | 56.171 | 46.054 | | mg/kg | 19.8 | | 20 | | |
| | MS | 2031364-10 | 56.171 | 136.24 | 100.00 | mg/kg | | 80.1 | | 75 - 125 | |
| | MSD | 2031364-10 | 56.171 | 150.24 | 100.00 | mg/kg | 9.8 | 94.1 | 20 | 75 - 125 | |
| Beryllium | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 10.297 | 10.000 | mg/kg | | 103 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 10.818 | 10.000 | mg/kg | 4.9 | 108 | 20 | 75 - 125 | |
| Cadmium | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 10.006 | 10.000 | mg/kg | | 100 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 10.827 | 10.000 | mg/kg | 7.9 | 108 | 20 | 75 - 125 | |
| **Chromium** | DUP | **2031364-10** | **12.137** | **9.2613** | | **mg/kg** | **26.9** | | **20** | | **A02** |
| | MS | **2031364-10** | **12.137** | **121.13** | **100.00** | **mg/kg** | | **109** | | **75 - 125** | |
| | MSD | **2031364-10** | **12.137** | **111.22** | **100.00** | **mg/kg** | **8.5** | **99.1** | **20** | **75 - 125** | |
| **Cobalt** | DUP | **2031364-10** | **6.1360** | **4.8871** | | **mg/kg** | **22.7** | | **20** | | **J,A02** |
| | MS | **2031364-10** | **6.1360** | **110.03** | **100.00** | **mg/kg** | | **104** | | **75 - 125** | |
| | MSD | **2031364-10** | **6.1360** | **114.08** | **100.00** | **mg/kg** | **3.6** | **108** | **20** | **75 - 125** | |
| Copper | DUP | 2031364-10 | 6.9397 | 5.8144 | | mg/kg | 17.6 | | 20 | | J |
| | MS | 2031364-10 | 6.9397 | 102.42 | 100.00 | mg/kg | | 95.5 | | 75 - 125 | |
| | MSD | 2031364-10 | 6.9397 | 107.15 | 100.00 | mg/kg | 4.5 | 100 | 20 | 75 - 125 | |
| Lead | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 105.24 | 100.00 | mg/kg | | 105 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 110.38 | 100.00 | mg/kg | 4.8 | 110 | 20 | 75 - 125 | |
| Molybdenum | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 93.982 | 100.00 | mg/kg | | 94.0 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 99.128 | 100.00 | mg/kg | 5.3 | 99.1 | 20 | 75 - 125 | |
| Nickel | DUP | 2031364-10 | 4.8267 | 4.4162 | | mg/kg | 8.9 | | 20 | | J |
| | MS | 2031364-10 | 4.8267 | 113.55 | 100.00 | mg/kg | | 109 | | 75 - 125 | |
| | MSD | 2031364-10 | 4.8267 | 114.00 | 100.00 | mg/kg | 0.4 | 109 | 20 | 75 - 125 | |
| **Selenium** | DUP | **2031364-10** | **2.4800** | **ND** | | **mg/kg** | | | **20** | | |
| | MS | **2031364-10** | **2.4800** | **21.005** | **25.000** | **mg/kg** | | **74.1** | | **75 - 125** | **Q03** |
| | MSD | **2031364-10** | **2.4800** | **23.585** | **25.000** | **mg/kg** | **11.6** | **84.4** | **20** | **75 - 125** | |
| Silver | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 9.6926 | 10.000 | mg/kg | | 96.9 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 10.012 | 10.000 | mg/kg | 3.2 | 100 | 20 | 75 - 125 | |

BC Laboratories, Inc.
Environmental Testing Laboratory Since 1949

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091174** | Used client sample: Y - Description: BB-M1-10, 10/22/2020 16:05 | | | | | | | | | | |
| Thallium | DUP | 2031364-10 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-10 | ND | 10.475 | 10.000 | mg/kg | | 105 | | 75 - 125 | |
| | MSD | 2031364-10 | ND | 10.915 | 10.000 | mg/kg | 4.1 | 109 | 20 | 75 - 125 | |
| **Vanadium** | DUP | **2031364-10** | **61.599** | **48.731** | | **mg/kg** | **23.3** | | **20** | | **A02** |
| | MS | **2031364-10** | **61.599** | **138.76** | **100.00** | **mg/kg** | | **77.2** | | **75 - 125** | |
| | MSD | **2031364-10** | **61.599** | **145.55** | **100.00** | **mg/kg** | **4.8** | **84.0** | **20** | **75 - 125** | |
| Zinc | DUP | 2031364-10 | 31.878 | 27.194 | | mg/kg | 15.9 | | 20 | | |
| | MS | 2031364-10 | 31.878 | 135.20 | 100.00 | mg/kg | | 103 | | 75 - 125 | |
| | MSD | 2031364-10 | 31.878 | 139.53 | 100.00 | mg/kg | 3.1 | 108 | 20 | 75 - 125 | |
| **QC Batch ID: B091180** | Used client sample: Y - Description: BB-011, 10/20/2020 14:14 | | | | | | | | | | |
| **Antimony** | DUP | **2031364-27** | **ND** | **ND** | | **mg/kg** | | | **20** | | |
| | MS | **2031364-27** | **ND** | **3.9375** | **10.000** | **mg/kg** | | **39.4** | | **16 - 119** | **J** |
| | MSD | **2031364-27** | **ND** | **3.0600** | **10.000** | **mg/kg** | **25.1** | **30.6** | **20** | **16 - 119** | **J,Q02** |
| **Arsenic** | DUP | **2031364-27** | **109.93** | **178.35** | | **mg/kg** | **47.5** | | **20** | | **Q01** |
| | MS | **2031364-27** | **109.93** | **197.22** | **25.000** | **mg/kg** | | **349** | | **75 - 125** | **A03** |
| | MSD | **2031364-27** | **109.93** | **296.19** | **25.000** | **mg/kg** | **40.1** | **745** | **20** | **75 - 125** | **A03,Q02** |
| Barium | DUP | 2031364-27 | 58.203 | 68.534 | | mg/kg | 16.3 | | 20 | | |
| | MS | 2031364-27 | 58.203 | 167.24 | 100.00 | mg/kg | | 109 | | 75 - 125 | |
| | MSD | 2031364-27 | 58.203 | 158.51 | 100.00 | mg/kg | 5.4 | 100 | 20 | 75 - 125 | |
| Beryllium | DUP | 2031364-27 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-27 | ND | 10.931 | 10.000 | mg/kg | | 109 | | 75 - 125 | |
| | MSD | 2031364-27 | ND | 11.038 | 10.000 | mg/kg | 1.0 | 110 | 20 | 75 - 125 | |
| Cadmium | DUP | 2031364-27 | 1.3127 | 1.5020 | | mg/kg | 13.4 | | 20 | | J |
| | MS | 2031364-27 | 1.3127 | 11.904 | 10.000 | mg/kg | | 106 | | 75 - 125 | |
| | MSD | 2031364-27 | 1.3127 | 11.823 | 10.000 | mg/kg | 0.7 | 105 | 20 | 75 - 125 | |
| **Chromium** | DUP | **2031364-27** | **4.5828** | **6.5959** | | **mg/kg** | **36.0** | | **20** | | **A02** |
| | MS | **2031364-27** | **4.5828** | **109.38** | **100.00** | **mg/kg** | | **105** | | **75 - 125** | |
| | MSD | **2031364-27** | **4.5828** | **110.90** | **100.00** | **mg/kg** | **1.4** | **106** | **20** | **75 - 125** | |
| Cobalt | DUP | 2031364-27 | 5.0599 | 5.9449 | | mg/kg | 16.1 | | 20 | | J |
| | MS | 2031364-27 | 5.0599 | 114.47 | 100.00 | mg/kg | | 109 | | 75 - 125 | |
| | MSD | 2031364-27 | 5.0599 | 117.78 | 100.00 | mg/kg | 2.8 | 113 | 20 | 75 - 125 | |
| Copper | DUP | 2031364-27 | 8.3944 | 8.9196 | | mg/kg | 6.1 | | 20 | | J |
| | MS | 2031364-27 | 8.3944 | 110.39 | 100.00 | mg/kg | | 102 | | 75 - 125 | |
| | MSD | 2031364-27 | 8.3944 | 109.60 | 100.00 | mg/kg | 0.7 | 101 | 20 | 75 - 125 | |
| **Lead** | DUP | **2031364-27** | **34.079** | **44.683** | | **mg/kg** | **26.9** | | **20** | | **Q01** |
| | MS | **2031364-27** | **34.079** | **151.49** | **100.00** | **mg/kg** | | **117** | | **75 - 125** | |
| | MSD | **2031364-27** | **34.079** | **143.03** | **100.00** | **mg/kg** | **5.7** | **109** | **20** | **75 - 125** | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091180** | Used client sample: Y - Description: BB-011, 10/20/2020 14:14 | | | | | | | | | | |
| Molybdenum | DUP | 2031364-27 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-27 | ND | 97.516 | 100.00 | mg/kg | | 97.5 | | 75 - 125 | |
| | MSD | 2031364-27 | ND | 102.00 | 100.00 | mg/kg | 4.5 | 102 | 20 | 75 - 125 | |
| **Nickel** | DUP | **2031364-27** | **3.0440** | **3.8778** | | **mg/kg** | **24.1** | | **20** | | **J,A02** |
| | MS | **2031364-27** | **3.0440** | **114.40** | **100.00** | **mg/kg** | | **111** | | **75 - 125** | |
| | MSD | **2031364-27** | **3.0440** | **117.00** | **100.00** | **mg/kg** | **2.2** | **114** | **20** | **75 - 125** | |
| **Selenium** | DUP | **2031364-27** | **3.9250** | **1.5600** | | **mg/kg** | **86.2** | | **20** | | **J,A02** |
| | MS | **2031364-27** | **3.9250** | **30.572** | **25.000** | **mg/kg** | | **107** | | **75 - 125** | |
| | MSD | **2031364-27** | **3.9250** | **28.845** | **25.000** | **mg/kg** | **5.8** | **99.7** | **20** | **75 - 125** | |
| Silver | DUP | 2031364-27 | 2.2771 | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-27 | 2.2771 | 10.569 | 10.000 | mg/kg | | 82.9 | | 75 - 125 | |
| | MSD | 2031364-27 | 2.2771 | 10.252 | 10.000 | mg/kg | 3.0 | 79.7 | 20 | 75 - 125 | |
| Thallium | DUP | 2031364-27 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031364-27 | ND | 11.105 | 10.000 | mg/kg | | 111 | | 75 - 125 | |
| | MSD | 2031364-27 | ND | 11.370 | 10.000 | mg/kg | 2.4 | 114 | 20 | 75 - 125 | |
| **Vanadium** | DUP | **2031364-27** | **20.697** | **28.129** | | **mg/kg** | **30.4** | | **20** | | **Q01** |
| | MS | **2031364-27** | **20.697** | **125.68** | **100.00** | **mg/kg** | | **105** | | **75 - 125** | |
| | MSD | **2031364-27** | **20.697** | **124.78** | **100.00** | **mg/kg** | **0.7** | **104** | **20** | **75 - 125** | |
| **Zinc** | DUP | **2031364-27** | **43.995** | **59.227** | | **mg/kg** | **29.5** | | **20** | | **Q01** |
| | MS | **2031364-27** | **43.995** | **161.68** | **100.00** | **mg/kg** | | **118** | | **75 - 125** | |
| | MSD | **2031364-27** | **43.995** | **160.43** | **100.00** | **mg/kg** | **0.8** | **116** | **20** | **75 - 125** | |
| **QC Batch ID: B091357** | Used client sample: Y - Description: BB-M1-10, 10/22/2020 16:05 | | | | | | | | | | |
| Mercury | DUP | 2031364-10 | 0.020317 | 0.022698 | | mg/kg | 11.1 | | 20 | | J |
| | MS | 2031364-10 | 0.020317 | 0.85873 | 0.79365 | mg/kg | | 106 | | 80 - 120 | |
| | MSD | 2031364-10 | 0.020317 | 0.85556 | 0.79365 | mg/kg | 0.4 | 105 | 20 | 80 - 120 | |
| **QC Batch ID: B091358** | Used client sample: Y - Description: BB-011, 10/20/2020 14:14 | | | | | | | | | | |
| Mercury | DUP | 2031364-27 | 0.76774 | 0.76935 | | mg/kg | 0.2 | | 20 | | |
| | MS | 2031364-27 | 0.76774 | 1.4839 | 0.80645 | mg/kg | | 88.8 | | 80 - 120 | |
| | MSD | 2031364-27 | 0.76774 | 1.5419 | 0.80645 | mg/kg | 3.8 | 96.0 | 20 | 80 - 120 | |
| **QC Batch ID: B091765** | Used client sample: N | | | | | | | | | | |
| Barium | DUP | 2031569-21 | 105.75 | 124.20 | | mg/kg | 16.0 | | 20 | | |
| | MS | 2031569-21 | 105.75 | 199.18 | 100.00 | mg/kg | | 93.4 | | 75 - 125 | |
| | MSD | 2031569-21 | 105.75 | 215.25 | 100.00 | mg/kg | 7.8 | 110 | 20 | 75 - 125 | |
| Beryllium | DUP | 2031569-21 | 0.30755 | 0.33007 | | mg/kg | 7.1 | | 20 | | J |
| | MS | 2031569-21 | 0.30755 | 10.088 | 10.000 | mg/kg | | 97.8 | | 75 - 125 | |
| | MSD | 2031569-21 | 0.30755 | 10.629 | 10.000 | mg/kg | 5.2 | 103 | 20 | 75 - 125 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Total Concentrations (TTLC)

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091765** | Used client sample: N | | | | | | | | | | |
| **Cadmium** | DUP | **2031569-21** | **0.99590** | **1.2695** | | **mg/kg** | **24.2** | | **20** | | **A02** |
| | MS | **2031569-21** | **0.99590** | **10.927** | **10.000** | **mg/kg** | | **99.3** | | **75 - 125** | |
| | MSD | **2031569-21** | **0.99590** | **11.663** | **10.000** | **mg/kg** | **6.5** | **107** | **20** | **75 - 125** | |
| Chromium | DUP | 2031569-21 | 16.118 | 16.823 | | mg/kg | 4.3 | | 20 | | |
| | MS | 2031569-21 | 16.118 | 114.94 | 100.00 | mg/kg | | 98.8 | | 75 - 125 | |
| | MSD | 2031569-21 | 16.118 | 121.37 | 100.00 | mg/kg | 5.4 | 105 | 20 | 75 - 125 | |
| Cobalt | DUP | 2031569-21 | 6.8353 | 7.5738 | | mg/kg | 10.3 | | 20 | | |
| | MS | 2031569-21 | 6.8353 | 103.06 | 100.00 | mg/kg | | 96.2 | | 75 - 125 | |
| | MSD | 2031569-21 | 6.8353 | 107.80 | 100.00 | mg/kg | 4.5 | 101 | 20 | 75 - 125 | |
| Copper | DUP | 2031569-21 | 22.171 | 23.420 | | mg/kg | 5.5 | | 20 | | |
| | MS | 2031569-21 | 22.171 | 122.28 | 100.00 | mg/kg | | 100 | | 75 - 125 | |
| | MSD | 2031569-21 | 22.171 | 130.50 | 100.00 | mg/kg | 6.5 | 108 | 20 | 75 - 125 | |
| Lead | DUP | 2031569-21 | 108.89 | 116.75 | | mg/kg | 7.0 | | 20 | | |
| | MS | 2031569-21 | 108.89 | 191.40 | 100.00 | mg/kg | | 82.5 | | 75 - 125 | |
| | MSD | 2031569-21 | 108.89 | 216.62 | 100.00 | mg/kg | 12.4 | 108 | 20 | 75 - 125 | |
| Molybdenum | DUP | 2031569-21 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031569-21 | ND | 92.449 | 100.00 | mg/kg | | 92.4 | | 75 - 125 | |
| | MSD | 2031569-21 | ND | 96.355 | 100.00 | mg/kg | 4.1 | 96.4 | 20 | 75 - 125 | |
| Nickel | DUP | 2031569-21 | 10.802 | 11.188 | | mg/kg | 3.5 | | 20 | | |
| | MS | 2031569-21 | 10.802 | 110.64 | 100.00 | mg/kg | | 99.8 | | 75 - 125 | |
| | MSD | 2031569-21 | 10.802 | 116.32 | 100.00 | mg/kg | 5.0 | 106 | 20 | 75 - 125 | |
| Silver | DUP | 2031569-21 | ND | ND | | mg/kg | | | 20 | | |
| | MS | 2031569-21 | ND | 9.6823 | 10.000 | mg/kg | | 96.8 | | 75 - 125 | |
| | MSD | 2031569-21 | ND | 10.085 | 10.000 | mg/kg | 4.1 | 101 | 20 | 75 - 125 | |
| Vanadium | DUP | 2031569-21 | 33.477 | 36.289 | | mg/kg | 8.1 | | 20 | | |
| | MS | 2031569-21 | 33.477 | 134.86 | 100.00 | mg/kg | | 101 | | 75 - 125 | |
| | MSD | 2031569-21 | 33.477 | 143.04 | 100.00 | mg/kg | 5.9 | 110 | 20 | 75 - 125 | |
| Zinc | DUP | 2031569-21 | 211.94 | 240.48 | | mg/kg | 12.6 | | 20 | | |
| | MS | 2031569-21 | 211.94 | 299.86 | 100.00 | mg/kg | | 87.9 | | 75 - 125 | |
| | MSD | 2031569-21 | 211.94 | 325.82 | 100.00 | mg/kg | 8.3 | 114 | 20 | 75 - 125 | |
| **QC Batch ID: B091770** | Used client sample: N | | | | | | | | | | |
| Mercury | DUP | 2032263-01 | 0.11629 | 0.11823 | | mg/kg | 1.7 | | 20 | | J |
| | MS | 2032263-01 | 0.11629 | 0.77097 | 0.80645 | mg/kg | | 81.2 | | 80 - 120 | |
| | MSD | 2032263-01 | 0.11629 | 0.76452 | 0.80645 | mg/kg | 0.8 | 80.4 | 20 | 80 - 120 | |
| **QC Batch ID: B091813** | Used client sample: N | | | | | | | | | | |
| Antimony | DUP | 2029141-02RE1 | 0.43925 | 0.47300 | | mg/kg | 7.4 | | 20 | | J |
| | MS | 2029141-02RE1 | 0.43925 | 6.1510 | 10.000 | mg/kg | | 57.1 | | 16 - 119 | |
| | MSD | 2029141-02RE1 | 0.43925 | 6.6395 | 10.000 | mg/kg | 7.6 | 62.0 | 20 | 16 - 119 | |

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

# Total Concentrations (TTLC)

## Quality Control Report - Precision & Accuracy

**QC Batch ID: B091813** Used client sample: N

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Arsenic** | DUP | **2029141-02RE1** | **33.330** | **32.700** | | **mg/kg** | **1.9** | | **20** | | |
| | MS | **2029141-02RE1** | **33.330** | **60.939** | **25.000** | **mg/kg** | | **110** | | **75 - 125** | |
| | MSD | **2029141-02RE1** | **33.330** | **65.248** | **25.000** | **mg/kg** | **6.8** | **128** | **20** | **75 - 125** | **Q03** |
| Selenium | DUP | 2029141-02RE1 | 0.15975 | 0.16550 | | mg/kg | 3.5 | | 20 | | J |
| | MS | 2029141-02RE1 | 0.15975 | 27.504 | 25.000 | mg/kg | | 109 | | 75 - 125 | |
| | MSD | 2029141-02RE1 | 0.15975 | 26.808 | 25.000 | mg/kg | 2.6 | 107 | 20 | 75 - 125 | |
| Thallium | DUP | 2029141-02RE1 | 0.11775 | 0.10975 | | mg/kg | 7.0 | | 20 | | J |
| | MS | 2029141-02RE1 | 0.11775 | 10.420 | 10.000 | mg/kg | | 103 | | 75 - 125 | |
| | MSD | 2029141-02RE1 | 0.11775 | 10.578 | 10.000 | mg/kg | 1.5 | 105 | 20 | 75 - 125 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B090599** | | | | | | |
| Total Recoverable Mercury | B090599-BLK1 | ND | ug/L | 0.20 | 0.022 | |
| **QC Batch ID: B091231** | | | | | | |
| **Total Recoverable Antimony** | **B091231-BLK1** | **0.20100** | **ug/L** | **2.0** | **0.11** | **J** |
| Total Recoverable Arsenic | B091231-BLK1 | ND | ug/L | 2.0 | 0.70 | |
| **Total Recoverable Barium** | **B091231-BLK1** | **0.43600** | **ug/L** | **1.0** | **0.21** | **J** |
| Total Recoverable Beryllium | B091231-BLK1 | ND | ug/L | 1.0 | 0.14 | |
| Total Recoverable Cadmium | B091231-BLK1 | ND | ug/L | 1.0 | 0.11 | |
| **Total Recoverable Chromium** | **B091231-BLK1** | **0.54100** | **ug/L** | **3.0** | **0.50** | **J** |
| Total Recoverable Cobalt | B091231-BLK1 | ND | ug/L | 1.0 | 0.10 | |
| **Total Recoverable Copper** | **B091231-BLK1** | **0.27300** | **ug/L** | **2.0** | **0.22** | **J** |
| Total Recoverable Lead | B091231-BLK1 | ND | ug/L | 1.0 | 0.10 | |
| Total Recoverable Molybdenum | B091231-BLK1 | ND | ug/L | 1.0 | 0.11 | |
| Total Recoverable Nickel | B091231-BLK1 | ND | ug/L | 2.0 | 0.19 | |
| Total Recoverable Selenium | B091231-BLK2 | ND | ug/L | 2.0 | 0.19 | |
| Total Recoverable Silver | B091231-BLK1 | ND | ug/L | 1.0 | 0.10 | |
| Total Recoverable Thallium | B091231-BLK1 | ND | ug/L | 1.0 | 0.10 | |
| Total Recoverable Vanadium | B091231-BLK1 | ND | ug/L | 3.0 | 0.78 | |
| Total Recoverable Zinc | B091231-BLK1 | ND | ug/L | 10 | 1.7 | |
| **QC Batch ID: B091493** | | | | | | |
| Dissolved Antimony | B091493-BLK1 | ND | ug/L | 2.0 | 0.23 | |
| Dissolved Arsenic | B091493-BLK1 | ND | ug/L | 2.0 | 0.38 | |
| Dissolved Barium | B091493-BLK1 | ND | ug/L | 1.0 | 0.066 | |
| Dissolved Beryllium | B091493-BLK1 | ND | ug/L | 1.0 | 0.050 | |
| Dissolved Cadmium | B091493-BLK1 | ND | ug/L | 1.0 | 0.034 | |
| Dissolved Chromium | B091493-BLK1 | ND | ug/L | 3.0 | 0.15 | |
| **Dissolved Cobalt** | **B091493-BLK1** | **0.015000** | **ug/L** | **1.0** | **0.011** | **J** |
| Dissolved Copper | B091493-BLK1 | ND | ug/L | 2.0 | 0.32 | |
| Dissolved Lead | B091493-BLK1 | ND | ug/L | 1.0 | 0.021 | |
| Dissolved Molybdenum | B091493-BLK1 | ND | ug/L | 1.0 | 0.033 | |
| Dissolved Nickel | B091493-BLK1 | ND | ug/L | 2.0 | 0.15 | |
| Dissolved Selenium | B091493-BLK1 | ND | ug/L | 2.0 | 0.25 | |
| Dissolved Silver | B091493-BLK1 | ND | ug/L | 1.0 | 0.015 | |
| Dissolved Thallium | B091493-BLK1 | ND | ug/L | 1.0 | 0.025 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

## Quality Control Report - Method Blank Analysis

| Constituent | QC Sample ID | MB Result | Units | PQL | MDL | Lab Quals |
|---|---|---|---|---|---|---|
| **QC Batch ID: B091493** | | | | | | |
| Dissolved Vanadium | B091493-BLK1 | ND | ug/L | 3.0 | 0.39 | |
| Dissolved Zinc | B091493-BLK1 | ND | ug/L | 5.0 | 2.2 | |
| **QC Batch ID: B091992** | | | | | | |
| Total Recoverable Mercury | B091992-BLK1 | ND | ug/L | 0.20 | 0.022 | |
| **QC Batch ID: B091995** | | | | | | |
| **Dissolved Mercury** | **B091995-BLK1** | **0.045750** | **ug/L** | **0.20** | **0.022** | **J** |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B090599** | | | | | | | | | | |
| Total Recoverable Mercury | B090599-BS1 | LCS | 0.91750 | 1.0000 | ug/L | 91.8 | | 85 - 115 | | |
| **QC Batch ID: B091231** | | | | | | | | | | |
| Total Recoverable Antimony | B091231-BS1 | LCS | 43.016 | 40.000 | ug/L | 108 | | 85 - 115 | | |
| Total Recoverable Arsenic | B091231-BS1 | LCS | 106.46 | 100.00 | ug/L | 106 | | 85 - 115 | | |
| Total Recoverable Barium | B091231-BS1 | LCS | 43.959 | 40.000 | ug/L | 110 | | 85 - 115 | | |
| Total Recoverable Beryllium | B091231-BS1 | LCS | 45.004 | 40.000 | ug/L | 113 | | 85 - 115 | | |
| Total Recoverable Cadmium | B091231-BS1 | LCS | 42.561 | 40.000 | ug/L | 106 | | 85 - 115 | | |
| Total Recoverable Chromium | B091231-BS1 | LCS | 42.454 | 40.000 | ug/L | 106 | | 85 - 115 | | |
| Total Recoverable Cobalt | B091231-BS1 | LCS | 40.627 | 40.000 | ug/L | 102 | | 85 - 115 | | |
| Total Recoverable Copper | B091231-BS1 | LCS | 113.33 | 100.00 | ug/L | 113 | | 85 - 115 | | |
| Total Recoverable Lead | B091231-BS1 | LCS | 113.56 | 100.00 | ug/L | 114 | | 85 - 115 | | |
| Total Recoverable Molybdenum | B091231-BS1 | LCS | 40.958 | 40.000 | ug/L | 102 | | 85 - 115 | | |
| Total Recoverable Nickel | B091231-BS1 | LCS | 101.33 | 100.00 | ug/L | 101 | | 85 - 115 | | |
| Total Recoverable Selenium | B091231-BS2 | LCS | 112.52 | 100.00 | ug/L | 113 | | 85 - 115 | | |
| Total Recoverable Silver | B091231-BS1 | LCS | 43.975 | 40.000 | ug/L | 110 | | 85 - 115 | | |
| Total Recoverable Thallium | B091231-BS1 | LCS | 44.502 | 40.000 | ug/L | 111 | | 85 - 115 | | |
| Total Recoverable Vanadium | B091231-BS1 | LCS | 40.968 | 40.000 | ug/L | 102 | | 85 - 115 | | |
| Total Recoverable Zinc | B091231-BS1 | LCS | 112.67 | 100.00 | ug/L | 113 | | 85 - 115 | | |
| **QC Batch ID: B091493** | | | | | | | | | | |
| Dissolved Antimony | B091493-BS1 | LCS | 39.875 | 40.000 | ug/L | 99.7 | | 85 - 115 | | |
| Dissolved Arsenic | B091493-BS1 | LCS | 104.31 | 100.00 | ug/L | 104 | | 85 - 115 | | |
| Dissolved Barium | B091493-BS1 | LCS | 42.010 | 40.000 | ug/L | 105 | | 85 - 115 | | |
| Dissolved Beryllium | B091493-BS1 | LCS | 39.487 | 40.000 | ug/L | 98.7 | | 85 - 115 | | |
| Dissolved Cadmium | B091493-BS1 | LCS | 40.993 | 40.000 | ug/L | 102 | | 85 - 115 | | |
| Dissolved Chromium | B091493-BS1 | LCS | 42.511 | 40.000 | ug/L | 106 | | 85 - 115 | | |
| Dissolved Cobalt | B091493-BS1 | LCS | 42.666 | 40.000 | ug/L | 107 | | 85 - 115 | | |
| Dissolved Copper | B091493-BS1 | LCS | 104.81 | 100.00 | ug/L | 105 | | 85 - 115 | | |
| Dissolved Lead | B091493-BS1 | LCS | 102.09 | 100.00 | ug/L | 102 | | 85 - 115 | | |
| Dissolved Molybdenum | B091493-BS1 | LCS | 38.895 | 40.000 | ug/L | 97.2 | | 85 - 115 | | |
| Dissolved Nickel | B091493-BS1 | LCS | 107.70 | 100.00 | ug/L | 108 | | 85 - 115 | | |
| Dissolved Selenium | B091493-BS1 | LCS | 105.14 | 100.00 | ug/L | 105 | | 85 - 115 | | |
| Dissolved Silver | B091493-BS1 | LCS | 40.404 | 40.000 | ug/L | 101 | | 85 - 115 | | |
| Dissolved Thallium | B091493-BS1 | LCS | 40.438 | 40.000 | ug/L | 101 | | 85 - 115 | | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

## Quality Control Report - Laboratory Control Sample

| Constituent | QC Sample ID | Type | Result | Spike Level | Units | Percent Recovery | RPD | Control Limits Percent Recovery | Control Limits RPD | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091493** | | | | | | | | | | |
| Dissolved Vanadium | B091493-BS1 | LCS | 40.279 | 40.000 | ug/L | 101 | | 85 - 115 | | |
| Dissolved Zinc | B091493-BS1 | LCS | 104.49 | 100.00 | ug/L | 104 | | 85 - 115 | | |
| **QC Batch ID: B091992** | | | | | | | | | | |
| Total Recoverable Mercury | B091992-BS1 | LCS | 0.96250 | 1.0000 | ug/L | 96.2 | | 85 - 115 | | |
| **QC Batch ID: B091995** | | | | | | | | | | |
| Dissolved Mercury | B091995-BS1 | LCS | 1.0100 | 1.0000 | ug/L | 101 | | 85 - 115 | | |

| ECM Consultants - Costa Mesa | **Reported:** | 02/18/2021 9:27 |
|---|---|---|
| 3525 Hyland Ave | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: | [none] |
| | Project Manager: | David Allison |

# Metals Analysis

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B090599** | Used client sample: N | | | | | | | | | | |
| Total Recoverable Mercury | DUP | 2031912-01 | 0.36000 | 0.34500 | | ug/L | 4.3 | | 20 | | |
| | MS | 2031912-01 | 0.36000 | 1.1575 | 1.0000 | ug/L | | 79.8 | | 70 - 130 | |
| | MSD | 2031912-01 | 0.36000 | 1.1725 | 1.0000 | ug/L | 1.3 | 81.2 | 20 | 70 - 130 | |
| **QC Batch ID: B091231** | Used client sample: Y - Description: RinseateBlank-01, 10/20/2020 17:15 | | | | | | | | | | |
| Total Recoverable Antimony | DUP | 2031364-14 | 0.18400 | 0.22000 | | ug/L | 17.8 | | 20 | | J |
| | MS | 2031364-14 | 0.18400 | 41.719 | 40.000 | ug/L | | 104 | | 70 - 130 | |
| | MSD | 2031364-14 | 0.18400 | 44.306 | 40.000 | ug/L | 6.0 | 110 | 20 | 70 - 130 | |
| Total Recoverable Arsenic | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 104.02 | 100.00 | ug/L | | 104 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 105.81 | 100.00 | ug/L | 1.7 | 106 | 20 | 70 - 130 | |
| Total Recoverable Barium | DUP | 2031364-14 | 0.43700 | 0.39300 | | ug/L | 10.6 | | 20 | | J |
| | MS | 2031364-14 | 0.43700 | 43.474 | 40.000 | ug/L | | 108 | | 70 - 130 | |
| | MSD | 2031364-14 | 0.43700 | 44.442 | 40.000 | ug/L | 2.2 | 110 | 20 | 70 - 130 | |
| Total Recoverable Beryllium | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 44.519 | 40.000 | ug/L | | 111 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 46.609 | 40.000 | ug/L | 4.6 | 117 | 20 | 70 - 130 | |
| Total Recoverable Cadmium | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 41.892 | 40.000 | ug/L | | 105 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 43.540 | 40.000 | ug/L | 3.9 | 109 | 20 | 70 - 130 | |
| **Total Recoverable Chromium** | DUP | **2031364-14** | **0.81700** | **1.3480** | | **ug/L** | **49.1** | | **20** | | **J,A02** |
| | MS | **2031364-14** | **0.81700** | **42.760** | **40.000** | **ug/L** | | **105** | | **70 - 130** | |
| | MSD | **2031364-14** | **0.81700** | **43.448** | **40.000** | **ug/L** | **1.6** | **107** | **20** | **70 - 130** | |
| Total Recoverable Cobalt | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 41.038 | 40.000 | ug/L | | 103 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 41.450 | 40.000 | ug/L | 1.0 | 104 | 20 | 70 - 130 | |
| **Total Recoverable Copper** | DUP | **2031364-14** | **0.38000** | **0.54600** | | **ug/L** | **35.9** | | **20** | | **J,A02** |
| | MS | **2031364-14** | **0.38000** | **111.18** | **100.00** | **ug/L** | | **111** | | **70 - 130** | |
| | MSD | **2031364-14** | **0.38000** | **114.23** | **100.00** | **ug/L** | **2.7** | **114** | **20** | **70 - 130** | |
| Total Recoverable Lead | DUP | 2031364-14 | ND | 0.16200 | | ug/L | | | 20 | | J |
| | MS | 2031364-14 | ND | 111.70 | 100.00 | ug/L | | 112 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 115.16 | 100.00 | ug/L | 3.0 | 115 | 20 | 70 - 130 | |
| **Total Recoverable Molybdenum** | DUP | **2031364-14** | **0.61300** | **0.18200** | | **ug/L** | **108** | | **20** | | **J,A02** |
| | MS | **2031364-14** | **0.61300** | **39.366** | **40.000** | **ug/L** | | **96.9** | | **70 - 130** | |
| | MSD | **2031364-14** | **0.61300** | **41.812** | **40.000** | **ug/L** | **6.0** | **103** | **20** | **70 - 130** | |
| Total Recoverable Nickel | DUP | 2031364-14 | ND | 0.28400 | | ug/L | | | 20 | | J |
| | MS | 2031364-14 | ND | 99.430 | 100.00 | ug/L | | 99.4 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 103.47 | 100.00 | ug/L | 4.0 | 103 | 20 | 70 - 130 | |

| | |
|---|---|
| ECM Consultants - Costa Mesa | **Reported:** 02/18/2021 9:27 |
| 3525 Hyland Ave | Project: USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | Project Number: [none] |
| | Project Manager: David Allison |

# Metals Analysis

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091231** | Used client sample: Y - Description: RinseateBlank-01, 10/20/2020 17:15 | | | | | | | | | | |
| Total Recoverable Selenium | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 112.70 | 100.00 | ug/L | | 113 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 116.40 | 100.00 | ug/L | 3.2 | 116 | 20 | 70 - 130 | |
| Total Recoverable Silver | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 41.884 | 40.000 | ug/L | | 105 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 42.854 | 40.000 | ug/L | 2.3 | 107 | 20 | 70 - 130 | |
| Total Recoverable Thallium | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 44.047 | 40.000 | ug/L | | 110 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 45.141 | 40.000 | ug/L | 2.5 | 113 | 20 | 70 - 130 | |
| Total Recoverable Vanadium | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 40.007 | 40.000 | ug/L | | 100 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 43.022 | 40.000 | ug/L | 7.3 | 108 | 20 | 70 - 130 | |
| Total Recoverable Zinc | DUP | 2031364-14 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031364-14 | ND | 111.09 | 100.00 | ug/L | | 111 | | 70 - 130 | |
| | MSD | 2031364-14 | ND | 114.61 | 100.00 | ug/L | 3.1 | 115 | 20 | 70 - 130 | |
| **QC Batch ID: B091493** | Used client sample: N | | | | | | | | | | |
| Dissolved Antimony | DUP | 2031808-01 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | ND | 206.59 | 204.08 | ug/L | | 101 | | 70 - 130 | |
| | MSD | 2031808-01 | ND | 207.79 | 204.08 | ug/L | 0.6 | 102 | 20 | 70 - 130 | |
| **Dissolved Arsenic** | DUP | **2031808-01** | **8.2300** | **15.525** | | **ug/L** | **61.4** | | **20** | | A02 |
| | MS | **2031808-01** | **8.2300** | **566.87** | **510.20** | **ug/L** | | **109** | | **70 - 130** | |
| | MSD | **2031808-01** | **8.2300** | **570.34** | **510.20** | **ug/L** | **0.6** | **110** | **20** | **70 - 130** | |
| Dissolved Barium | DUP | 2031808-01 | 15.315 | 15.980 | | ug/L | 4.2 | | 20 | | |
| | MS | 2031808-01 | 15.315 | 222.92 | 204.08 | ug/L | | 102 | | 70 - 130 | |
| | MSD | 2031808-01 | 15.315 | 223.22 | 204.08 | ug/L | 0.1 | 102 | 20 | 70 - 130 | |
| Dissolved Beryllium | DUP | 2031808-01 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | ND | 199.48 | 204.08 | ug/L | | 97.7 | | 70 - 130 | |
| | MSD | 2031808-01 | ND | 206.76 | 204.08 | ug/L | 3.6 | 101 | 20 | 70 - 130 | |
| Dissolved Cadmium | DUP | 2031808-01 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | ND | 201.29 | 204.08 | ug/L | | 98.6 | | 70 - 130 | |
| | MSD | 2031808-01 | ND | 197.81 | 204.08 | ug/L | 1.7 | 96.9 | 20 | 70 - 130 | |
| Dissolved Chromium | DUP | 2031808-01 | 2.6750 | 2.8300 | | ug/L | 5.6 | | 20 | | J |
| | MS | 2031808-01 | 2.6750 | 197.56 | 204.08 | ug/L | | 95.5 | | 70 - 130 | |
| | MSD | 2031808-01 | 2.6750 | 198.33 | 204.08 | ug/L | 0.4 | 95.9 | 20 | 70 - 130 | |
| Dissolved Cobalt | DUP | 2031808-01 | 1.6200 | 1.7500 | | ug/L | 7.7 | | 20 | | J |
| | MS | 2031808-01 | 1.6200 | 187.49 | 204.08 | ug/L | | 91.1 | | 70 - 130 | |
| | MSD | 2031808-01 | 1.6200 | 190.30 | 204.08 | ug/L | 1.5 | 92.5 | 20 | 70 - 130 | |

ECM Consultants - Costa Mesa
3525 Hyland Ave
Costa Mesa, CA 92626

**Reported:** 02/18/2021 9:27
Project: USFS- Big Blue Mill
Project Number: [none]
Project Manager: David Allison

# Metals Analysis

## Quality Control Report - Precision & Accuracy

| Constituent | Type | Source Sample ID | Source Result | Result | Spike Added | Units | RPD | Percent Recovery | Control Limits RPD | Control Limits Percent Recovery | Lab Quals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **QC Batch ID: B091493** | Used client sample: N | | | | | | | | | | |
| Dissolved Copper | DUP | 2031808-01 | 8.4100 | 8.7700 | | ug/L | 4.2 | | 20 | | J |
| | MS | 2031808-01 | 8.4100 | 502.70 | 510.20 | ug/L | | 96.9 | | 70 - 130 | |
| | MSD | 2031808-01 | 8.4100 | 505.90 | 510.20 | ug/L | 0.6 | 97.5 | 20 | 70 - 130 | |
| Dissolved Lead | DUP | 2031808-01 | 0.10000 | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | 0.10000 | 480.24 | 510.20 | ug/L | | 94.1 | | 70 - 130 | |
| | MSD | 2031808-01 | 0.10000 | 488.11 | 510.20 | ug/L | 1.6 | 95.7 | 20 | 70 - 130 | |
| Dissolved Molybdenum | DUP | 2031808-01 | 9.6150 | 9.0700 | | ug/L | 5.8 | | 20 | | |
| | MS | 2031808-01 | 9.6150 | 220.51 | 204.08 | ug/L | | 103 | | 70 - 130 | |
| | MSD | 2031808-01 | 9.6150 | 223.21 | 204.08 | ug/L | 1.2 | 105 | 20 | 70 - 130 | |
| Dissolved Nickel | DUP | 2031808-01 | 16.425 | 17.290 | | ug/L | 5.1 | | 20 | | |
| | MS | 2031808-01 | 16.425 | 466.16 | 510.20 | ug/L | | 88.1 | | 70 - 130 | |
| | MSD | 2031808-01 | 16.425 | 475.27 | 510.20 | ug/L | 1.9 | 89.9 | 20 | 70 - 130 | |
| Dissolved Selenium | DUP | 2031808-01 | 67.840 | 62.045 | | ug/L | 8.9 | | 20 | | |
| | MS | 2031808-01 | 67.840 | 593.55 | 510.20 | ug/L | | 103 | | 70 - 130 | |
| | MSD | 2031808-01 | 67.840 | 619.72 | 510.20 | ug/L | 4.3 | 108 | 20 | 70 - 130 | |
| Dissolved Silver | DUP | 2031808-01 | 0.16500 | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | 0.16500 | 198.84 | 204.08 | ug/L | | 97.4 | | 70 - 130 | |
| | MSD | 2031808-01 | 0.16500 | 195.46 | 204.08 | ug/L | 1.7 | 95.7 | 20 | 70 - 130 | |
| Dissolved Thallium | DUP | 2031808-01 | ND | ND | | ug/L | | | 20 | | |
| | MS | 2031808-01 | ND | 194.23 | 204.08 | ug/L | | 95.2 | | 70 - 130 | |
| | MSD | 2031808-01 | ND | 197.28 | 204.08 | ug/L | 1.6 | 96.7 | 20 | 70 - 130 | |
| **Dissolved Vanadium** | DUP | **2031808-01** | **4.9750** | **2.6550** | | **ug/L** | **60.8** | | **20** | | **J,A02** |
| | MS | **2031808-01** | **4.9750** | **205.82** | **204.08** | **ug/L** | | **98.4** | | **70 - 130** | |
| | MSD | **2031808-01** | **4.9750** | **204.66** | **204.08** | **ug/L** | **0.6** | **97.8** | **20** | **70 - 130** | |
| Dissolved Zinc | DUP | 2031808-01 | 11.185 | 11.560 | | ug/L | 3.3 | | 20 | | J |
| | MS | 2031808-01 | 11.185 | 512.85 | 510.20 | ug/L | | 98.3 | | 70 - 130 | |
| | MSD | 2031808-01 | 11.185 | 504.31 | 510.20 | ug/L | 1.7 | 96.7 | 20 | 70 - 130 | |
| **QC Batch ID: B091992** | Used client sample: N | | | | | | | | | | |
| Total Recoverable Mercury | DUP | 2031529-01 | 0.16625 | 0.14050 | | ug/L | 16.8 | | 20 | | J |
| | MS | 2031529-01 | 0.16625 | 1.1100 | 1.0000 | ug/L | | 94.4 | | 70 - 130 | |
| | MSD | 2031529-01 | 0.16625 | 1.0825 | 1.0000 | ug/L | 2.5 | 91.6 | 20 | 70 - 130 | |
| **QC Batch ID: B091995** | Used client sample: N | | | | | | | | | | |
| Dissolved Mercury | DUP | 2031228-01 | 0.35250 | 0.29750 | | ug/L | 16.9 | | 20 | | |
| | MS | 2031228-01 | 0.35250 | 1.3225 | 1.0000 | ug/L | | 97.0 | | 70 - 130 | |
| | MSD | 2031228-01 | 0.35250 | 1.3150 | 1.0000 | ug/L | 0.6 | 96.2 | 20 | 70 - 130 | |

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

December 02, 2020

Analytical Report for Service Request No: K2009986

Tina Green
BC Laboratories, Inc.
4100 Atlas Court
Bakersfield, CA 93308

RE: EPA 1340 IVBA Metals

Dear Tina,

Enclosed are the results of the sample(s) submitted to our laboratory November 02, 2020
For your reference, these analyses have been assigned our service request number K2009986.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 3364. You may also contact me via email at howard.holmes@alsglobal.com.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Howard Holmes
Project Manager

ALS Environmental
ALS Group USA, Corp
1317 South 13th Avenue
Kelso, WA 98626
T : +1 360 577 7222
F : +1 360 636 1068
www.alsglobal.com

# Table of Contents

## Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| A2LA | American Association for Laboratory Accreditation |
| CARB | California Air Resources Board |
| CAS Number | Chemical Abstract Service registry Number |
| CFC | Chlorofluorocarbon |
| CFU | Colony-Forming Unit |
| DEC | Department of Environmental Conservation |
| DEQ | Department of Environmental Quality |
| DHS | Department of Health Services |
| DOE | Department of Ecology |
| DOH | Department of Health |
| EPA | U. S. Environmental Protection Agency |
| ELAP | Environmental Laboratory Accreditation Program |
| GC | Gas Chromatography |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| LOD | Limit of Detection |
| LOQ | Limit of Quantitation |
| LUFT | Leaking Underground Fuel Tank |
| M | Modified |
| MCL | Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA. |
| MDL | Method Detection Limit |
| MPN | Most Probable Number |
| MRL | Method Reporting Limit |
| NA | Not Applicable |
| NC | Not Calculated |
| NCASI | National Council of the Paper Industry for Air and Stream Improvement |
| ND | Not Detected |
| NIOSH | National Institute for Occupational Safety and Health |
| PQL | Practical Quantitation Limit |
| RCRA | Resource Conservation and Recovery Act |
| SIM | Selected Ion Monitoring |
| TPH | Total Petroleum Hydrocarbons |
| tr | Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL. |

## Inorganic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- E The result is an estimate amount because the value exceeded the instrument calibration range.
- J The result is an estimated value.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.
- H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

## Metals Data Qualifiers

- # The control limit criteria is not applicable. See case narrative.
- J The result is an estimated value.
- E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
- M The duplicate injection precision was not met.
- N The Matrix Spike sample recovery is not within control limits. See case narrative.
- S The reported value was determined by the Method of Standard Additions (MSA).
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
- i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
- X See case narrative.
- \+ The correlation coefficient for the MSA is less than 0.995.
- Q See case narrative. One or more quality control criteria was outside the limits.

## Organic Data Qualifiers

- * The result is an outlier. See case narrative.
- # The control limit criteria is not applicable. See case narrative.
- A A tentatively identified compound, a suspected aldol-condensation product.
- B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
- C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
- D The reported result is from a dilution.
- E The result is an estimated value.
- J The result is an estimated value.
- N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
- P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
- U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
- i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
- X See case narrative.
- Q See case narrative. One or more quality control criteria was outside the limits.

## Additional Petroleum Hydrocarbon Specific Qualifiers

- F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
- L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
- H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
- O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
- Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
- Z The chromatographic fingerprint does not resemble a petroleum product.

## ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
## State Certifications, Accreditations, and Licenses

| Agency | Web Site | Number |
|---|---|---|
| Alaska DEH | http://dec.alaska.gov/eh/lab/cs/csapproval.htm | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2795 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L16-58-R4 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Hawaii DOH | http://health.hawaii.gov/ | - |
| ISO 17025 | http://www.pjlabs.com/ | L16-57 |
| Louisiana DEQ | http://www.deq.louisiana.gov/page/la-lab-accreditation | 03016 |
| Maine DHS | http://www.maine.gov/dhhs/ | WA01276 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA01276 |
| New Jersey DEP | http://www.nj.gov/dep/enforcement/oqa.html | WA005 |
| New York - DOH | https://www.wadsworth.org/regulatory/elap | 12060 |
| North Carolina DEQ | https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/laboratory-certification-branch/non-field-lab-certification | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA100010 |
| South Carolina DHEC | http://www.scdhec.gov/environment/EnvironmentalLabCertification/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | T104704427 |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C544 |
| Wyoming (EPA Region 8) | https://www.epa.gov/region8-waterops/epa-region-8-certified-drinking-water | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

# Case Narrative

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

RIGHT SOLUTIONS | RIGHT PARTNER

1317 South 13th Ave, Kelso, WA 98626 | 1-360-577-7222 | www.alsglobal.com

ALS Environmental

**Client:** BC Laboratories, Incorporated **Service Request:** K2009986
**Project:** EPA 1340 IVBA Metals **Date Received:** 11/02/2020
**Sample Matrix:** Soil

## CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples for the Tier II level requested by the client.

**Sample Receipt:**

Two soil samples were received for analysis at ALS Environmental on 11/02/2020. Any discrepancies upon initial sample inspection are annotated on the sample receipt and preservation form included within this report. The samples were stored at minimum in accordance with the analytical method requirements.

**Metals:**

Method 6020A, 11/30/2020: The matrix spike recovery of Antimony for sample 2031364-29 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential low bias in this matrix. No further corrective action was appropriate.

Method 7471B, 11/23/2020: The matrix spike recovery of Mercury for sample 2031364-29 was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential high bias in this matrix. No further corrective action was appropriate.

Approved by ____________ Date 12/02/2020

ALS Environmental

# Chain of Custody

ALS Environmental—Kelso Laboratory
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

To: ALS

K2009986

BC LABORATORIES, INC.

4100 Atlas Ct. – Bakersfield, CA 93308 – 661.327.4911 – Fax: 661.327.1918 – www.bclabs.com

# Chain of Custody Form

Report To:
Client: BC labs
Attn: Tina Green
Street Address: 4100 Atlas Ct
City, State, Zip: Bak. CA 93308
Phone: Fax:
Email: tina@bclabs.com
Work Order #:

Project #:
Project Name:
Sampler(s):

Analysis Requested: Bioavailability By 1340 Sb, As, Pb, Hg

Page ___ of ___

Comments:

Result Request **Surcharge: ☐ STD (10 Day) ☐ 5 Day** ☐ 4 Day** ☐ 3 Day** ☐ 2 Day** ☐ 1 Day**

| Sample # | Description | Date Sampled | Time Sampled | Bioavailability By 1340 Sb, As, Pb, Hg | Sample Matrix: Soil / Sludge / Drinking Water / Ground Water / Waste Water / Other | Notes |
|---|---|---|---|---|---|---|
| | 2031364-22 | 10/22/20 | 1023 | X | | JR/ |
| | 2031364-29 | 10/20/20 | 1442 | X | | JR/ |

Billing: ☒ Same as above
Client:
Address:
City: State: Zip:
Attn:
P.O. #:

*Send Copy to State of CA? (EDT) ☐ Yes ☒ No
System # (Needed for EDT)

EDF Required Geotracker ☐ Yes ☒ No Global ID

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished By: [signature] | 10-30-20 | 1230 | 1. Received By: [signature] | 11/2/20 | 1000 |
| 2. Relinquished By | | | 2. Received By | | |
| 3. Relinquished By | | | 3. Received By | | |

*For Drinking Water, mark "EDT - yes or no." If marked no, BCL will not upload at a future date.

Page 9 of 35

PM HH

## Cooler Receipt and Preservation Form

Client BC Labs Service Request K20 09986
Received: 11/2/20 Opened: 11/2/20 By: NP Unloaded: 11/2/20 By: NP

1. Samples were received via? (USPS) Fed Ex UPS DHL PDX Courier Hand Delivered
2. Samples were received in: (circle) (Cooler) Box Envelope Other ______ NA
3. Were custody seals on coolers? NA Y (N) If yes, how many and where? ______
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Was a Temperature Blank present in cooler? NA Y (N) If yes, notate the temperature in the appropriate column below:
   If no, take the temperature of a representative sample bottle contained within the cooler; notate in the column "Sample Temp":
5. Were samples received within the method specified temperature ranges? NA Y (N)
   If no, were they received on ice and same day as collected? If not, notate the cooler # below and notify the PM. NA Y (N)
   If applicable, tissue samples were received: Frozen Partially Thawed Thawed

| Temp Blank | Sample Temp | IR Gun | Cooler #/COC ID/(NA) | Out of temp indicate with "X" | PM Notified If out of temp | Tracking Number NA | Filed |
|---|---|---|---|---|---|---|---|
| S-9NP | 8.9 | IR01 | | X | Yes | 1105710302037182 | |
| | | | | | | 9637 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

6. Packing material: Inserts Baggies ~~Bubble Wrap~~ Gel Packs (Wet Ice) Dry Ice Sleeves ______
7. Were custody papers properly filled out (ink, signed, etc.)? NA (Y) N
8. Were samples received in good condition (unbroken) NA (Y) N
9. Were all sample labels complete (ie. analysis, preservation, etc.)? NA (Y) N
10. Did all sample labels and tags agree with custody papers? NA (Y) N
11. Were appropriate bottles/containers and volumes received for the tests indicated? NA (Y) N
12. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* (NA) Y N
13. Were VOA vials received without headspace? *Indicate in the table below.* (NA) Y N
14. Was Cl2/Res negative? (NA) Y N

| Sample ID on Bottle | Sample ID on COC | Identified by: |
|---|---|---|
| | | |
| | | |
| | | |

| Sample ID | Bottle Count Bottle Type | Head-space | Broke | pH | Reagent | Volume added | Reagent Lot Number | Initials | Time |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Notes, Discrepancies, Resolutions:______

# Metals

**ALS Environmental—Kelso Laboratory**
1317 South 13th Avenue, Kelso, WA 98626
Phone (360)577-7222 Fax (360)636-1068
www.alsglobal.com

RIGHT SOLUTIONS | RIGHT PARTNER

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/22/2020 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/2/2020 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | NA |

Bioaccessibility Value
Analyte: Antimony
Units: Percent (%)

| Sample Name | Lab Code | Result |
|---|---|---|
| 2033164-22 | K2009986-001 | 2.7 |
| 2031364-29 | K2009986-002 | <1.0 |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/22/2020 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/2/2020 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | NA |

Bioaccessibility Value
Analyte: Arsenic
Units: Percent (%)

| Sample Name | Lab Code | Result |
|---|---|---|
| 2033164-22 | K2009986-001 | 3.2 |
| 2031364-29 | K2009986-002 | <1.0 |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/22/2020 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/2/2020 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | NA |

Bioaccessibility Value
Analyte: Lead
Units: Percent (%)

| Sample Name | Lab Code | Result |
|---|---|---|
| 2033164-22 | K2009986-001 | 15.8 |
| 2031364-29 | K2009986-002 | 92.4 |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/22/2020 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/2/2020 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | NA |

Bioaccessibility Value
Analyte: Mercury
Units: Percent (%)

| Sample Name | Lab Code | Result |
|---|---|---|
| 2033164-22 | K2009986-001 | <1.0 |
| 2031364-29 | K2009986-002 | 1.1 |

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

**Client:** BC Laboratories, Incorporated
**Project:** EPA 1340 IVBA Metals
**Sample Matrix:** Soil
**Service Request:** K2009986
**Date Collected:** 10/22/20 10:33
**Date Received:** 11/02/20 10:00

**Sample Name:** 2033164-22
**Lab Code:** K2009986-001
**Basis:** Dry

**Total Metals – IVBA Analysis**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | **76.1** | mg/Kg | 0.19 | 20 | 11/30/20 16:51 | 11/18/20 | |
| Arsenic | 6020A | **35200** | mg/Kg | 97 | 1000 | 11/30/20 17:04 | 11/18/20 | |
| Lead | 6020A | **3220** | mg/Kg | 0.19 | 20 | 11/30/20 16:51 | 11/18/20 | |
| Mercury | 7471B | **67.6** | mg/Kg | 2.0 | 100 | 11/17/20 13:03 | 11/17/20 | |

Printed 12/1/2020 5:10:33 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/22/20 10:33 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 10:00 |
| **Sample Name:** | 2033164-22 | **Basis:** | Dry |
| **Lab Code:** | K2009986-001 | | |

**IVBA Metals**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | **2.06** | mg/Kg | 0.20 | 20 | 11/30/20 15:17 | 11/19/20 | |
| Arsenic | 6020A | **1120** | mg/Kg | 2.0 | 20 | 11/30/20 15:17 | 11/19/20 | |
| Lead | 6020A | **510** | mg/Kg | 0.20 | 20 | 11/30/20 15:17 | 11/19/20 | |
| Mercury | 7471B | **ND U** | mg/Kg | 0.40 | 20 | 11/23/20 14:31 | 11/20/20 | |

Printed 12/1/2020 5:10:33 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 14:42 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 10:00 |
| **Sample Name:** | 2031364-29 | **Basis:** | Dry |
| **Lab Code:** | K2009986-002 | | |

**Total Metals – IVBA Analysis**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | **47.8** | mg/Kg | 0.20 | 20 | 11/30/20 16:53 | 11/18/20 | |
| Arsenic | 6020A | **58800** | mg/Kg | 100 | 1000 | 11/30/20 17:07 | 11/18/20 | |
| Lead | 6020A | **2250** | mg/Kg | 0.20 | 20 | 11/30/20 16:53 | 11/18/20 | |
| Mercury | 7471B | **956** | mg/Kg | 80 | 4000 | 11/17/20 13:26 | 11/17/20 | |

Printed 12/1/2020 5:10:33 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 14:42 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 10:00 |
| **Sample Name:** | 2031364-29 | **Basis:** | Dry |
| **Lab Code:** | K2009986-002 | | |

**IVBA Metals**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | **0.43** | mg/Kg | 0.20 | 20 | 11/30/20 15:19 | 11/19/20 | |
| Arsenic | 6020A | **109** | mg/Kg | 2.0 | 20 | 11/30/20 15:19 | 11/19/20 | |
| Lead | 6020A | **2080** | mg/Kg | 0.20 | 20 | 11/30/20 15:19 | 11/19/20 | |
| Mercury | 7471B | **10.8** | mg/Kg | 0.40 | 20 | 11/23/20 14:33 | 11/20/20 | |

Printed 12/1/2020 5:10:33 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | Dry |
| **Lab Code:** | KQ2018111-01 | | |

**Total Metals – IVBA Analysis**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | ND U | mg/Kg | 0.050 | 5 | 11/30/20 16:47 | 11/18/20 | |
| Arsenic | 6020A | ND U | mg/Kg | 0.50 | 5 | 11/30/20 16:47 | 11/18/20 | |
| Lead | 6020A | ND U | mg/Kg | 0.050 | 5 | 11/30/20 16:47 | 11/18/20 | |

Printed 12/1/2020 5:10:34 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | Dry |
| **Lab Code:** | KQ2018110-01 | | |

## IVBA Metals

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Antimony | 6020A | ND U | mg/Kg | 0.050 | 5 | 11/30/20 15:11 | 11/19/20 | |
| Arsenic | 6020A | ND U | mg/Kg | 0.50 | 5 | 11/30/20 15:11 | 11/19/20 | |
| Lead | 6020A | ND U | mg/Kg | 0.050 | 5 | 11/30/20 15:11 | 11/19/20 | |

Printed 12/1/2020 5:10:34 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | Dry |
| **Lab Code:** | KQ2018050-01 | | |

**Total Metals - IVBA Analysis**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury | 7471B | ND U | mg/Kg | 0.020 | 1 | 11/17/20 12:40 | 11/17/20 | |

Printed 12/1/2020 5:10:35 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | NA |
| **Sample Matrix:** | Soil | **Date Received:** | NA |
| **Sample Name:** | Method Blank | **Basis:** | Dry |
| **Lab Code:** | KQ2018397-01 | | |

**IVBA Metals**

| Analyte Name | Analysis Method | Result | Units | MRL | Dil. | Date Analyzed | Date Extracted | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury | 7471B | ND U | mg/Kg | 0.40 | 20 | 11/23/20 14:26 | 11/20/20 | |

Printed 12/1/2020 5:10:35 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/30/20 |

**Replicate Sample Summary**
**Total Metals – IVBA Analysis**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |

| Analyte Name | Analysis Method | MRL | Sample Result | Duplicate Sample KQ2018111-03 Result | Average | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|
| Antimony | 6020A | 0.20 | 47.8 | 44.4 | 46.1 | 7 | 20 |
| Arsenic | 6020A | 99 | 58800 | 57600 | 58200 | 2 | 20 |
| Lead | 6020A | 0.20 | 2250 | 2110 | 2180 | 6 | 20 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 12/1/2020 5:10:34 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/30/20 |

## Replicate Sample Summary
## IVBA Metals

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |

| Analyte Name | Analysis Method | MRL | Sample Result | Duplicate Sample KQ2018110-04 Result | Average | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|
| Antimony | 6020A | 0.20 | 0.43 | 0.41 | 0.42 | 5 | 20 |
| Arsenic | 6020A | 2.0 | 109 | 104 | 107 | 5 | 20 |
| Lead | 6020A | 0.20 | 2080 | 2040 | 2060 | 2 | 20 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 12/1/2020 5:10:34 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/17/20 |

**Replicate Sample Summary**
**Total Metals - IVBA Analysis**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |

| Analyte Name | Analysis Method | MRL | Sample Result | Duplicate Sample KQ2018050-03 Result | Average | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|
| Mercury | 7471B | 78 | 956 | 988 | 972 | 3 | 20 |

Results flagged with an asterisk (*) indicate values outside control criteria.
Results flagged with a pound (#) indicate the control criteria is not applicable.
Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 12/1/2020 5:10:35 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/23/20 |

**Replicate Sample Summary**
**IVBA Metals**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |

| Analyte Name | Analysis Method | MRL | Sample Result | Duplicate Sample KQ2018397-04 Result | Average | RPD | RPD Limit |
|---|---|---|---|---|---|---|---|
| Mercury | 7471B | 0.39 | 10.8 | 10.5 | 10.7 | 3 | 20 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Printed 12/1/2020 5:10:35 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/30/20 |
| | | **Date Extracted:** | 11/18/20 |

**Matrix Spike Summary**
**Total Metals – IVBA Analysis**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |
| **Analysis Method:** | 6020A | | |
| **Prep Method:** | EPA 3050B | | |

**Matrix Spike**
KQ2018111-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Antimony | 47.8 | 141 | 99.0 | 94 | 75-125 |
| Arsenic | 58800 | 58100 | 99 | -687 # | 75-125 |
| Lead | 2250 | 2390 | 99.0 | 135 # | 75-125 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.**

Printed 12/1/2020 5:10:34 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/30/20 |
| | | **Date Extracted:** | 11/19/20 |

**Matrix Spike Summary**
**IVBA Metals**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |
| **Analysis Method:** | 6020A | | |
| **Prep Method:** | EPA 9200.2-86 | | |

**Matrix Spike**
KQ2018110-05

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Antimony | 0.43 | 72.1 | 98.0 | 73 N | 75-125 |
| Arsenic | 109 | 199 | 98.0 | 92 | 75-125 |
| Lead | 2080 | 2070 | 98.0 | -8 # | 75-125 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.**

Printed 12/1/2020 5:10:34 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**
QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/17/20 |
| | | **Date Extracted:** | 11/17/20 |

**Matrix Spike Summary Total**
**Metals - IVBA Analysis**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |
| **Analysis Method:** | 7471B | | |
| **Prep Method:** | Method | | |

**Matrix Spike**
KQ2018050-04

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Mercury | 956 | 1000 | 0.5 | 9776 # | 80-120 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.**

Printed 12/1/2020 5:10:35 PM Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Collected:** | 10/20/20 |
| **Sample Matrix:** | Soil | **Date Received:** | 11/02/20 |
| | | **Date Analyzed:** | 11/23/20 |
| | | **Date Extracted:** | 11/20/20 |

**Matrix Spike Summary**
**IVBA Metals**

| | | | |
|---|---|---|---|
| **Sample Name:** | 2031364-29 | **Units:** | mg/Kg |
| **Lab Code:** | K2009986-002 | **Basis:** | Dry |
| **Analysis Method:** | 7471B | | |
| **Prep Method:** | Method | | |

**Matrix Spike**
KQ2018397-05

| Analyte Name | Sample Result | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Mercury | 10.8 | 26.3 | 11.8 | 131 N | 80-120 |

**Results flagged with an asterisk (*) indicate values outside control criteria.**

**Results flagged with a pound (#) indicate the control criteria is not applicable.**

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

**Matrix Spike and Matrix Spike Duplicate Data is presented for information purposes only. The matrix may or may not be relevant to samples reported in this report. The laboratory evaluates system performance based on the LCS and LCSD control limits.**

Printed 12/1/2020 5:10:35 PM Superset Reference:

**ALS Group USA, Corp.**
dba ALS Environmental

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Analyzed:** | 11/30/20 |
| **Sample Matrix:** | Soil | | |

**Lab Control Sample Summary**
**Total Metals – IVBA Analysis**

**Units:**mg/Kg
**Basis:**Dry

**Lab Control Sample**
KQ2018111-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Antimony | 6020A | 82.6 | 228 | 36 | 10-132 |
| Arsenic | 6020A | 93.8 | 104 | 90 | 64-119 |
| Lead | 6020A | 102 | 92.4 | 110 | 70-130 |

Printed 12/1/2020 5:10:34 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | BC Laboratories, Incorporated | **Service Request:** | K2009986 |
| **Project:** | EPA 1340 IVBA Metals | **Date Analyzed:** | 11/30/20 |
| **Sample Matrix:** | Soil | | |

## Lab Control Sample Summary
## IVBA Metals

**Units:**mg/Kg
**Basis:**Dry

**Lab Control Sample**
KQ2018110-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Antimony | 6020A | 102 | 100 | 102 | 80-120 |
| Arsenic | 6020A | 97.7 | 100 | 98 | 80-120 |
| Lead | 6020A | 106 | 100 | 106 | 80-120 |

Printed 12/1/2020 5:10:34 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

**Client:** BC Laboratories, Incorporated
**Project:** EPA 1340 IVBA Metals
**Sample Matrix:** Soil

**Service Request:** K2009986
**Date Analyzed:** 11/17/20

**Lab Control Sample Summary**
**Total Metals - IVBA Analysis**

**Units:**mg/Kg
**Basis:**Dry

**Lab Control Sample**
KQ2018050-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Mercury | 7471B | 18.5 | 26.6 | 70 | 41-110 |

Printed 12/1/2020 5:10:35 PM

Superset Reference:

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

**Client:** BC Laboratories, Incorporated
**Project:** EPA 1340 IVBA Metals
**Sample Matrix:** Soil

**Service Request:** K2009986
**Date Analyzed:** 11/23/20

**Lab Control Sample Summary**
**IVBA Metals**

**Units:**mg/Kg
**Basis:**Dry

**Lab Control Sample**
KQ2018397-02

| Analyte Name | Analytical Method | Result | Spike Amount | % Rec | % Rec Limits |
|---|---|---|---|---|---|
| Mercury | 7471B | 10.3 | 12.0 | 86 | 80-120 |

Printed 12/1/2020 5:10:35 PM

Superset Reference:

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| BC Laboratories<br>4100 Atlas Court<br>Bakersfield, CA 93308 | **Project Name: No Project**<br>Work Order: **X0K0037**<br>Reported: 12-Nov-20 11:47 |
|---|---|

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received | Notes |
|---|---|---|---|---|---|
| 2031364-12 | X0K0037-01 | Solid | 20-Oct-20 16:23 | 03-Nov-2020 | |
| 2031364-18 | X0K0037-02 | Solid | 22-Oct-20 12:13 | 03-Nov-2020 | |
| 2031364-22 | X0K0037-03 | Solid | 22-Oct-20 10:33 | 03-Nov-2020 | |
| 2031364-29 | X0K0037-04 | Solid | 20-Oct-20 14:42 | 03-Nov-2020 | |

Solid samples are analyzed on an as-received, wet-weight basis, unless otherwise requested.
Sample preparation is defined by the client as per their Data Quality Objectives.
This report supercedes any previous reports for this Work Order. The complete report includes pages for each sample, a full QC report, and a notes section.
Analyses were performed in accordance with SVL standard operating procedures and calibrations were performed and met SVL internal QC criteria.
The results presented in this report relate only to the samples, and meet all requirements of the NELAC Standards unless otherwise noted.
This report shall not be reproduced except in full, without the written approval of SVL Analytical, Inc.

Case Narrative: X0K0037

The state of origin is not indicated on the COC.

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

BC Laboratories
4100 Atlas Court
Bakersfield, CA 93308

**Project Name: No Project**
Work Order: **X0K0037**
Reported: 12-Nov-20 11:47

Client Sample ID: **2031364-12**
SVL Sample ID: **X0K0037-01 (Solid)**

**Sample Report Page 1 of 1**

Sampled: 20-Oct-20 16:23
Received: 03-Nov-20
Sampled By:

| Method | Analyte | Result | Units | RL | MDL | Dilution | Batch | Analyst | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Acid/Base Accounting & Sulfur Forms** | | | | | | | | | | |
| Modified Sobek | **ABA** | -0.8 | TCaCO3/kT | 0.3 | | | N/A | | 11/11/20 09:55 | |
| Modified Sobek | **AGP** | 0.8 | TCaCO3/kT | 0.3 | | | N/A | | 11/10/20 16:33 | |
| Modified Sobek | ANP | < 0.3 | TCaCO3/kT | 0.3 | | | X046057 | PRM | 11/11/20 09:55 | |
| Modified Sobek | Non-extractable Sulfur | < 0.0100 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 15:02 | |
| Modified Sobek | **Non-Sulfate Sulfur** | 0.0268 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 16:33 | |
| Modified Sobek | **Pyritic Sulfur** | 0.03 | % | 0.0100 | | | N/A | | 11/10/20 16:33 | |
| Modified Sobek | **Sulfate Sulfur** | 0.08 | % | 0.0100 | | | N/A | | 11/10/20 16:33 | |
| Modified Sobek | **Total Sulfur** | 0.102 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/04/20 16:27 | |

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Herman J. Haring
Project Manager

**SVL holds the following certifications:**
**AZ**:0538, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **SC**:58004001, **UT(TNI)**:ID000192015-1, **WA**:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| BC Laboratories | Project Name: No Project |
|---|---|
| 4100 Atlas Court | Work Order: X0K0037 |
| Bakersfield, CA 93308 | Reported: 12-Nov-20 11:47 |

Client Sample ID: **2031364-18**
SVL Sample ID: **X0K0037-02 (Solid)**

**Sample Report Page 1 of 1**

Sampled: 22-Oct-20 12:13
Received: 03-Nov-20
Sampled By:

| Method | Analyte | Result | Units | RL | MDL | Dilution | Batch | Analyst | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Acid/Base Accounting & Sulfur Forms** | | | | | | | | | | |
| Modified Sobek | **ABA** | -0.3 | TCaCO3/kT | 0.3 | | | N/A | | 11/11/20 09:55 | |
| Modified Sobek | **AGP** | 0.3 | TCaCO3/kT | 0.3 | | | N/A | | 11/10/20 16:36 | |
| Modified Sobek | ANP | < 0.3 | TCaCO3/kT | 0.3 | | | X046057 | PRM | 11/11/20 09:55 | |
| Modified Sobek | Non-extractable Sulfur | < 0.0100 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 15:05 | |
| Modified Sobek | **Non-Sulfate Sulfur** | 0.0100 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 16:36 | |
| Modified Sobek | **Pyritic Sulfur** | 0.01 | % | 0.0100 | | | N/A | | 11/10/20 16:36 | |
| Modified Sobek | **Sulfate Sulfur** | 0.08 | % | 0.0100 | | | N/A | | 11/10/20 16:36 | |
| Modified Sobek | **Total Sulfur** | 0.0902 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/04/20 16:30 | |

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Herman J. Haring
Project Manager

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| BC Laboratories | Project Name: No Project |
|---|---|
| 4100 Atlas Court | Work Order: X0K0037 |
| Bakersfield, CA 93308 | Reported: 12-Nov-20 11:47 |

Client Sample ID: **2031364-22**
SVL Sample ID: **X0K0037-03 (Solid)**

**Sample Report Page 1 of 1**

Sampled: 22-Oct-20 10:33
Received: 03-Nov-20
Sampled By:

| Method | Analyte | Result | Units | RL | MDL | Dilution | Batch | Analyst | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Acid/Base Accounting & Sulfur Forms** | | | | | | | | | | |
| Modified Sobek | **ABA** | -1.5 | TCaCO3/kT | 0.3 | | | N/A | | 11/11/20 09:55 | |
| Modified Sobek | **AGP** | 1.5 | TCaCO3/kT | 0.3 | | | N/A | | 11/10/20 16:39 | |
| Modified Sobek | ANP | < 0.3 | TCaCO3/kT | 0.3 | | | X046057 | PRM | 11/11/20 09:55 | |
| Modified Sobek | Non-extractable Sulfur | < 0.0100 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 15:08 | |
| Modified Sobek | **Non-Sulfate Sulfur** | 0.0484 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 16:39 | |
| Modified Sobek | **Pyritic Sulfur** | 0.05 | % | 0.0100 | | | N/A | | 11/10/20 16:39 | |
| Modified Sobek | **Sulfate Sulfur** | 0.16 | % | 0.0100 | | | N/A | | 11/10/20 16:39 | |
| Modified Sobek | **Total Sulfur** | 0.206 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/04/20 16:33 | |

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Herman J. Haring
Project Manager

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| BC Laboratories | Project Name: No Project |
|---|---|
| 4100 Atlas Court | Work Order: X0K0037 |
| Bakersfield, CA 93308 | Reported: 12-Nov-20 11:47 |

Client Sample ID: **2031364-29**
SVL Sample ID: **X0K0037-04 (Solid)**

**Sample Report Page 1 of 1**

Sampled: 20-Oct-20 14:42
Received: 03-Nov-20
Sampled By:

| Method | Analyte | Result | Units | RL | MDL | Dilution | Batch | Analyst | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Acid/Base Accounting & Sulfur Forms** | | | | | | | | | | |
| Modified Sobek | **ABA** | -0.4 | TCaCO3/kT | 0.3 | | | N/A | | 11/11/20 09:55 | |
| Modified Sobek | **AGP** | 0.4 | TCaCO3/kT | 0.3 | | | N/A | | 11/10/20 16:42 | |
| Modified Sobek | ANP | < 0.3 | TCaCO3/kT | 0.3 | | | X046057 | PRM | 11/11/20 09:55 | |
| Modified Sobek | **Non-extractable Sulfur** | 0.0171 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 15:11 | |
| Modified Sobek | **Non-Sulfate Sulfur** | 0.0292 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/10/20 16:42 | |
| Modified Sobek | **Pyritic Sulfur** | 0.01 | % | 0.0100 | | | N/A | | 11/10/20 16:42 | |
| Modified Sobek | **Sulfate Sulfur** | 0.23 | % | 0.0100 | | | N/A | | 11/10/20 16:42 | |
| Modified Sobek | **Total Sulfur** | 0.257 | % | 0.0100 | 0.0084 | | X045086 | PRM | 11/04/20 16:36 | |

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Herman J. Haring
Project Manager

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| | |
|---|---|
| BC Laboratories | Project Name: No Project |
| 4100 Atlas Court | Work Order: X0K0037 |
| Bakersfield, CA 93308 | Reported: 12-Nov-20 11:47 |

## Quality Control - BLANK Data

**Acid/Base Accounting & Sulfur Forms**

| Method | Analyte | Units | Result | MDL | MRL | Batch ID | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|
| Modified Sobek | ANP | TCaCO3/kT | <0.3 | | 0.3 | X046057 | 11-Nov-20 | |
| Modified Sobek | Non-extractable Sulfur | % | <0.0100 | 0.0084 | 0.0100 | X045086 | 10-Nov-20 | |
| Modified Sobek | Non-Sulfate Sulfur | % | <0.0100 | 0.0084 | 0.0100 | X045086 | 10-Nov-20 | |
| Modified Sobek | Total Sulfur | % | <0.0100 | 0.0084 | 0.0100 | X045086 | 04-Nov-20 | |

## Quality Control - LABORATORY CONTROL SAMPLE Data

**Acid/Base Accounting & Sulfur Forms**

| Method | Analyte | Units | LCS Result | LCS True | % Rec. | Acceptance Limits | Batch ID | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Modified Sobek | ANP | TCaCO3/kT | 1050 | 1000 | 105 | 80 - 120 | X046057 | 11-Nov-20 | |
| Modified Sobek | Total Sulfur | % | 0.995 | 0.970 | 103 | 80 - 120 | X045086 | 04-Nov-20 | |

## Quality Control - DUPLICATE Data

**Acid/Base Accounting & Sulfur Forms**

| Method | Analyte | Units | Duplicate Result | Sample Result | RPD | RPD Limit | Batch and Source ID | Analyzed | Notes |
|---|---|---|---|---|---|---|---|---|---|
| Modified Sobek | ANP | TCaCO3/kT | 10.5 | 10.8 | 2.4 | 20 | X046057 - X0J0484-02 | 11-Nov-20 | |
| Modified Sobek | Non-extractable Sulfur | % | <0.0100 | <0.0100 | UDL | 20 | X045086 - X0J0484-01 | 10-Nov-20 | |
| Modified Sobek | Non-Sulfate Sulfur | % | 0.120 | 0.0387 | 102.0 | 20 | X045086 - X0J0484-01 | 10-Nov-20 | R2B |
| Modified Sobek | Total Sulfur | % | 0.497 | 0.487 | 1.9 | 20 | X045086 - X0J0484-01 | 04-Nov-20 | |

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

One Government Gulch - PO Box 929
Kellogg, ID 83837-0929
(208) 784-1258
www.svl.net

| | | |
|---|---|---|
| BC Laboratories | **Project Name:** | **No Project** |
| 4100 Atlas Court | Work Order: | **X0K0037** |
| Bakersfield, CA 93308 | Reported: | 12-Nov-20 11:47 |

## Notes and Definitions

| | |
|---|---|
| R2B | RPD exceeded the laboratory acceptance limit. |
| LCS | Laboratory Control Sample (Blank Spike) |
| RPD | Relative Percent Difference |
| UDL | A result is less than the detection limit |
| 0.30R>S | % recovery not applicable; spike level is less than 30% of the sample concentration |
| <RL | A result is less than the reporting limit |
| MRL | Method Reporting Limit |
| MDL | Method Detection Limit |
| N/A | Not Applicable |

**SVL holds the following certifications:**
AZ:0538, ID:ID00019 & ID00965 (Microbiology), NV:ID000192007A, SC:58004001, UT(TNI):ID000192015-1, WA:C573

| | | | |
|---|---|---|---|
| ECM Consultants - Costa Mesa | | **Reported:** | 02/18/2021 9:27 |
| 3525 Hyland Ave | | Project: | USFS- Big Blue Mill |
| Costa Mesa, CA 92626 | | Project Number: | [none] |
| | | Project Manager: | David Allison |

## Notes And Definitions

| | |
|---|---|
| J | Estimated Value (CLP Flag) |
| MDL | Method Detection Limit |
| ND | Analyte Not Detected |
| PQL | Practical Quantitation Limit |
| A01 | Detection and quantitation limits are raised due to sample dilution. |
| A02 | The difference between duplicate readings is less than the quantitation limit. |
| A03 | The sample concentration was more than 4 times the spike level. |
| A07 | Detection and quantitation limits were raised due to sample dilution caused by high analyte concentration or matrix interference. |
| Q01 | Sample precision is not within the control limits. |
| Q02 | Matrix spike precision is not within the control limits. |
| Q03 | Matrix spike recovery(s) was(were) not within the control limits. |
| S08 | The internal standard on the sample was not within the control limits. |
| Z1 | Sample was analysed twice and both times internal standards were low. |

# Appendix G
# XRF and Laboratory Correlation Graphs

Figure G1
Correlation of XRF Sample Field Readings and Analytical Results for Lead
Big Blue Mill Site
Site Inspection

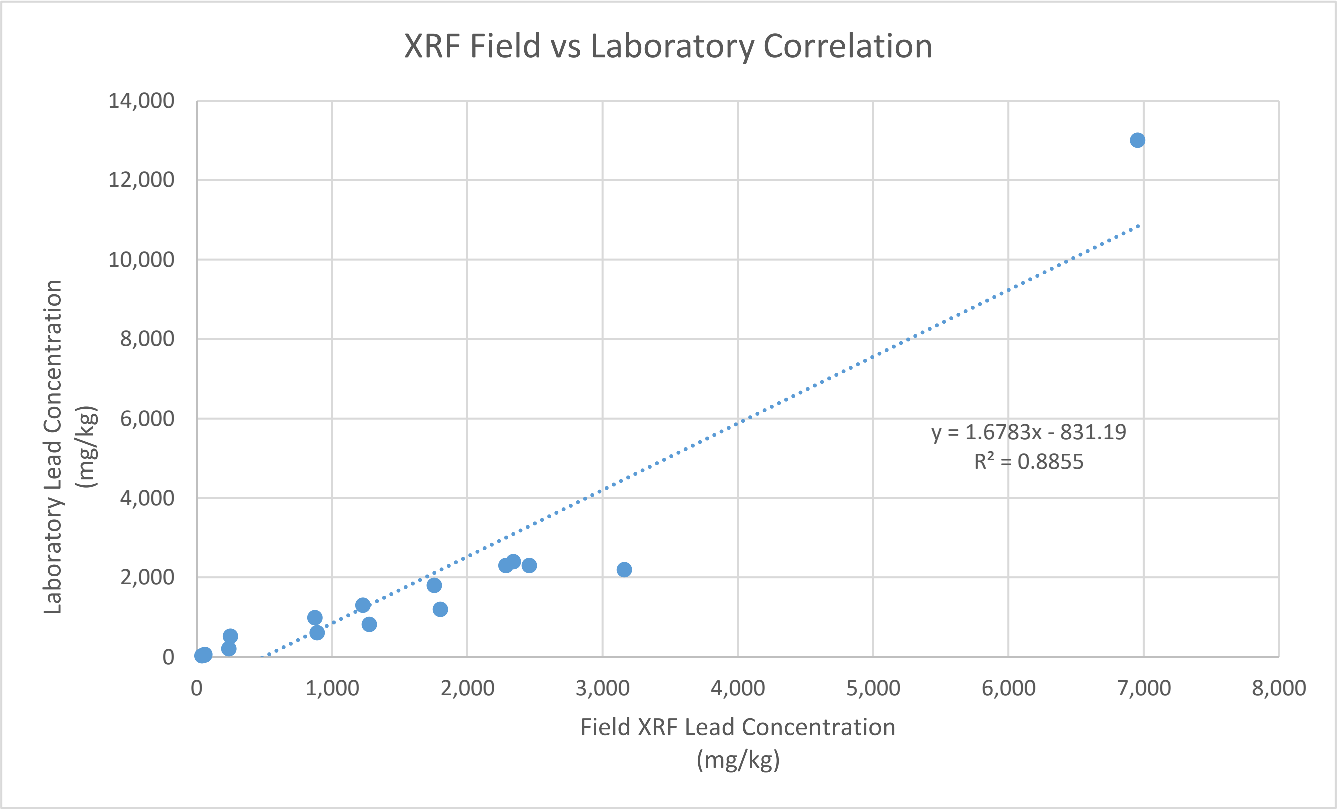


Figure G2

Correlation of XRF Sample Field Readings and Analytical Results for Arsenic

Big Blue Mill Site

Site Inspection

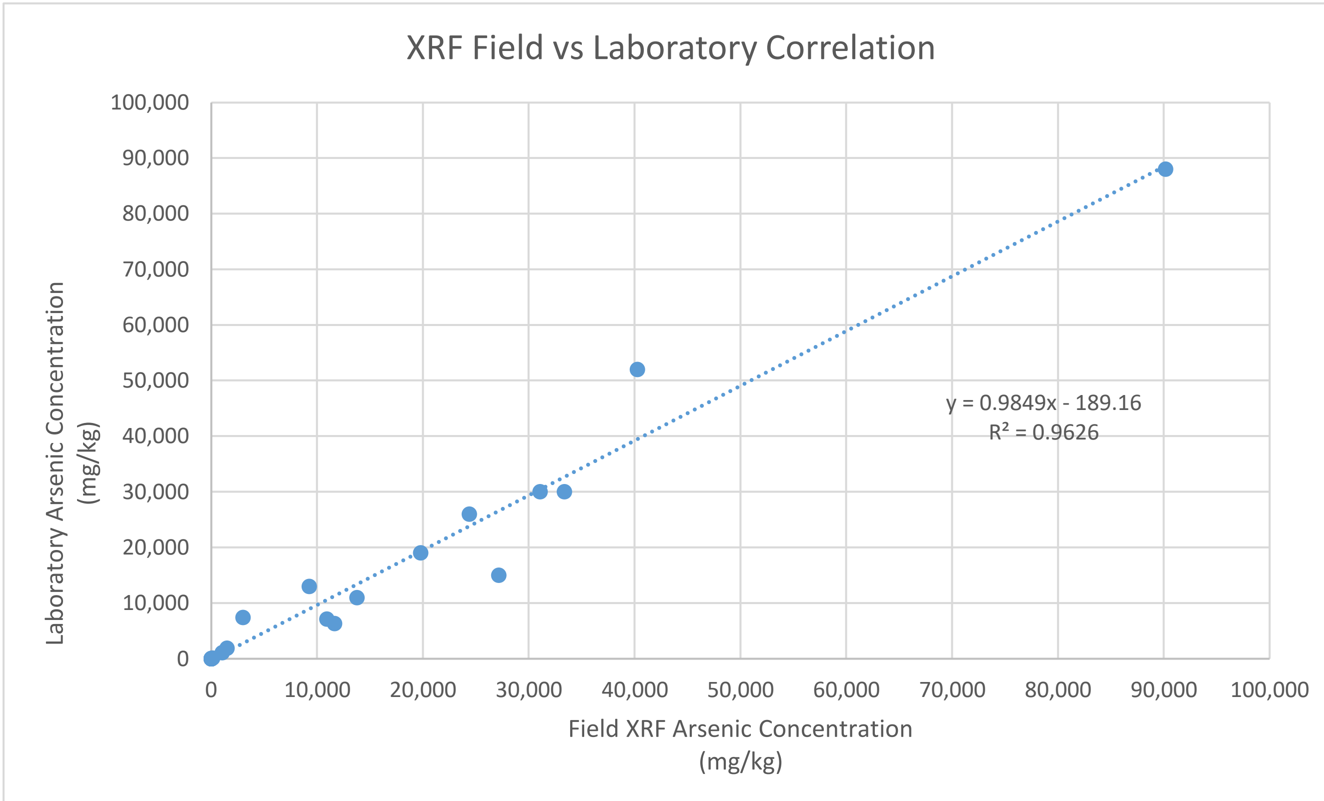


Figure G3
Correlation of XRF Sample Field Readings and Analytical Results for Mercury
Big Blue Mill Site
Site Inspection

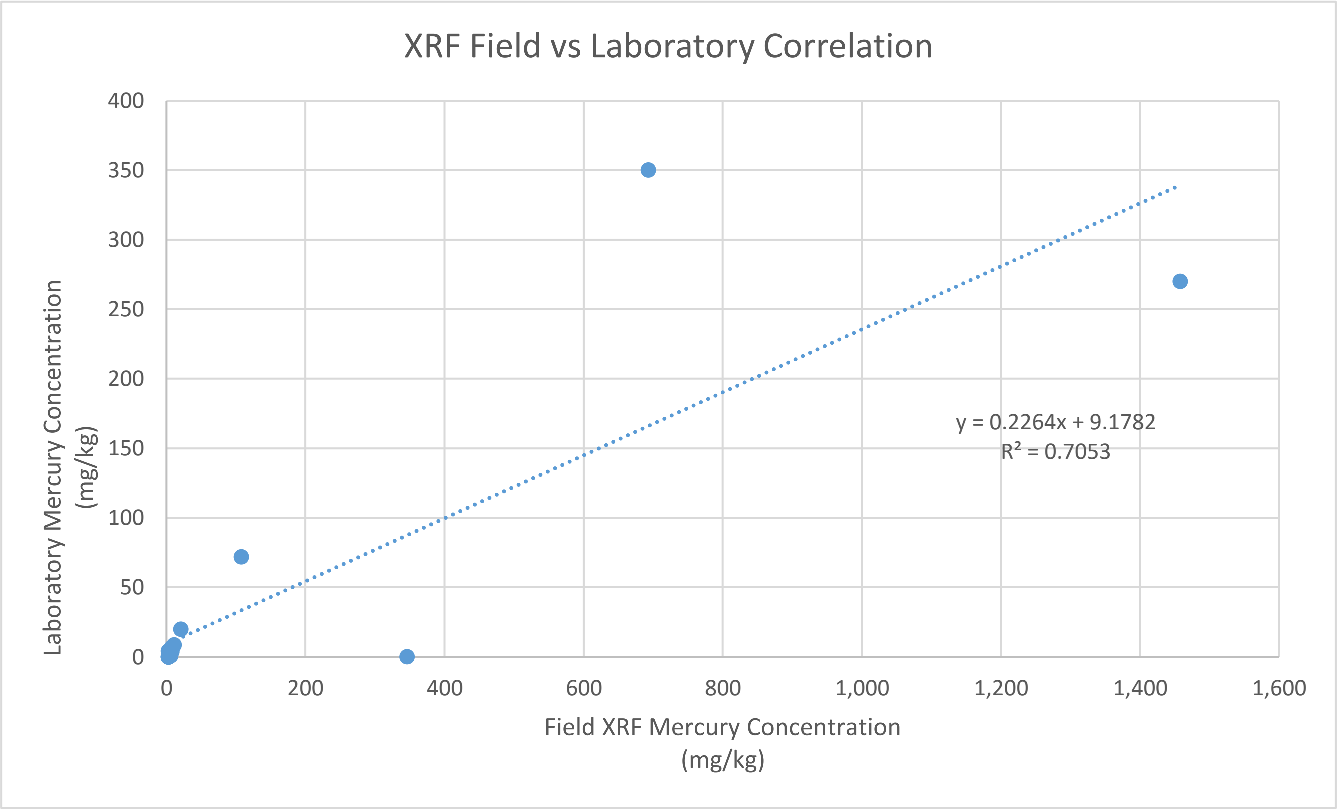


Figure G4
Correlation of XRF Sample Field Readings and Analytical Results for Mercury
Big Blue Mill Site
Site Inspection

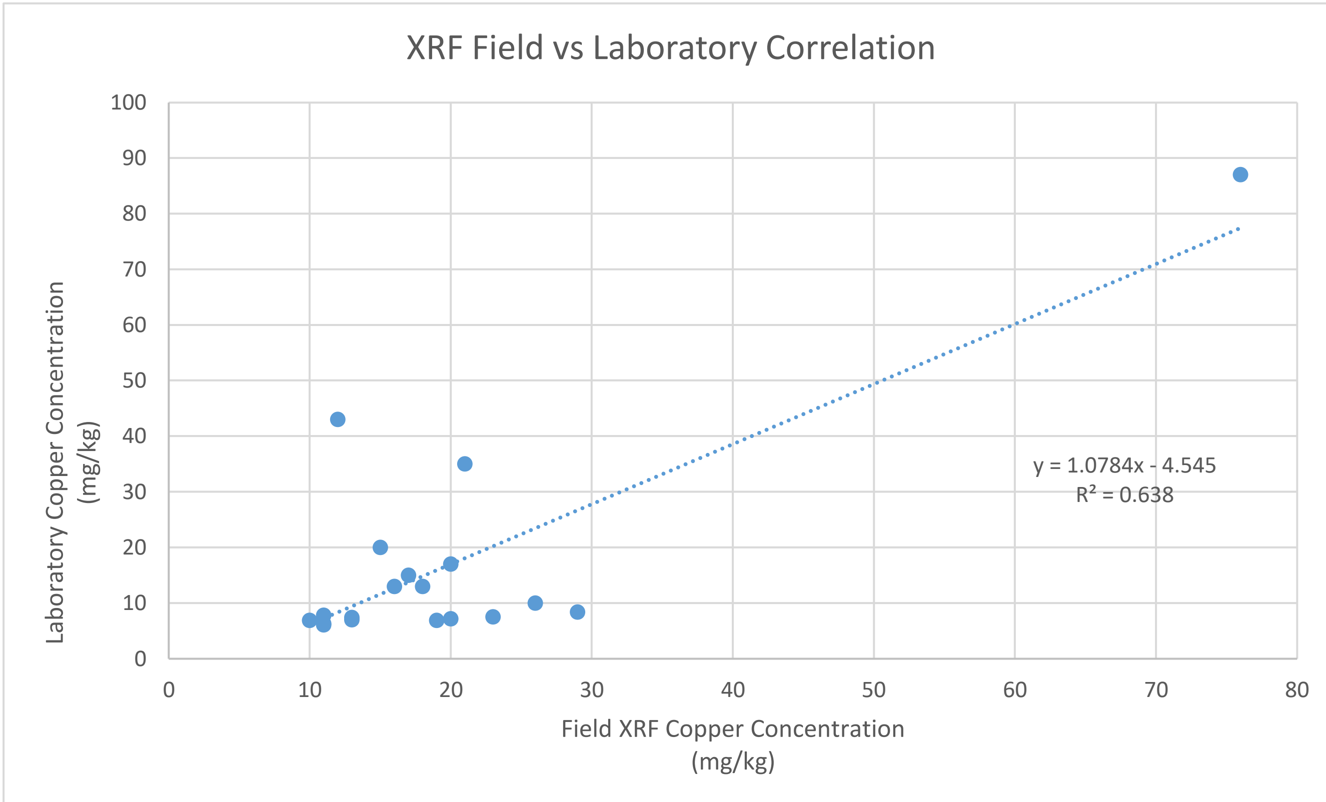


Figure G5
Correlation of XRF Sample Field Readings and Analytical Results for Antimony
Big Blue Mill Site
Site Inspection

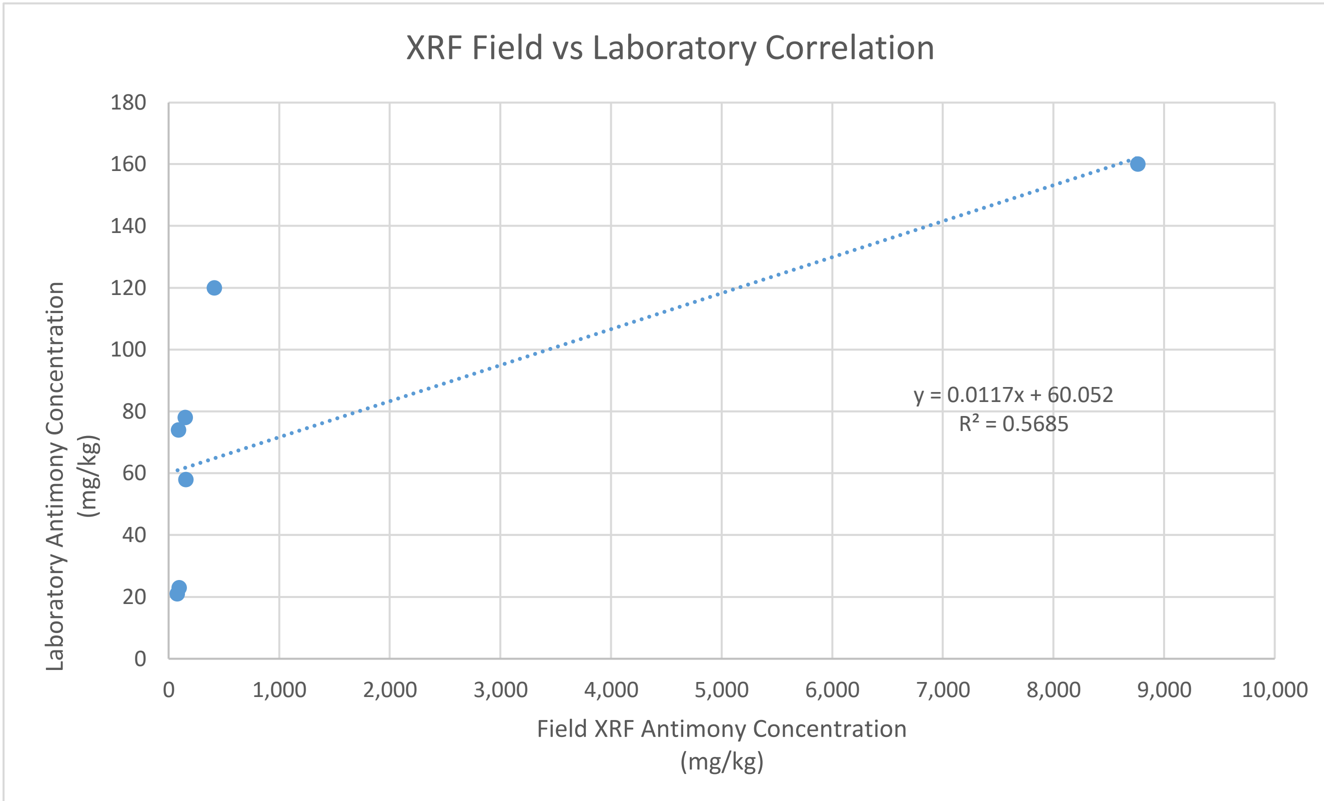
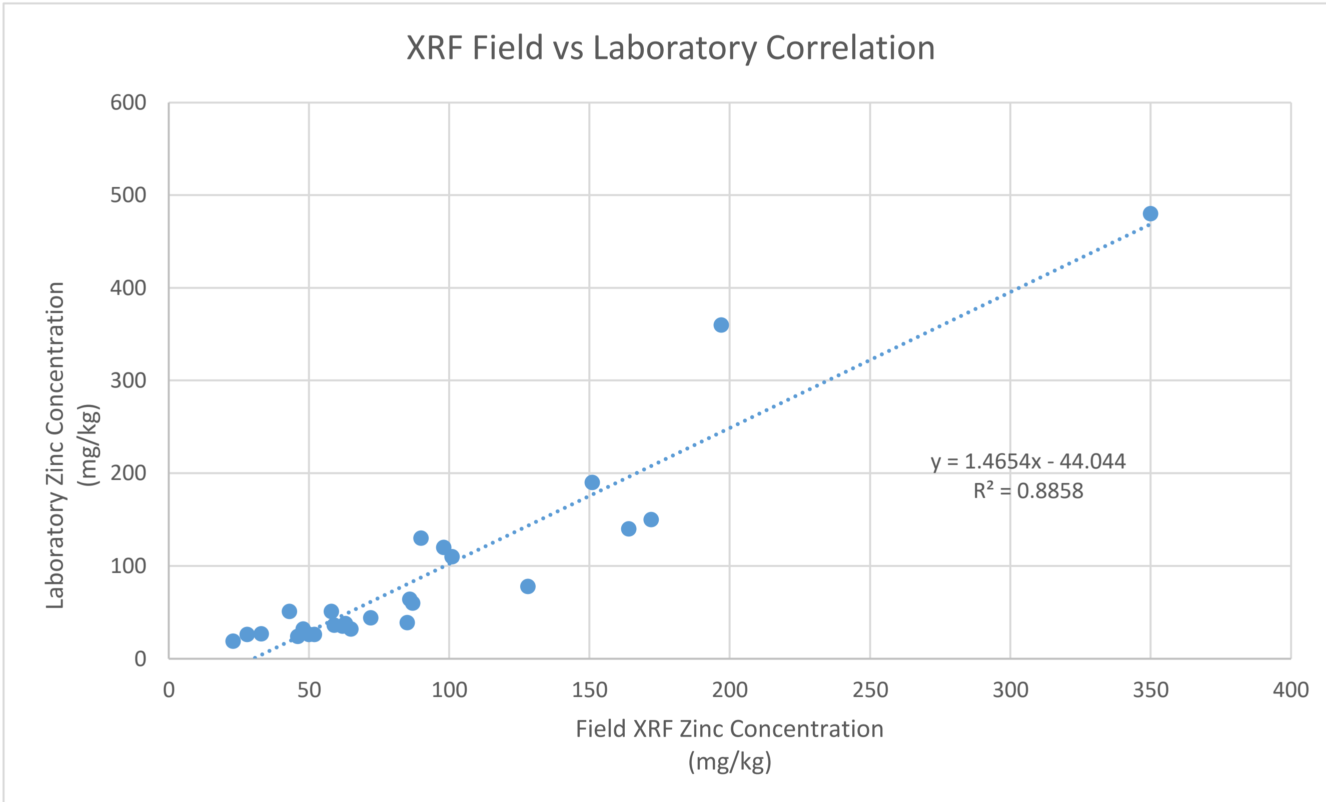


Figure G6
Correlation of XRF Sample Field Readings and Analytical Results for Zinc
Big Blue Mill Site
Site Inspection



# Appendix H
# Risk Assessment Tables

**Table H1-1**
Soil COPC and COPEC Selection Summary (XRF Data)
Big Blue Mill
Kern County, CA

| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/kg) | Background Screening Criteria (mg/kg) | EPA Residential RSL (mg/kg) | ESV (mg/kg) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | R ≥ 0.7 | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 18 | 233 | 8% | 8,764 | 0.8 | 31 | 0.27 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background (labortory) and both human and ecological screening values. XRF background value not available. |
| Arsenic | 233 | 233 | 100.0% | 90,189 | 57 | 0.68 | 18 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Barium | 0 | 0 | 0.0% | -- | 246 | 15000 | 110 | N | N | N | N | -- | N | N | Not retained - less than 5% detections. |
| Beryllium | 0 | 0 | 0.0% | -- | 0.47 | 160 | 2.5 | N | N | N | N | -- | N | N | Not retained - less than 5% detections. |
| Cadmium | 4 | 233 | 1.7% | 17 | 0.52 | 71 | 0.36 | N | Y | N | Y | N | N | N | Maximum concentration exceeds background (laboratory value) and ecological screening value. XRF background value not available. |
| Chromium | 108 | 233 | 46.4% | 62 | 72 | 120000 | 0.4 | Y | N | N | Y | N | N | N | Maximum concentration less than background laboratory value. |
| Cobalt | 0 | 233 | 0.0% | 104 | 18.9 | 23 | 13 | N | Y | Y | Y | -- | N | N | Not retained - less than 5% detections. |
| Copper | 218 | 233 | 93.6% | 88 | 78 | 3,100 | 28 | Y | Y | N | Y | N | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Lead | 233 | 233 | 100.0% | 6,956 | 177 | 80 | 11 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Mercury | 156 | 233 | 67.0% | 1,458 | 9 | 1 | 0.013 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Molybdenum | 149 | 233 | 63.9% | 18 | 18 | 390 | 0.52 | Y | N | N | Y | -- | N | N | Maximum concentration less than background (laboratory value). XRF background value not available. |
| Nickel | 219 | 233 | 94.0% | 37 | 39 | 820 | 38 | Y | N | N | N | N | N | N | Not retained; maximum concentration less than background and human health and ecological screening criteria. |
| Selenium | 6 | 233 | 2.6% | 4 | 1.1 | 390 | 0.52 | N | Y | N | Y | -- | N | N | Not retained - less than 5% detections. |
| Silver | 32 | 233 | 13.7% | 210 | 0.67 | 390 | 4.2 | Y | Y | N | Y | -- | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Thallium | 0 | 0 | 0.0% | -- | 0.49 | 0.78 | 0.42 | N | N | N | N | -- | N | N | Not retained - less than 5% detections. |
| Vanadium | 229 | 233 | 98.3% | 365 | 627 | 390 | 2 | Y | N | N | Y | N | N | N | Maximum concentration less than background (laboratory value). XRF background value not available. |
| Zinc | 233 | 233 | 100.0% | 550 | 384 | 23,000 | 46 | Y | Y | N | Y | Y | N | Y | Maximum concentration exceeds background and ecological screening value. |

Notes:

red text is DTSC number
BG = Background (3 times laboratory result or RL if ND)
COPEC = contaminant of potential ecological concern
COPC = contaminant of potential concern
EPA = Environmental Protection Agency

ESV = Ecological Screening Value
DL = Detection Limit
mg/kg = milligram per kilogram
RSL = Regional Screening Level

Max > BG? = Is the maximum concentration greater than Background Screening Criterion (3 X XRF result or 3 x Lab result if XRF not available)?
Max > HH RSL? = Is the maximum concentration greater than Human Health Regional Screening Level?
Max > ESV? = Is the maximum concentration greater than the Ecological Screening Value?
HH COPC? = Is analyte retained as a human health contaminant of potential concern?
ECO COPEC? = Is analyte retained as a contaminant of potential ecological concern?

Red Highlight = Denotes analyte retained as a human health and/or ecological contaminant of potential concern
Green Highlight = Denotes analyte not retained as a human health and/or ecological contaminant of potential concern

**Table H1-2**
Soil COPC and COPEC Selection Summary (Laboratory Data)
Big Blue Mill
Kern County, California

| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/kg) | Background Screening Criteria (mg/kg) | EPA Residential RSL (mg/kg) | ESV (mg/kg) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | R ≥ 0.7 $R^2$ ≥ 0.8 | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 15 | 26 | 58% | 160 | 0.8 | 31 | 0.27 | Y | Y | Y | Y | N | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Arsenic | 25 | 26 | 96.2% | 88,000 | 60 | 0.68 | 18 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Barium | 25 | 26 | 96.2% | 210 | 246 | 15000 | 110 | Y | N | N | Y | -- | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Beryllium | 2 | 26 | 7.7% | 0.620 | 0.47 | 160 | 2.5 | Y | Y | N | N | -- | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Cadmium | 16 | 26 | 61.5% | 630 | 0.52 | 71 | 0.36 | Y | Y | Y | Y | N | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Chromium | 25 | 26 | 96.2% | 34 | 30 | 120000 | 0.4 | Y | Y | N | Y | N | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Cobalt | 25 | 26 | 96.2% | 7.9 | 18.9 | 23 | 13 | Y | N | N | N | -- | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Copper | 26 | 26 | 100.0% | 87 | 30 | 3,100 | 28 | Y | Y | N | Y | N | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Lead | 16 | 26 | 61.5% | 13,000 | 129 | 80 | 11 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Mercury | 22 | 26 | 84.6% | 350 | 1.86 | 1 | 0.013 | Y | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Molybdenum | 3 | 26 | 11.5% | 4.3 | 0.5 | 390 | 0.52 | Y | Y | N | Y | -- | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Nickel | 24 | 26 | 92.3% | 10 | 14.7 | 820 | 38 | Y | N | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Selenium | 5 | 26 | 19.2% | 3.9 | 1.1 | 390 | 0.52 | Y | Y | N | Y | -- | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Silver | 15 | 26 | 57.7% | 69 | 0.67 | 390 | 4.2 | Y | Y | N | Y | -- | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Thallium | 0 | 26 | 0.0% | 0.49 | 0.49 | 0.78 | 0.42 | N | N | N | Y | -- | N | N | Not retained - less than 5% detections. |
| Vanadium | 26 | 26 | 100.0% | 65 | 90 | 390 | 2 | Y | N | N | Y | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Zinc | 26 | 26 | 100.0% | 480 | 234 | 23,000 | 46 | Y | Y | N | Y | Y | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Benzene | 1 | 4 | 25.0% | 0.0011 | N/A | 0.33 | 24 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Toluene | 2 | 4 | 50.0% | 0.0014 | N/A | 1,100 | 23 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Acenaphthylene | 1 | 4 | 25.0% | 0.0012 | N/A | -- | 120 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Anthracene | 1 | 4 | 25.0% | 0.00077 | N/A | 17,000 | 6.8 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Benzo[a]anthracene | 4 | 4 | 100.0% | 0.0056 | N/A | 1.1 | 0.73 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Benzo[a]pyrene | 4 | 4 | 100.0% | 0.021 | N/A | 0.11 | 62 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Benzo[b]fluoranthene | 4 | 4 | 100.0% | 0.013 | N/A | 1.1 | 18 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Benzo[g,h,i]perylene | 4 | 4 | 100.0% | 0.025 | N/A | -- | 25 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Benzo[k]fluoranthene | 2 | 4 | 50.0% | 0.0026 | N/A | 11 | 71 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Chrysene | 4 | 4 | 100.0% | 0.0064 | N/A | 110 | 3.1 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |

**Table H1-2**
Soil COPC and COPEC Selection Summary (Laboratory Data)
Big Blue Mill
Kern County, California



| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/kg) | Background Screening Criteria (mg/kg) | EPA Residential RSL (mg/kg) | ESV (mg/kg) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | R ≥ 0.7 $R^2 \geq 0.8$ | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dibenz(a,h)anthracene | 2 | 4 | 50.0% | 0.0049 | N/A | 0.028 | -- | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Fluoranthene | 4 | 4 | 100.0% | 0.0097 | N/A | 2,400 | 10 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Indeno[1,2,3-cd]pyrene | 2 | 4 | 50.0% | 0.0055 | N/A | 1.1 | 71 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Phenanthrene | 2 | 4 | 50.0% | 0.0013 | N/A | -- | 6 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Pyrene | 4 | 4 | 100.0% | 0.0082 | N/A | 1,800 | 10 | Y | N/A | N | N | N/A | N | N | Not retained; maximum concentration less than human and ecological screening values. |

Notes:

BG = Background (3 times laboratory result or RL if ND)
COPEC = contaminant of potential ecological concern
COPC = contaminant of potential concern
EPA = Environmental Protection Agency

ESV = Ecological Screening Value
DL = Detection Limit
mg/kg = milligram per kilogram
RSL = Regional Screening Level

Max > BG? = Is the maximum concentration greater than Background Screening Criterion (3 X laboratory result or RL if ND)?
Max > HH RSL? = Is the maximum concentration greater than Human Health Regional Screening Level?
Max > ESV? = Is the maximum concentration greater than the Ecological Screening Value?
HH COPC? = Is analyte retained as a human health contaminant of potential concern?
ECO COPEC? = Is analyte retained as a contaminant of potential ecological concern?

Red Highlight = Denotes analyte retained as a human health and/or ecological contaminant of potential concern
Green Highlight = Denotes analyte not retained as a human health and/or ecological contaminant of potential concern

**Table H1-3**
Sediment COPC and COPEC Selection Summary (Laboratory Data)
Big Blue Mill
Kern County, California



| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/kg) | Background Screening Criteria (mg/kg) | EPA Residential RSL (mg/kg) | ESV (mg/kg) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 1 | 3 | 33% | 0.13 | <0.8 | 31 | NE | Y | Y | N | N | N | N | Not retained; maximum concentration less than human screening value and no ecological screening value established. |
| Arsenic | 3 | 3 | 100.0% | 32 | 2.7 | 0.11 | 9.79 | Y | Y | Y | Y | Y | Y | Maximum concentration exceeds background and both human and ecological screening values. |
| Barium | 3 | 3 | 100.0% | 31 | 52 | 15000 | NE | Y | N | N | N | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Beryllium | 1 | 3 | 33.3% | 0.22 | <0.47 | 16 | NE | Y | Y | N | N | N | N | Not retained; maximum concentration less than human screening value and no ecological screening value established. |
| Cadmium | 1 | 3 | 33.3% | 0.31 | <0.52 | 71 | 0.99 | Y | Y | N | N | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Chromium | 3 | 3 | 100.0% | 7.2 | 9.2 | 120000 | 43.4 | Y | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Cobalt | 3 | 3 | 100.0% | 3.4 | 5.3 | 23 | NE | Y | N | N | N | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Copper | 3 | 3 | 100.0% | 3.8 | 5.4 | 3,100 | 31.6 | Y | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Lead | 1 | 3 | 33.3% | 2.6 | <4.1 | 80 | 35.8 | Y | Y | N | N | N | N | Not retained; maximum concentration less than human and ecological screening values. |
| Mercury | 3 | 3 | 100.0% | 0.55 | <0.016 | 1 | 0.18 | Y | Y | N | Y | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Molybdenum | 0 | 3 | 0.0% | 0.5 | <0.5 | 390 | NE | N | N | N | N | N | N | Not retained - less than 5% detections. |
| Nickel | 3 | 3 | 100.0% | 3.3 | 3.9 | 820 | 22.7 | Y | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Selenium | 2 | 3 | 66.7% | 1.8 | <1.1 | 390 | 0.9 | Y | Y | N | Y | N | Y | Maximum concentration exceeds background and ecological screening value. |
| Silver | 0 | 3 | 0.0% | 0.67 | <0.67 | 390 | 1 | N | N | N | N | N | N | Not retained - less than 5% detections. |
| Thallium | 1 | 3 | 33.3% | 0.1 | <0.49 | 0.78 | NE | Y | Y | N | N | N | N | Not retained; maximum concentration less than human screening value and no ecological screening value established. |
| Vanadium | 3 | 3 | 100.0% | 35 | 57 | 390 | NE | Y | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Zinc | 3 | 3 | 100.0% | 24 | 30 | 23,000 | 121 | Y | N | N | N | N | N | Not retained; maximum concentration less than background screening criterion. |

Notes:

BG = Background (3 times laboratory result or RL if ND)
COPEC = contaminant of potential ecological concern
COPC = contaminant of potential concern
EPA = Environmental Protection Agency

ESV = Ecological Screening Value
DL = Detection Limit
mg/kg = milligram per kilogram
RSL = Regional Screening Level

Max > BG? = Is the maximum concentration greater than Background Screening Criterion (3 X laboratory result or RL if ND)?
Max > HH RSL? = Is the maximum concentration greater than Human Health Regional Screening Level?
Max > ESV? = Is the maximum concentration greater than the Ecological Screening Value?
HH COPC? = Is analyte retained as a human health contaminant of potential concern?
ECO COPEC? = Is analyte retained as a contaminant of potential ecological concern?

Red Highlight = Denotes analyte retained as a human health and/or ecological contaminant of potential concern
Green Highlight = Denotes analyte not retained as a human health and/or ecological contaminant of potential concern

**Table H1-4**
Surface Water COPEC Selection Summary (Laboratory Data)
Big Blue Mill
Kern County, California

| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/kg) | Background Screening Criteria (mg/kg) | EPA Residential RSL (mg/kg) | ESV (mg/kg) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 0 | 3 | 0% | 0.23 | <0.23 | N/A | 30 | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Arsenic | 3 | 3 | 100.0% | 7.3 | 6.4 | N/A | 150 | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Barium | 3 | 3 | 100.0% | 18 | 18 | N/A | NE | Y | N | N/A | N | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Beryllium | 0 | 3 | 0.0% | 0.05 | <0.05 | N/A | NE | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Cadmium | 2 | 3 | 66.7% | 0.05 | <0.034 | N/A | 0.25 | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Chromium | 0 | 3 | 0.0% | 0.15 | <0.15 | N/A | 74 | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Cobalt | 3 | 3 | 100.0% | 0.051 | 0.059 | N/A | NE | Y | N | N/A | N | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Copper | 1 | 3 | 33.3% | 0.34 | <0.32 | N/A | 9 | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Lead | 2 | 3 | 66.7% | 0.059 | <0.021 | N/A | 2.5 | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Mercury | 3 | 3 | 100.0% | 0.25 | 0.12 | N/A | 0.77 | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Molybdenum | 3 | 3 | 100.0% | 6.8 | 6.5 | N/A | NE | Y | Y | N/A | N | N | N | Not retained; maximum concentration less than ecological screening value. |
| Nickel | 3 | 3 | 100.0% | 0.45 | 0.48 | N/A | 52 | Y | N | N/A | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Selenium | 0 | 3 | 0.0% | 0.25 | <0.25 | N/A | 5 | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Silver | 0 | 3 | 0.0% | 0.015 | <0.015 | N/A | 3.2 | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Thallium | 0 | 3 | 0.0% | 0.025 | <0.025 | N/A | NE | N | N | N/A | N | N | N | Not retained - less than 5% detections. |
| Vanadium | 3 | 3 | 100.0% | 0.66 | 0.67 | N/A | NE | Y | N | N/A | N | N | N | Not retained; maximum concentration less than background screening criterion. |
| Zinc | 0 | 3 | 0.0% | 2.2 | <2.2 | N/A | 120 | N | N | N/A | N | N | N | Not retained - less than 5% detections. |

Notes:

BG = Background (3 times laboratory result or RL if ND)
COPEC = contaminant of potential ecological concern
COPC = contaminant of potential concern
EPA = Environmental Protection Agency
N/A = Dissolved concentrations do not apply to human health surface water screening criteria which are based on total concentrations.

ESV = Ecological Screening Value
DL = Detection Limit
mg/kg = milligram per kilogram
RSL = Regional Screening Level

Max > BG? = Is the maximum concentration greater than Background Screening Criterion (3 X laboratory result or RL if ND)?
Max > HH RSL? = Is the maximum concentration greater than Human Health Regional Screening Level?
Max > ESV? = Is the maximum concentration greater than the Ecological Screening Value?
HH COPC? = Is analyte retained as a human health contaminant of potential concern?
ECO COPEC? = Is analyte retained as a contaminant of potential ecological concern?

Red Highlight = Denotes analyte retained as a human health and/or ecological contaminant of potential concern
Green Highlight = Denotes analyte not retained as a human health and/or ecological contaminant of potential concern

**Table H1-5**
Surface Water COPC Selection Summary (Laboratory Data)
Big Blue Mill
Kern County, California

| Analyte | Number of Detections | Number of Samples | Percent Detections (%) | Max Concentration or Max DL (mg/L) | Background Screening Criteria (mg/L) | EPA Residential RSL (mg/L) | ESV (mg/L) | Percent Detections > 5%? | Max > Background? | Max > HH RSL? | Max > ESV? | HH COPC? | ECO COPEC? | Selection Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 3 | 3 | 100% | 0.19 | 0.30 | 5.6 | N/A | Y | N | N | N/A | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Arsenic | 3 | 3 | 100.0% | 6.7 | 5.7 | 0.018 | N/A | Y | Y | Y | N/A | **Y** | N | Maximum concentration exceeds background and human screening value. |
| Barium | 3 | 3 | 100.0% | 18 | 18 | 1000 | N/A | Y | N | N | N/A | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Beryllium | 0 | 3 | 0.0% | 0.14 | <0.14 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Cadmium | 0 | 3 | 0.0% | 0.11 | <0.11 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Chromium | 0 | 3 | 0.0% | 0.5 | 0.55 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Cobalt | 1 | 3 | 33.3% | 0.1 | <0.1 | NE | N/A | Y | N | N | N/A | N | N | Not retained; maximum concentration less than the background screening criterion. |
| Copper | 3 | 3 | 100.0% | 0.66 | 0.62 | 1,300 | N/A | Y | Y | N | N/A | N | N | Not retained; maximum concentration less than human screening value. |
| Lead | 0 | 3 | 0.0% | 0.1 | <0.1 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Mercury | 3 | 3 | 100.0% | 0.39 | 0.21 | 0.05 | N/A | Y | Y | Y | N/A | **Y** | N | Maximum concentration exceeds background and human screening value. |
| Molybdenum | 3 | 3 | 100.0% | 7.9 | 7.3 | NE | N/A | Y | Y | N | N/A | N | N | Not retained; maximum concentration less than human screening value. |
| Nickel | 3 | 3 | 100.0% | 0.48 | 0.44 | 610 | N/A | Y | Y | N | N/A | N | N | Not retained; maximum concentration less than human screening value. |
| Selenium | 0 | 3 | 0.0% | 0.19 | <0.19 | 170 | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Silver | 0 | 3 | 0.0% | 0.1 | <0.1 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Thallium | 0 | 3 | 0.0% | 0.1 | <0.1 | 0.24 | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Vanadium | 0 | 3 | 0.0% | 0.78 | <0.78 | NE | N/A | N | N | N | N/A | N | N | Not retained - less than 5% detections. |
| Zinc | 1 | 3 | 33.3% | 1.9 | <1.7 | 120 | N/A | Y | Y | N | N/A | N | N | Not retained; maximum concentration less than human screening value. |

Notes:

BG = Background (3 times laboratory result or RL if ND)
COPEC = contaminant of potential ecological concern
COPC = contaminant of potential concern
EPA = Environmental Protection Agency
N/A = Total concentrations do not apply to ecological surface water screening criteria which are based on dissolved concentrations.

ESV = Ecological Screening Value
DL = Detection Limit
mg/kg = milligram per kilogram
RSL = Regional Screening Level

Max > BG? = Is the maximum concentration greater than Background Screening Criterion (3 X laboratory result or RL if ND)?
Max > HH RSL? = Is the maximum concentration greater than Human Health Regional Screening Level?
Max > ESV? = Is the maximum concentration greater than the Ecological Screening Value?
HH COPC? = Is analyte retained as a human health contaminant of potential concern?
ECO COPEC? = Is analyte retained as a contaminant of potential ecological concern?

Red Highlight = Denotes analyte retained as a human health and/or ecological contaminant of potential concern
Green Highlight = Denotes analyte not retained as a human health and/or ecological contaminant of potential concern

**Table H2-1**
**Risk Characterization for Background**
**Big Blue Mill**
**Kern County, California**

| Background Evaluation Surface Soil (composite sample concentration, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| BB-B-COMP-01 | 10/19/2020 | Background Area | <376 | 19 | -- | -- | <164 | 24 | <80 | 26 | 59 | 3 | 6 | 13 | <3 | <131 | -- | 209 | 128 |

| Background Evaluation Surface Soil (composite sample concentration, Lab) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30.0 | 18.9 | 30.0 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90.0 | 234 |
| BB-B-COMP-01 | 10/19/2020 | Background Area | <0.8 | 20 | 82 | <0.47 | <0.52 | 10 | 6.3 | 10 | 43 | 0.6200 | <0.5 | 4.9 | <1.1 | <0.67 | <0.49 | 30 | 78 |

| Risk Characterization for Composite Background Sample (XRF) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | <376 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 19 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **2E-04** | 6E-07 | **46** | 0 | 1 | 0 | 0 | 0 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | <164 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 24 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | <80 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 26 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 59 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 1 | 0 | 0 | 0 | 1 | **5** |
| Mercury | 3 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **3** | 0 | **10** | **30** | **2** | **231** |
| Molybdenum | 6 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | -- | Not a COC | Not a COC |
| Nickel | 13 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | <3 | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | <131 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 209 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | -- | Not a COC | Not a COC |
| Zinc | 128 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | HI | **50** | 0 | **13** | **32** | **5** | **240** |

**Table H2-1**
**Risk Characterization for Background**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for Background Sample BG-BK-1 (Laboratory) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Constituents** | **EPC (mean)** | **Residential SL** | **Recreational Visitor RSL** | **ESV Plant** | **ESV Invertebrate** | **ESV Mammals** | **ESV Avian** | **Residential Risk** | **Recreational Visitor Risk** | **Residential HQ** | **Recreational Visitor HQ** | **Plant HQ** | **Invertebrate HQ** | **Mammal HQ** | **Avian HQ** |
| | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **unitless** | | | | | | | |
| Antimony | <0.8 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 20.0 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **2E-04** | 7E-07 | **49** | 0 | 1 | 0 | 0 | 0 |
| Barium | 82 | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | <0.47 | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | <0.52 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | -- | -- | -- | -- | -- | -- |
| Chromium | 10.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | **10** | **25** | 0 | 0 |
| Cobalt | 6.3 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 10.0 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 0 |
| Lead | 43.0 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 1 | 0 | 0 | 0 | 1 | **4** |
| Mercury | 0.62 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 1 | 0 | **2** | **6** | 0 | **48** |
| Molybdenum | <0.5 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Nickel | 4.90 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | <1.1 | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Silver | <0.67 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | <0.49 | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 30 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 78 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 0 | 1 | 1 | **2** |
| | | | | | | | | | HI | **50** | 0 | **14** | **32** | **3** | **55** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
DTSC = Departement of Toxic Substances Control
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
RSL = regional screening level
-- = screening criterion not available
ppm = parts per million

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020

EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/

Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search

Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

DTSC. 2020. DTSC-modified Screening Levels (DTSC-SLs). HERO HHRA Note Number 3. June.

**Table H2-2**
**RIsk Characterization for AOC 1**
**Big Blue Mill**
**Kern County, California**

| AOC 1 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | -- | 12.60 | -- | -- | -- | 34.73 | -- | 21.72 | 11.42 | 3.90 | 7.56 | 22.22 | -- | -- | -- | 242.10 | 95.40 |

**Risk Characterization for AOC 1 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 12.60 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **1E-04** | 4E-07 | **31** | 0 | 1 | 0 | 0 | 0 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 34.73 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 21.72 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 11.42 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 0 | 0 | 0 | 0 | 0 | 1 |
| Mercury | 3.90 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **4** | 0 | **13** | **39** | **2** | **300** |
| Molybdenum | 7.56 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 22.22 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 242.10 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 95.40 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | 1 | 2 |
| | | | | | | | | | **HI** | **35** | 0 | **15** | **40** | **4** | **304** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-3**
**Risk Characterization for AOC 2**
**Big Blue Mill**
**Kern County, California**



| AOC 2 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Sample Date** | **Location** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | -- | 77.46 | -- | -- | -- | 31.73 | -- | 29.69 | 102.30 | 9.76 | 6.50 | 21.83 | -- | -- | -- | 224.80 | 143.80 |

**Risk Characterization for AOC 2 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 77.46 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **7E-04** | **3E-06** | **189** | 0 | **4** | 1 | **2** | **2** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 31.73 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 29.69 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 102.30 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 1 | 0 | 1 | 0 | **2** | **9** |
| Mercury | 9.76 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **10** | 0 | **33** | **98** | **6** | **751** |
| Molybdenum | 6.50 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 21.83 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 224.80 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 143.80 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | **HI** | **200** | 0 | **39** | **101** | **12** | **766** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-4**
**RIsk Characterization for AOC 3**
**Big Blue Mill**
**Kern County, California**

| AOC 3 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Sample Date** | **Location** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | -- | 647.30 | -- | -- | -- | 36.84 | -- | 37.24 | 153.80 | 33.80 | 8.78 | 21.74 | -- | -- | -- | 235.30 | 157.50 |

**Risk Characterization for AOC 3 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 647.30 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **6E-03** | **2E-05** | **1579** | 1 | **36** | **11** | **14** | **15** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 36.84 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 37.24 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 1 | 0 | 1 | 1 |
| Lead | 153.80 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **2** | 0 | 1 | 0 | **3** | **14** |
| Mercury | 33.80 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **34** | 0 | **113** | **338** | **20** | **2600** |
| Molybdenum | 8.78 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 21.74 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 235.30 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 157.50 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | **HI** | **1615** | 1 | **151** | **351** | **39** | **2634** |

Notes:
RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).
HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.
**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:
BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:
BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-5**
**RIsk Characterization for AOC 4**
**Big Blue Mill**
**Kern County, California**

| AOC 4 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | 8764.0 | 10663.00 | -- | -- | -- | 38.34 | -- | 19.29 | 458.10 | 8.11 | 7.02 | 20.07 | -- | 17.0 | -- | 236.40 | 202.90 |

| AOC 4 Surface Soil (mean concentrations, Lab) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30.0 | 18.9 | 30.0 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90.0 | 234 |
| BB-020 | 10/20/2020 | | 160 | 7400 | 98 | <0.47 | 60 | 10.0 | 6.7 | 15.0 | 520 | 2 | <0.5 | 8.1 | <1.1 | 8.500 | <0.49 | 28.0 | 150 |
| BB-025 | 10/21/2020 | | 120 | 7100 | 94 | <0.47 | 51 | 7.1 | 4.5 | 17 | 610 | 3 | <0.5 | 4.9 | <1.1 | 11 | <0.49 | 21 | 360 |
| EPC (maximum concentration) | | | 160 | 7400 | 98 | 0 | 60 | 10 | 6.7 | 17 | 610 | 3 | 0 | 8.1 | 0 | 11 | 0 | 28 | 360 |

**Risk Characterization for AOC 4 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 8764 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | 283 | 11 | 1753 | 112 | 32459 | -- |
| Arsenic | 10663 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | 1E-01 | 3E-04 | 26007 | 12 | 592 | 178 | 232 | 248 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 38.34 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 19.29 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 458.10 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 6 | 1 | 4 | 0 | 8 | 42 |
| Mercury | 8.11 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 8 | 0 | 27 | 81 | 5 | 624 |
| Molybdenum | 7.02 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 20.07 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 17.0 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 1 | 4 |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 236.40 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 202.90 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 2 | 3 | 4 |
| | | | | | | | | | HI | 26304 | 24 | 2378 | 373 | 32708 | 922 |

**Table H2-5**
**RIsk Characterization for AOC 4**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 4 (Maximum, Laboratory) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Constituents** | **EPC (mean)** | **Residential SL** | **Recreational Visitor RSL** | **ESV Plant** | **ESV Invertebrate** | **ESV Mammals** | **ESV Avian** | **Residential Risk** | **Recreational Visitor Risk** | **Residential HQ** | **Recreational Visitor HQ** | **Plant HQ** | **Invertebrate HQ** | **Mammal HQ** | **Avian HQ** |
| | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **unitless** | | | | | | | |
| Antimony | 160 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | **5** | 0 | **32** | **2** | **593** | **--** |
| Arsenic | 7400.0 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **7E-02** | **2E-04** | **18049** | **8** | **411** | **123** | **161** | **172** |
| Barium | 98.00 | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | 0.00 | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 60 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | 1 | 0 | **2** | 0 | **167** | **78** |
| Chromium | 10.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | **10** | **25** | 0 | 0 |
| Cobalt | 6.7 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 17.00 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 610.00 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **8** | 1 | **5** | 0 | **11** | **55** |
| Mercury | 3 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **3** | 0 | **10** | **30** | **2** | **231** |
| Molybdenum | 0.00 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | 0 | **--** | 0 | 0 |
| Nickel | 8.10 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | 0 | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 0 |
| Silver | 11 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | **--** | 1 | **3** |
| Thallium | 0.00 | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 28.00 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 360.00 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | **2** | **3** | **5** | **8** |
| | | | | | | | | | **HI** | **18065** | **9** | **473** | **184** | **939** | **548** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020

EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/

Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search

Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-6**
**RIsk Characterization for AOC 5**
**Big Blue Mill**
**Kern County, California**

| AOC 5 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | 85.8 | 36217 | -- | -- | -- | 39.80 | -- | 37.62 | 3042 | 1373 | 13.06 | 19.21 | -- | 130.9 | -- | 211.50 | 189.60 |

| AOC 5 Surface Soil (mean concentrations, Lab) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30.0 | 18.9 | 30.0 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90.0 | 234 |
| EPC (95% UCL) | | | 69.11 | 40475 | 59.31 | -- | 289.7 | 7.989 | 5.179 | 43.63 | 12584 | 350 | 4.3 | 6.197 | -- | 26.03 | -- | 25.35 | 136.4 |

**Risk Characterization for AOC 5 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 86 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | **3** | 0 | **17** | 1 | **318** | -- |
| Arsenic | 36217 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **3E-01** | **1E-03** | **88334** | **41** | **2012** | **604** | **787** | **842** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 39.80 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 37.62 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 1 | 0 | 1 | 1 |
| Lead | 3042 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **38** | **4** | **25** | **2** | **54** | **277** |
| Mercury | 1373 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **1373** | **5** | **4577** | **13730** | **808** | **105615** |
| Molybdenum | 13.06 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 19.21 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 130.9 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | **9** | **31** |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 211.50 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 189.60 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | **2** | **2** | **4** |
| | | | | | | | | | **HI** | **89748** | **50** | **6633** | **14339** | **1980** | **106771** |

**Table H2-6**
**RIsk Characterization for AOC 5**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 5 (95% UCL, Laboratory) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Constituents** | **EPC (mean)** | **Residential SL** | **Recreational Visitor RSL** | **ESV Plant** | **ESV Invertebrate** | **ESV Mammals** | **ESV Avian** | **Residential Risk** | **Recreational Visitor Risk** | **Residential HQ** | **Recreational Visitor HQ** | **Plant HQ** | **Invertebrate HQ** | **Mammal HQ** | **Avian HQ** |
| | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **unitless** | | | | | | | |
| Antimony | 69.11 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | **2** | 0 | **14** | 1 | **256** | -- |
| Arsenic | 40475 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **4E-01** | **1E-03** | **98720** | **46** | **2249** | **675** | **880** | **941** |
| Barium | 59.31 | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 289.7 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | **4** | 0 | **9** | **2** | **805** | **376** |
| Chromium | 8.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | **8** | **20** | 0 | 0 |
| Cobalt | 5.179 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 43.63 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 1 | 1 | 1 | **2** |
| Lead | 12584.00 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **157** | **16** | **105** | **7** | **225** | **1144** |
| Mercury | 350 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **350** | 1 | **1167** | **3500** | **206** | **26923** |
| Molybdenum | 4.30 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | **2** | -- | **8** | 0 |
| Nickel | 6.20 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Silver | 26.03 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | **2** | **6** |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 25.35 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 136.40 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | **HI** | **99233** | **64** | **3555** | **4207** | **2384** | **29396** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-7**
**RIsk Characterization for AOC 6**
**Big Blue Mill**
**Kern County, California**

| AOC 6 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Sample Date** | **Location** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** | **ppm** |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | -- | 154.60 | -- | -- | -- | 40.68 | -- | 34.23 | 31.48 | 6.99 | 9.32 | 23.07 | -- | -- | -- | 257.40 | 100.10 |

| AOC 6 Surface Soil (mean concentrations, Lab) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Sample Date** | **Location** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30.0 | 18.9 | 30.0 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90.0 | 234 |
| BB-020 | 10/20/2020 | | <0.8 | 110 | 58 | <0.47 | 1.3 | 4.6 | 5.1 | 8.4 | 34 | 0.77 | <0.5 | 3.0 | 4 | 2.300 | <0.49 | 21.0 | 44 |
| EPC (as reported) | | | <0.8 | 110 | 58 | <0.47 | 1.3 | 4.6 | 5.1 | 8.4 | 34 | 0.77 | <0.5 | 3 | 3.9 | 2.3 | <0.49 | 21 | 44 |

**Risk Characterization for AOC 6 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 155 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **1E-03** | **5E-06** | **377** | 0 | **9** | **3** | **3** | **4** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | 40.68 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 34.23 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 31.48 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 0 | 0 | 0 | 0 | 1 | **3** |
| Mercury | 6.99 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **7** | 0 | **23** | **70** | **4** | **538** |
| Molybdenum | 9.32 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 23.07 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 257.4 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 100.1 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | 1 | **2** |
| | | | | | | | | | **HI** | **384** | 0 | **33** | **74** | **10** | **548** |

**Table H2-7**
**RIsk Characterization for AOC 6**
**Big Blue Mill**
**Kern County, California**

**Risk Characterization for AOC 6 (Single Point Estimate, Laboratory)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | <0.8 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 110.0 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **1E-03** | **4E-06** | **268** | 0 | **6** | **2** | **2** | **3** |
| Barium | 58.00 | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | <0.47 | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 1.3 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | 0 | 0 | 0 | 0 | **4** | **2** |
| Chromium | 4.6 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | **5** | **12** | 0 | 0 |
| Cobalt | 5.1 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 8.40 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 0 |
| Lead | 34 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 0 | 0 | 0 | 0 | 1 | **3** |
| Mercury | 1 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 1 | 0 | **3** | **8** | 0 | **59** |
| Molybdenum | <0.5 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Nickel | 3 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | 3.9 | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | **8** | 1 | **6** | **3** |
| Silver | 2.3 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 0 | 1 |
| Thallium | <0.49 | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 21 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 44 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| | | | | | | | | | HI | 270 | 0 | 22 | 22 | 14 | 72 |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-8**
**RIsk Characterization for AOC 7**
**Big Blue Mill**
**Kern County, California**

| AOC 7 Surface Soil (mean concentrations, XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72.0 | -- | 78.0 | 177 | 9 | 18 | 39.0 | -- | -- | ;-- | 627.0 | 384 |
| EPC (95% UCL) | | | -- | 17 | -- | -- | -- | -- | -- | 17.87 | 8.475 | 3.5 | -- | 22.39 | -- | -- | -- | 319.30 | 64.30 |

| AOC 7 Surface Soil (mean concentrations, Lab) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Location | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30.0 | 18.9 | 30.0 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90.0 | 234 |
| EPC (95% UCL) | | | -- | 11.18 | 68.04 | -- | -- | 10.41 | 6.417 | 9.674 | -- | 4.3 | -- | 6.16 | -- | -- | -- | 48.98 | 37.76 |

**Risk Characterization for AOC 7 (95% UCL, XRF)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 17 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **2E-04** | 6E-07 | **42** | 0 | 1 | 0 | 0 | 0 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Chromium | -- | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 17.87 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 8 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 0 | 0 | 0 | 0 | 0 | 1 |
| Mercury | 4 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **4** | 0 | **12** | **35** | **2** | **269** |
| Molybdenum | -- | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 22.39 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 319.3 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 64.3 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 0 | 1 | 1 | 1 |
| | | | | | | | | | **HI** | **45** | 0 | **13** | **36** | **4** | **273** |

**Table H2-8**
**RIsk Characterization for AOC 7**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 7 (95% UCL, Laboratory) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Constituents** | **EPC (mean)** | **Residential SL** | **Recreational Visitor RSL** | **ESV Plant** | **ESV Invertebrate** | **ESV Mammals** | **ESV Avian** | **Residential Risk** | **Recreational Visitor Risk** | **Residential HQ** | **Recreational Visitor HQ** | **Plant HQ** | **Invertebrate HQ** | **Mammal HQ** | **Avian HQ** |
| | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **mg/kg** | **unitless** | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 11 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **1E-04** | 4E-07 | **27** | 0 | 1 | 0 | 0 | 0 |
| Barium | 68.04 | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | -- | -- | -- | -- | -- | -- |
| Chromium | 10.4 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | **10** | **26** | 0 | 0 |
| Cobalt | 6.417 | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 9.67 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 0 |
| Lead | -- | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | -- | -- | -- | -- | -- | -- |
| Mercury | 4.3 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **4** | 0 | **14** | **43** | **3** | **331** |
| Molybdenum | -- | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Nickel | 6.16 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 49.0 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 37.8 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| | | | | | | | | | **HI** | **32** | 0 | **26** | **70** | **4** | **333** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
ppm = parts per million
RSL = regional screening level
-- = screening criterion not available

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020

EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/

Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search

Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| AOC 4 Depth Investigation, surface soil samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium* | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | -- | 57 | -- | -- | -- | 72 | -- | 78 | 177 | 9 | 18 | 39 | -- | -- | ;-- | 627 | 384 |
| 0 feet | | | | | | | | | | | | | | | | | | | |
| BB-025 | 10/20/2020 | 0 | 414 | 10929 | Not Reported | Not Reported | 51 | 38 | <82 | 20 | 891 | <52 | <26 | 11 | <7 | 26 | -- | 138 | 197 |
| BB-025-SO-01 | 10/22/2020 | 0 | 224 | 4678 | | | N/A | 28 | <79 | 29 | 461 | 7 | 5 | 24 | <5 | <123 | -- | 187 | 185 |
| EPC (mean) | | | 319.00 | 7803.50 | -- | --- | 51.00 | 33.00 | --- | 24.50 | 676.00 | 7.00 | 5.00 | 17.50 | --- | 26.00 | --- | 162.50 | 191.00 |
| EPC (maximum) | | | 414 | 10929 | 0.0 | 0.0 | 51 | 38 | 0 | 29 | 891 | 7 | 5 | 24 | 0 | 26 | 0 | 187 | 197 |

| AOC 4 Depth Investigation, 0-1 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium* | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| >0-1 feet bgs | | | | | | | | | | | | | | | | | | | |
| BB-025-0.5 | 10/22/2020 | 0.5 | 157 | 24390 | Not Reported | Not Reported | 160 | 45 | <84 | <9 | 1757 | <64 | <22 | 6 | <9 | 45 | Not Reported | 144 | 43 |
| BB-025-1 | 10/22/2020 | 1 | 27 | 3179 | | | N/A | 22 | <83 | 24 | 131 | <34 | <29 | 15 | <5 | 10 | | 227 | 118 |
| BB-025-SO-01-0. | 10/22/2020 | 0.5 | 111 | 11422 | | | N/A | 29 | <87 | <10 | 782 | <50 | <26 | 17 | <7 | 18 | | 220 | 103 |
| BB-025-SO-01-1 | 10/22/2020 | 1 | 40 | 2483 | | | N/A | 28 | <85 | 31 | 299 | 15 | 5 | 23 | <5 | <128 | | 218 | 538 |
| EPC (mean) | | | 83.75 | 10368.50 | -- | --- | 160.00 | 31.00 | --- | 27.50 | 742.25 | 15.00 | 5.00 | 15.25 | --- | 24.33 | --- | 202.25 | 200.50 |
| EPC (maximum) | | | 157 | 24390 | 0 | 0 | 160 | 45 | 0 | 31 | 1757 | 15 | 5 | 23 | 0 | 45 | 0 | 227 | 538 |

| AOC 4 Depth Investigation, 1-2 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| 1-2 feet bgs | | | | | | | | | | | | | | | | | | | |
| BB-025-1.5 | 10/22/2020 | 1.5 | <396 | 546 | Not Reported | Not Reported | 13 | 45 | <70 | 24 | 59 | <30 | <31 | 26 | <4 | <136 | Not Reported | 275 | 377 |
| EPC (mean) | | | -- | 546 | -- | --- | 13 | 45 | -- | 24 | 59 | -- | -- | 26 | -- | -- | -- | 275 | 377 |
| EPC (maximum) | | | 0 | 546 | 0 | 0 | 13 | 45 | 0 | 24 | 59 | 0 | 0 | 26 | 0 | 0 | 0 | 275 | 377 |

| AOC 5 Depth Investigation, surface soil samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium* | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| Three X Background Concentrations (mg/kg) | | | <0.8 | 60 | 246 | <0.47 | <0.52 | 30 | 18.9 | 30 | 129 | 1.86 | <0.5 | 14.7 | <1.1 | <0.67 | <0.49 | 90 | 234 |
| 0 feet | | | | | | | | | | | | | | | | | | | |
| BB-123 | 10/20/2020 | 0 | <272 | 27168 | Not Reported | Not Reported | N/A | 33 | <96 | <9 | 1801 | 693 | <21 | <11 | <9 | 39 | Not Reported | 98 | 59 |
| BB-129 | 10/20/2020 | 0 | <306 | 19793 | | | 140 | 37 | <92 | <9 | 874 | 21 | <23 | <11 | <8 | 17 | | 114 | 23 |
| BB-116 | 5/21/2020 | 0 | 28 | 1833 | | | N/A | <28 | <79 | 33 | 1002 | 19 | 18 | 16 | 2 | <127 | | 216 | 189 |
| BB-116-SO-01 | 10/22/2020 | 0 | 95 | 9270 | | | 91 | <28 | <83 | 15 | 1229 | 11 | 12 | 10 | <1 | 34 | | 144 | 101 |
| BB-023 | 10/20/2020 | 0 | 79 | 31092 | | | 210 | 29 | <74 | <11 | 3162 | 108 | <23 | <11 | 4 | 68 | | <49 | 98 |
| EPC (mean) | | | 67.33 | 17831.20 | -- | --- | 147.00 | 33.00 | --- | 24.00 | 1613.60 | 170.40 | 15.00 | 13.00 | --- | 39.50 | --- | 143.00 | 94.00 |
| EPC (maximum) | | | 95 | 31092 | 0.0 | 0.0 | 210 | 37 | 0 | 33 | 3162 | 693 | 18 | 16 | 4 | 68 | 0 | 216 | 189 |

| AOC 5 Depth Investigation, 0-1 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium* | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| >0-1 feet bgs | | | | | | | | | | | | | | | | | | | |
| BB-123-0.5 | 10/20/2020 | 0.5 | <343 | 11670 | Not Reported | Not Reported | 84 | 29 | <89 | <10 | 1276 | 346 | <26 | <12 | <8 | 15 | Not Reported | 170 | 87 |
| BB-123-1 | 10/20/2020 | 1 | <376 | 5632 | | | N/A | 20 | <74 | 5 | 313 | 79 | <28 | 6 | <6 | 10 | | 151 | 44 |
| BB-129-0.5 | 10/20/2020 | 0.5 | <343 | 13786 | | | 86 | 22 | <86 | <9 | 237 | 8 | <26 | <12 | <7 | 10 | | 161 | 28 |
| BB-129-1 | 10/20/2020 | 1 | <368 | 10103 | | | N/A | 20 | <73 | <9 | 154 | <52 | <28 | <12 | <7 | <127 | | 159 | 24 |
| BB-116-0.5 | 10/22/2020 | 0.5 | 367 | 64693 | | | N/A | 53 | <89 | <10 | 6211 | <90 | 6 | <10 | <2 | 210 | | <44 | 111 |
| BB-116-SO-01-0. | 10/22/2020 | 0.5 | 152 | 33372 | | | 210 | 62 | <90 | 12 | 2459 | <71 | <20 | <10 | <9 | 71 | | 81 | 90 |
| BB-116-SO-01-1 | 10/22/2020 | 1 | 58 | 15474 | | | N/A | 37 | <86 | 54 | 1289 | 12 | 4 | 14 | <8 | 30 | | 65 | 475 |
| BB-023-0.5 | 10/22/2020 | 0.5 | 42 | 15526 | | | N/A | 25 | <75 | 27 | 884 | 72 | <27 | <12 | <8 | 24 | | 61 | 99 |
| BB-023-1 | 10/22/2020 | 1 | <10 | 40262 | | | 350 | <26 | <99 | 21 | 2287 | <79 | <20 | <11 | <10 | 68 | | <47 | 350 |
| EPC (mean) | | | 154.75 | 23390.89 | -- | --- | 182.50 | 33.50 | --- | 23.80 | 1678.89 | 103.40 | 5.00 | 10.00 | --- | 54.75 | --- | 121.14 | 145.33 |
| EPC (maximum) | | | 367 | 64693 | 0 | 0 | 350 | 62 | 0 | 54 | 6211 | 346 | 6 | 14 | 0 | 210 | 0 | 170 | 475 |

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| AOC 5 Depth Investigation, 1-2 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| | 1-2 feet bgs | | | | | | | | | | | | | | | | | | |
| BB-123-2 | 10/20/2020 | 2 | <396 | 1097 | | | <171 | <29 | <77 | 14 | 38 | 17 | 4 | 11 | <4 | <136 | | 254 | 108 |
| BB-129-2 | 10/20/2020 | 2 | <366 | 9430 | | | <157 | 33 | <72 | <9 | 50 | <50 | <27 | 11 | <6 | 12 | | 218 | 23 |
| BB-116-SO-01-1.5 | 10/22/2020 | 1.5 | 40 | 6260 | Not Reported | Not Reported | <149 | 30 | <88 | 36 | 566 | 47 | <26 | 12 | <6 | 17 | Not Reported | 162 | 131 |
| BB-116-SO-01-2 | 10/22/2020 | 2 | <367 | 3997 | | | <157 | 32 | <83 | 27 | 129 | 8 | <28 | 24 | <5 | <124 | | 191 | 211 |
| BB-023-2 | 10/22/2020 | 2 | <295 | 25511 | | | <126 | 30 | <90 | <10 | 902 | 156 | <23 | <11 | <9 | 33 | | 114 | 326 |
| EPC (mean) | | | 40 | 9259 | -- | -- | -- | 31 | -- | 26 | 337 | 57 | 4 | 15 | -- | 21 | -- | 188 | 160 |
| EPC (maximum) | | | 40 | 25511 | 0 | 0 | 0 | 33 | 0 | 36 | 902 | 156 | 4 | 24 | 0 | 33 | 0 | 254 | 326 |

| AOC 5 Depth Investigation, 2-3 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| | 2-3 feet bgs | | | | | | | | | | | | | | | | | | |
| BB-123-3 | 10/20/2020 | 3 | <373 | 1086 | | | <161 | 33 | <86 | 25 | 59 | 51 | <29 | 25 | <4 | <127 | | 272 | 194 |
| BB-129-3 | 10/20/2020 | 3 | <372 | 8493 | Not Reported | Not Reported | <160 | 30 | <76 | <10 | 62 | <47 | <28 | 13 | <6 | <127 | Not Reported | 223 | 40 |
| BB-116-SO-01-2.5 | 10/22/2020 | 2.5 | <353 | 5954 | | | <152 | 34 | <88 | 33 | 298 | 65 | <27 | 15 | <5 | <121 | | 161 | 251 |
| BB-023-3 | 10/22/2020 | 3 | <307 | 13761 | | | <131 | 62 | <100 | 14 | 375 | 40 | <23 | 10 | <6 | <103 | | 234 | 222 |
| EPC (mean) | | | --- | 7323.50 | -- | --- | --- | 39.75 | --- | 24.00 | 198.50 | 52.00 | --- | 15.75 | --- | --- | --- | 222.50 | 176.75 |
| EPC (maximum) | | | 0 | 13761 | 0 | 0 | 0 | 62 | 0 | 33 | 375 | 65 | 0 | 25 | 0 | 0 | 0 | 272 | 251 |

| AOC 5 Depth Investigation, 3-4 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| | 3-4 feet bgs | | | | | | | | | | | | | | | | | | |
| BB-123-4 | 10/20/2020 | 4 | <368 | 3186 | | | <159 | <27 | <80 | 6 | 62 | 40 | <27 | 11 | <4 | <125 | | 184 | 110 |
| BB-129-4 | 10/20/2020 | 4 | <389 | 4822 | Not Reported | Not Reported | <168 | 34 | <66 | 6 | 22 | <40 | <28 | 13 | <5 | <133 | Not Reported | 192 | 38 |
| BB-023-4 | 10/22/2020 | 4 | <343 | 4647 | | | <146 | 37 | <89 | 37 | 172 | 35 | <26 | 26 | <5 | <116 | | 225 | 209 |
| EPC (mean) | | | --- | 4218.33 | -- | --- | --- | 35.50 | --- | 16.33 | 85.33 | 37.50 | --- | 16.67 | --- | --- | --- | 200.33 | 119.00 |
| EPC (maximum) | | | 0 | 4822 | 0 | 0 | 0 | 37 | 0 | 37 | 172 | 40 | 0 | 26 | 0 | 0 | 0 | 225 | 209 |

| AOC 5 Depth Investigation, 4-5 feet bgs samples (XRF) | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Date | Depth (ft) | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm | ppm |
| | 4-5 feet bgs | | | | | | | | | | | | | | | | | | |
| BB-129-5 | 10/20/2020 | 5 | <343 | 10622 | Not Reported | Not Reported | <148 | <29 | <94 | <9 | 38 | <47 | 6 | 11 | <6 | <118 | Not Reported | 188 | 61 |
| BB-023-5 | 10/22/2020 | 5 | <375 | 1105 | | | <161 | 42 | <86 | 46 | 24 | <29 | <28 | 14 | <4 | <128 | | 242 | 219 |
| EPC (mean) | | | -- | 5863.50 | -- | --- | -- | 42.00 | -- | 46.00 | 31.00 | -- | 6.00 | 12.50 | -- | -- | -- | 215.00 | 140.00 |
| EPC (maximum) | | | 0 | 10622 | 0 | 0 | 0 | 42 | 0 | 46 | 38 | 0 | 6 | 14 | 0 | 0 | 0 | 242 | 219 |

Zero values for XRF data were below the limit of detection (LOD). LOD for each sample is shown in Table 1.

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

**Risk Characterization for AOC 4 (surface) XRF (mean)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 319 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | 10 | 0 | 64 | 4 | 1181 | -- |
| Arsenic | 7804 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | 7E-02 | 3E-04 | 19033 | 9 | 434 | 130 | 170 | 181 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 51 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | 2 | 0 | 142 | 66 |
| Chromium | 33 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 25 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 676 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 8 | 1 | 6 | 0 | 12 | 61 |
| Mercury | 7 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 7 | 0 | 23 | 70 | 4 | 538 |
| Molybdenum | 5 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 18 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 26 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 2 | 6 |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 163 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 191 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 2 | 2 | 4 |
| | | | | | | | | | HI | 19059 | 10 | 529 | 207 | 1514 | 859 |

**Risk Characterization for AOC 4 (0-1 feet bgs) XRF (mean)**

| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 83.8 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | 3 | 0 | 17 | 1 | 310 | -- |
| Arsenic | 10368.5 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | 9E-02 | 3E-04 | 25289 | 12 | 576 | 173 | 225 | 241 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 160.0 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | 5 | 1 | 444 | 208 |
| Chromium | 31.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 27.5 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 742.3 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 9 | 1 | 6 | 0 | 13 | 67 |
| Mercury | 15.0 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 15 | 0 | 50 | 150 | 9 | 1154 |
| Molybdenum | 5.0 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 15.3 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 24.3 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 2 | 6 |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 202.3 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 200.5 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 2 | 3 | 4 |
| | | | | | | | | | HI | 25316 | 13 | 656 | 327 | 1007 | 1681 |

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 4 (1-2 feet bgs) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 546 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | 5E-03 | 2E-05 | 1332 | 1 | 30 | 9 | 12 | 13 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 13 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | 0 | 0 | 36 | 17 |
| Chromium | 45 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 24 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 59 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 1 | 0 | 0 | 0 | 1 | 5 |
| Mercury | -- | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | -- | -- | -- | -- | -- | -- |
| Molybdenum | -- | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 26 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 275 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 377 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 2 | 3 | 5 | 8 |
| | | | | | | | | | HI | 1332 | 1 | 34 | 13 | 54 | 44 |

| Risk Characterization for AOC 5 (surface) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 67.3 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | 2 | 0 | 13 | 1 | 249 | -- |
| Arsenic | 17831.2 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | 2E-01 | 6E-04 | 43491 | 20 | 991 | 297 | 388 | 415 |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 147.0 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | 5 | 1 | 408 | 191 |
| Chromium | 33.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 24.0 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 1613.6 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 20 | 2 | 13 | 1 | 29 | 147 |
| Mercury | 170.4 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | 170 | 1 | 568 | 1704 | 100 | 13108 |
| Molybdenum | 15.0 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 13.0 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 39.5 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 3 | 9 |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 143.0 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 94.0 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | 1 | 2 |
| | | | | | | | | | HI | 43683 | 23 | 1591 | 2005 | 1179 | 13872 |

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 5 (0-1 feet bgs) XRF (mean) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 154.8 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | **5** | 0 | **31** | **2** | **573** | -- |
| Arsenic | 23390.9 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **2E-01** | **8E-04** | **57051** | **27** | **1299** | **390** | **508** | **544** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | 182.5 | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | **6** | 1 | **507** | **237** |
| Chromium | 33.5 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 23.8 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 1678.9 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **21** | **2** | **14** | 1 | **30** | **153** |
| Mercury | 103.4 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **103** | 0 | **345** | **1034** | **61** | **7954** |
| Molybdenum | 5.0 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 10.0 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 54.8 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | **4** | **13** |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 121.1 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 145.3 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | HI | **57180** | **29** | **1696** | **1430** | **1686** | **8905** |

| Risk Characterization for AOC 5 (1-2 feet bgs) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | 40.0 | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | 1 | 0 | **8** | 1 | **148** | -- |
| Arsenic | 9259.0 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **8E-02** | **3E-04** | **22583** | **11** | **514** | **154** | **201** | **215** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | -- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Chromium | 31.3 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 25.7 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 1 | 1 |
| Lead | 337.0 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **4** | 0 | **3** | 0 | **6** | **31** |
| Mercury | 57.0 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **57** | 0 | **190** | **570** | **34** | **4385** |
| Molybdenum | 4.0 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 14.5 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | 20.7 | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | 0 | -- | 1 | **5** |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 187.8 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 159.8 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | HI | **22645** | **11** | **717** | **727** | **393** | **4640** |

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 5 (2-3 feet bgs) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| Constituents | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | --- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 7323.5 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **7E-02** | **2E-04** | **17862** | **8** | **407** | **122** | **159** | **170** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | --- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Chromium | 39.8 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 24.0 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 198.5 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | **2** | 0 | **2** | 0 | **4** | **18** |
| Mercury | 52.0 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **52** | 0 | **173** | **520** | **31** | **4000** |
| Molybdenum | --- | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 15.8 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | --- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 222.5 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 176.8 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **4** |
| | | | | | | | | | HI | **17917** | **9** | **583** | **644** | **196** | **4193** |

| Risk Characterization for AOC 5 (3-4 feet bgs) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| Constituents | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | --- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 4218.3 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **4E-02** | **1E-04** | **10289** | **5** | **234** | **70** | **92** | **98** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | --- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Chromium | 35.5 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | --- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 16.3 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 0 | 0 | 0 | 1 |
| Lead | 85.3 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 1 | 0 | 1 | 0 | **2** | **8** |
| Mercury | 37.5 | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | **38** | 0 | **125** | **375** | **22** | **2885** |
| Molybdenum | --- | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 16.7 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | --- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | --- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | --- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 200.3 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 119.0 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | HI | **10327** | **5** | **361** | **447** | **117** | **2994** |

**Table H2-9**
**Risk Characterization for Depth Assessment Samples, AOC 4 and AOC 5**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for AOC 5 (4-5 feet bgs) XRF (mean) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EPC (mean) | Residential SL | Recreational Visitor RSL | ESV Plant | ESV Invertebrate | ESV Mammals | ESV Avian | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Plant HQ | Invertebrate HQ | Mammal HQ | Avian HQ |
| **Constituents** | ppm | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | | | | |
| Antimony | -- | 31 | 782 | 5 | 78 | 0.27 | -- | NA | NA | -- | -- | -- | -- | -- | -- |
| Arsenic | 5863.5 | 0.11 | 30.6 | 18 | 60 | 46 | 43 | **5E-02** | **2E-04** | **14301** | **7** | **326** | **98** | **127** | **136** |
| Barium | -- | 15,000 | 390,000 | 110 | 330 | 2000 | 720 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Beryllium | --- | 16 | 3,910 | 2.5 | 40 | 21 | -- | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cadmium | -- | 71.0 | 1,780 | 32 | 140 | 0.36 | 0.77 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Chromium | 42.0 | 120,000 | 1,000,000 | 1 | 0.4 | 34 | 26 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Cobalt | -- | 23 | 586 | 13 | -- | 230 | 120 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Copper | 46.0 | 3,100 | 78,200 | 70 | 80 | 49 | 28 | NA | NA | Not a COC | Not a COC | 1 | 1 | 1 | **2** |
| Lead | 31.0 | 80 | 800 | 120 | 1700 | 56 | 11 | NA | NA | 0 | 0 | 0 | 0 | 1 | **3** |
| Mercury | -- | 1 | 271 | 0.3 | 0.1 | 1.7 | 0.013 | NA | NA | -- | -- | -- | -- | -- | -- |
| Molybdenum | 6.0 | 390 | 9780 | 2 | -- | 0.52 | 15 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Nickel | 12.5 | 820 | 39,000 | 38 | 280 | 130 | 210 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Selenium | -- | 390 | 9,780 | 0.52 | 4.1 | 0.63 | 1.2 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Silver | -- | 390 | 9,780 | 560 | -- | 14 | 4.2 | NA | NA | Not a COC | Not a COC | -- | -- | -- | -- |
| Thallium | -- | 0.78 | 19.6 | 1 | -- | 0.42 | 4.5 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Vanadium | 215.0 | 390 | 9,850 | 2 | -- | 280 | 7.8 | NA | NA | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC | Not a COC |
| Zinc | 140.0 | 23000 | 587,000 | 160 | 120 | 79 | 46 | NA | NA | Not a COC | Not a COC | 1 | 1 | **2** | **3** |
| | | | | | | | | | HI | **14302** | **7** | **328** | **99** | **131** | **144** |

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

* Laboratory results for cadmium have been used where available since XRF interference may have prevented detection of low-level cadmium concentrations.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
NA = not applicable
ppm = parts per million
-- = screening criterion not available
RSL = regional screening level

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites
EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020
EPA ECOTOX Website. Ecological Screening Levels (EcoSSLs). 2020. https:/cfpub.epa.gov/.ecotox/
Oak Ridge National Laboratory (ORNL). 2018. RAIS - The Risk Assessment Information System Ecological Benchmark Tool. https://rais.ornl.gov/tools/eco_search
Los Alamos National Laboratory (LANL). 2017. ECORISK Database (Release 4.1). https://www.lanl.gov/environment/protection/eco-risk-assessment.php

**Table H2-10**
**Risk Characterization for Kern River Sediment Samples**
**Big Blue Mill**
**Kern County, California**



| Sediment | | | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Cobalt | Copper | Lead | Mercury | Molybdenum | Nickel | Selenium | Silver | Thallium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Sample Dat | Location | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| BB-SW-01-SED | 10/22/2020 | Upriver of Site | <0.8 | 2.7 | 52 | <0.47 | <0.52 | 9.2 | 5.3 | 5.4 | <4.1 | <0.016 | <0.5 | 3.9 | <1.1 | <0.67 | <0.49 | 57 | 30 |
| BB-SW-02-SED | 10/22/2020 | Adjacent to Site | <0.8 | 32 | 31 | <0.47 | <0.52 | 5.8 | 3.4 | 3.8 | <4.1 | 0.55 | <0.5 | 2.8 | 1.8 | <0.67 | <0.49 | 31 | 24 |
| BB-SW-03-SED | 10/22/2020 | Downriver of Site in sandy deposits (Mod area) | <0.8 | 13 | 24 | <0.47 | <0.52 | 4.4 | 2.3 | 2.8 | <4.1 | 0.17 | <0.5 | 3.3 | 1.2 | <0.67 | <0.49 | 17 | 15 |
| BB-M1-SED-01 | 10/22/2020 | Downriver of MOD area | 0.13 | 22 | 21 | 0.22 | 0.31 | 7.2 | 3 | 3 | 2.6 | 0.08 | <0.05 | 2.2 | <0.11 | <0.067 | 0.1 | 35 | 16 |

Bolded values were reported above the method detection limit. Values in italics were reported below the reporting limit. The value shown is the method detection limit.

**Risk Characterization for Stream Sediment in Kern River upriver of site, Sample BB-SW-01-SED (mg/kg, Laboratory)**

| Constituents | EPC | Residential SL | Recreational Visitor RSL | Aquatic Invertebrate | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Aquatic Invertebrate |
|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | |
| Antimony | <0.8 | 31 | 782 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Arsenic | 2.7 | 0.11 | 30.6 | 9.79 | **2E-05** | 9E-08 | **7** | 0 | 0 |
| Barium | 52 | 15,000 | 390,000 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Beryllium | <0.47 | 16 | 3,910 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Cadmium | <0.52 | 71.0 | 1,780 | 0.99 | NA | NA | Not a COC | Not a COC | Not a COC |
| Chromium | 9.2 | 120,000 | 1,000,000 | 43.4 | NA | NA | Not a COC | Not a COC | Not a COC |
| Cobalt | 5.3 | 23 | 586 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Copper | 5.4 | 3,100 | 78,200 | 31.6 | NA | NA | Not a COC | Not a COC | Not a COC |
| Lead | <4.1 | 80 | 800 | 35.8 | NA | NA | Not a COC | Not a COC | Not a COC |
| Mercury | <0.016 | 1 | 271 | 0.18 | NA | NA | Not a COC | Not a COC | -- |
| Molybdenum | <0.5 | 390 | 9780 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Nickel | 3.9 | 820 | 39,000 | 22.7 | NA | NA | Not a COC | Not a COC | Not a COC |
| Selenium | <1.1 | 390 | 9,780 | 0.9 | NA | NA | Not a COC | Not a COC | -- |
| Silver | <0.67 | 390 | 9,780 | 1 | NA | NA | Not a COC | Not a COC | Not a COC |
| Thallium | <0.49 | 0.78 | 19.6 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Jun-21 | 57 | 390 | 9,850 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Zinc | 30 | 23000 | 587,000 | 121 | NA | NA | Not a COC | Not a COC | Not a COC |
| | | | | | | HI | **7** | 0 | 0 |

**Risk Characterization for Stream Sediment in Kern River adjacent to site, Sample BB-SW-02-SED (mg/kg, Laboratory)**

| Constituents | EPC | Residential SL | Recreational Visitor RSL | Aquatic Invertebrate | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Aquatic Invertebrate |
|---|---|---|---|---|---|---|---|---|---|
| | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | |
| Antimony | <0.8 | 31 | 782 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Arsenic | 32 | 0.11 | 30.6 | 9.79 | **3E-04** | 1E-06 | **78** | 0 | **3** |
| Barium | 31 | 15,000 | 390,000 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Beryllium | <0.47 | 16 | 3,910 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Cadmium | <0.52 | 71.0 | 1,780 | 0.99 | NA | NA | Not a COC | Not a COC | Not a COC |
| Chromium | 5.8 | 120,000 | 1,000,000 | 43.4 | NA | NA | Not a COC | Not a COC | Not a COC |
| Cobalt | 3.4 | 23 | 586 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Copper | 3.8 | 3,100 | 78,200 | 31.6 | NA | NA | Not a COC | Not a COC | Not a COC |
| Lead | <4.1 | 80 | 800 | 35.8 | NA | NA | Not a COC | Not a COC | Not a COC |
| Mercury | 0.55 | 1 | 271 | 0.18 | NA | NA | Not a COC | Not a COC | **3** |
| Molybdenum | <0.5 | 390 | 9780 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Nickel | 2.8 | 820 | 39,000 | 22.7 | NA | NA | Not a COC | Not a COC | Not a COC |
| Selenium | 1.8 | 390 | 9,780 | 0.9 | NA | NA | Not a COC | Not a COC | **2** |
| Silver | <0.67 | 390 | 9,780 | 1 | NA | NA | Not a COC | Not a COC | Not a COC |
| Thallium | <0.49 | 0.78 | 19.6 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Vanadium | 31 | 390 | 9,850 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Zinc | 24 | 23000 | 587,000 | 121 | NA | NA | Not a COC | Not a COC | Not a COC |
| | | | | | | HI | **78** | 0 | **8** |

**Table H2-10**
**Risk Characterization for Kern River Sediment Samples**
**Big Blue Mill**
**Kern County, California**

| Risk Characterization for Stream Sediment in Kern River downriver of site in AOC 7, Sample BB-SW-03-SED (mg/kg, Laboratory) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC | Residential SL | Recreational Visitor RSL | Aquatic Invertebrate | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Aquatic Invertebrate |
| | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | |
| Antimony | <0.8 | 31 | 782 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Arsenic | 13 | 0.11 | 30.6 | 9.79 | **1E-04** | 4E-07 | **32** | 0 | 1 |
| Barium | 24 | 15,000 | 390,000 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Beryllium | <0.47 | 16 | 3,910 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Cadmium | <0.52 | 71.0 | 1,780 | 0.99 | NA | NA | Not a COC | Not a COC | Not a COC |
| Chromium | 4.4 | 120,000 | 1,000,000 | 43.4 | NA | NA | Not a COC | Not a COC | Not a COC |
| Cobalt | 2.3 | 23 | 586 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Copper | 2.8 | 3,100 | 78,200 | 31.6 | NA | NA | Not a COC | Not a COC | Not a COC |
| Lead | <4.1 | 80 | 800 | 35.8 | NA | NA | Not a COC | Not a COC | Not a COC |
| Mercury | 0.17 | 1 | 271 | 0.18 | NA | NA | Not a COC | Not a COC | 1 |
| Molybdenum | <0.5 | 390 | 9780 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Nickel | 3.3 | 820 | 39,000 | 22.7 | NA | NA | Not a COC | Not a COC | Not a COC |
| Selenium | 1.2 | 390 | 9,780 | 0.9 | NA | NA | Not a COC | Not a COC | 1 |
| Silver | <0.67 | 390 | 9,780 | 1 | NA | NA | Not a COC | Not a COC | Not a COC |
| Thallium | <0.49 | 0.78 | 19.6 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Vanadium | 17 | 390 | 9,850 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Zinc | 15 | 23000 | 587,000 | 121 | NA | NA | Not a COC | Not a COC | Not a COC |
| | | | | | | HI | **32** | 0 | **4** |

| Risk Characterization for Stream Sediment in Kern River downriver of AOC 7, Sample BB-M1-SED-01 (mg/kg, Laboratory) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Constituents | EPC | Residential SL | Recreational Visitor RSL | Aquatic Invertebrate | Residential Risk | Recreational Visitor Risk | Residential HQ | Recreational Visitor HQ | Aquatic Invertebrate |
| | mg/kg | mg/kg | mg/kg | mg/kg | unitless | | | | |
| Antimony | 0.13 | 31 | 782 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Arsenic | 22 | 0.11 | 30.6 | 9.79 | **2E-04** | 7E-07 | **54** | 0 | **2** |
| Barium | 21 | 15,000 | 390,000 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Beryllium | 0.22 | 16 | 3,910 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Cadmium | 0.31 | 71.0 | 1,780 | 0.99 | NA | NA | Not a COC | Not a COC | Not a COC |
| Chromium | 7.2 | 120,000 | 1,000,000 | 43.4 | NA | NA | Not a COC | Not a COC | Not a COC |
| Cobalt | 3 | 23 | 586 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Copper | 3 | 3,100 | 78,200 | 31.6 | NA | NA | Not a COC | Not a COC | Not a COC |
| Lead | 2.6 | 80 | 800 | 35.8 | NA | NA | Not a COC | Not a COC | Not a COC |
| Mercury | 0.08 | 1 | 271 | 0.18 | NA | NA | Not a COC | Not a COC | 0 |
| Molybdenum | <0.05 | 390 | 9780 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Nickel | 2.2 | 820 | 39,000 | 22.7 | NA | NA | Not a COC | Not a COC | Not a COC |
| Selenium | <0.11 | 390 | 9,780 | 0.9 | NA | NA | Not a COC | Not a COC | -- |
| Silver | <0.067 | 390 | 9,780 | 1 | NA | NA | Not a COC | Not a COC | Not a COC |
| Thallium | 0.1 | 0.78 | 19.6 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Vanadium | 35 | 390 | 9,850 | -- | NA | NA | Not a COC | Not a COC | Not a COC |
| Zinc | 16 | 23000 | 587,000 | 121 | NA | NA | Not a COC | Not a COC | Not a COC |
| | | | | | | HI | **54** | 0 | **3** |

**Table H2-10**
**Risk Characterization for Kern River Sediment Samples**
**Big Blue Mill**
**Kern County, California**

Notes:

RSLs for arsenic noncancer endpoints were 0.41 mg/kg for the residential exposure scenario (DTSC, 2020) and 874 mg/kg for the recreational visitor exposure scenario (RSL calculator, EPA, 2020).

HQs rounded to the nearest whole number.

**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:

BLM = Bureau of Land Management
COC = chemical of concern
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
NA = not applicable
-- = screening criterion not available
RSL = regional screening level

Sources:

BLM (2017). BLM Technical Memorandum, Screening Assessment Approaches for Metals in Soil at BLM HazMat/AML Sites

EPA (2020). Regional Screening Levels (RSLs) - Generic Tables (Industrial Soil) and RSL Calculator. May 2020 update. Available online at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2020

D.D. MacDonald, C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31 (2000).

Thompson, P.A., J. Kurias, and S. Mihok. 2005. Derivation and Use of Sediment Guidelines for Ecological Risk Assessment of Metals and Radionuclides Released to the Environment from Uranium Mining and Milling Activities in Canada. Environ. Monit. Assess. 110:71-85.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environ. Manag. 19:81-97.

**Table H2-11**
**Risk Characterization Summary for Metals in Surface Water**
**Big Blue Mill**
**Kern County, California**

| Surface Water (Upriver of Site) | | | | Arsenic | Mercury |
|---|---|---|---|---|---|
| Sample ID | Sample Date | Matrix | Type | µg/L | µg/L |
| BB-SW-01 - Total | 10/22/2020 | Surface Water | | 5.7 | 0.21 |
| **Surface Water (Adjacent to Site)** | | | | **Arsenic** | **Mercury** |
| **Sample ID** | **Sample Date** | **Matrix** | **Type** | **µg/L** | **µg/L** |
| BB-SW-02 - Total | 10/22/2020 | Surface Water | | 6 | 0.39 |
| Dup-01 - Total (BB-SW-02) | 10/22/2020 | Surface Water | Duplicate | 5.9 | 0.22 |
| **Surface Water (Downriver of Site - AOC 7 area)** | | | | **Arsenic** | **Mercury** |
| **Sample ID** | **Sample Date** | **Matrix** | **Type** | **µg/L** | **µg/L** |
| BB-SW-03 - Total | 10/22/2020 | Surface Water | | 6.7 | 0.16 |

Analytes with detections only are shown.

**Risk Characterization for Surface Water, Sample BB-SW-01 (Single Point Estimate)**

| Constituents | EPC (As Reported) | EPA National Water Quality Criteria (cancer) [1] | California Toxics Rule [2] | EPA National Water Quality Criteria Risk | California Toxics Rule HQ |
|---|---|---|---|---|---|
| | µg/L | µg/L | µg/L | unitless | |
| Arsenic | 5.7 | 0.018 | -- | **3E-04** | -- |
| Mercury | 0.21 | NA | 0.05 | -- | **4** |
| | | | | **HI** | **4** |

**Risk Characterization for Surface Water, Sample BB-SW-02 (Maximum Concentration)**

| Constituents | EPC (As Reported) | EPA National Water Quality Criteria (cancer) [1] | California Toxics Rule [2] | EPA National Water Quality Criteria Risk | California Toxics Rule HQ |
|---|---|---|---|---|---|
| | µg/L | µg/L | µg/L | unitless | |
| Arsenic | 6 | 0.018 | -- | **3E-04** | -- |
| Mercury | 0.39 | NA | 0.05 | -- | **8** |
| | | | | **HI** | **8** |

**Risk Characterization for Surface Water, Sample BB-SW-03 (Single Point Estimate)**

| Constituents | EPC (As Reported) | EPA National Water Quality Criteria (cancer) [1] | California Toxics Rule [2] | EPA National Water Quality Criteria Risk | California Toxics Rule HQ |
|---|---|---|---|---|---|
| | µg/L | µg/L | µg/L | unitless | |
| Arsenic | 6.7 | 0.018 | -- | **4E-04** | -- |
| Mercury | 0.16 | NA | 0.05 | -- | **3** |
| | | | | **HI** | **3** |

Notes:
HQs rounded to the nearest whole number. Risk shown as 0 is between 0.49 and 0.
**Bold** values indicate cancer risk exceeds 1 x $10^{-6}$ or HQ exceeds 1.

Abbreviations:
µg/L = micrograms per liter
EPA = U.S. Environmental Protection Agency
EPC = exposure point concentration
ESV = ecological screening value
HI = hazard index
HQ = hazard quotient
MCL = maximum contaminant level
NA = not applicable

Sources:
[1] EPA. 2020a. National Recommended Water Quality Criteria - Human Health Criteria Table Consumption of Water and Organisms and Aquatic Life Criteria Tables. February.
[2] EPA. 2000. 40 Code of Federal Regulations Part 131, Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

| Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43.0 | 1 | 26.0 | 1 | 16 | 1 | 31 | 1 | 3.0 | 1 | | | 21.0 | 1 | 244.0 | 1 | 139 | 1 |
| 162.0 | 1 | 28.0 | 1 | 20 | 1 | 56 | 1 | 3.00 | 1 | | | 23.0 | 1 | 227.0 | 1 | 106 | 1 |
| 35.0 | 1 | | | 18 | 1 | 75 | 1 | 4.00 | 1 | 7.0 | 1 | 20.0 | 1 | 205.0 | 1 | 121 | 1 |
| 16.0 | 1 | | | 22 | 1 | 34.0 | 1 | 3.00 | 1 | 5.0 | 1 | 20.0 | 1 | 197.0 | 1 | 100.0 | 1 |
| 20.0 | 1 | | | 31 | 1 | 85 | 1 | 31.0 | 1 | 5.0 | 1 | 25.0 | 1 | 198.0 | 1 | 119 | 1 |
| 87.0 | 1 | | | 16 | 1 | 26 | 1 | 3.00 | 1 | 3.0 | 1 | 28.0 | 1 | 236 | 1 | 98 | 1 |
| 37.0 | 1 | 32.0 | 1 | 21 | 1 | 61 | 1 | 4.0 | 1 | 3.0 | 1 | 25.0 | 1 | 225 | 1 | 119 | 1 |
| 53.0 | 1 | | | 23 | 1 | 85.0 | 1 | 5.0 | 1 | 3.0 | 1 | 27.0 | 1 | 250.0 | 1 | 114.0 | 1 |
| 17.0 | 1 | 21.0 | 1 | 14 | 1 | 22 | 1 | 3.00 | 1 | | | 16.0 | 1 | 231.0 | 1 | 77.0 | 1 |
| 18.0 | 1 | 24.0 | 1 | 14 | 1 | 27 | 1 | 3.00 | 1 | | | 18.0 | 1 | 256.0 | 1 | 89 | 1 |
| 40 | 1 | | | 24 | 1 | 74 | 1 | 3 | 1 | 5 | 1 | 22 | 1 | 233 | 1 | 165 | 1 |
| 22 | 1 | 44 | 1 | 24 | 1 | 89 | 1 | 3 | 1 | | | 25 | 1 | 257 | 1 | 197 | 1 |
| 28 | 1 | 28 | 1 | 40 | 1 | 99 | 1 | 6 | 1 | 3 | 1 | 20 | 1 | 233 | 1 | 159 | 1 |
| 50 | 1 | 29 | 1 | 17 | 1 | 33 | 1 | 3 | 1 | | | 19 | 1 | 224 | 1 | 85 | 1 |
| 70 | 1 | | | 24 | 1 | 94 | 1 | 13 | 1 | 8 | 1 | 18 | 1 | 175 | 1 | 139 | 1 |
| 47 | 1 | 22 | 1 | 30 | 1 | 119 | 1 | 15 | 1 | 5 | 1 | 22 | 1 | 227 | 1 | 152 | 1 |
| 55 | 1 | 39 | 1 | 26 | 1 | 87 | 1 | 8 | 1 | 6 | 1 | 19 | 1 | 206 | 1 | 161 | 1 |
| 20 | 1 | | | 30 | 1 | 90 | 1 | 9 | 1 | 6 | 1 | 24 | 1 | 232 | 1 | 142 | 1 |
| 69 | 1 | | | 33 | 1 | 202 | 1 | 11 | 1 | 4 | 1 | 19 | 1 | 191 | 1 | 175 | 1 |
| 24 | 1 | 23 | 1 | 24 | 1 | 40 | 1 | 3 | 1 | 8 | 1 | 18 | 1 | 189 | 1 | 127 | 1 |
| 32 | 1 | | | 24 | 1 | 62 | 1 | 3 | 1 | 11 | 1 | 16 | 1 | 118 | 1 | 162 | 1 |
| 26 | 1 | 27 | 1 | 32 | 1 | 193 | 1 | 16 | 1 | 4 | 1 | 20 | 1 | 204 | 1 | 129 | 1 |
| 43 | 1 | | | 15 | 1 | 76 | 1 | 9 | 1 | 3 | 1 | 17 | 1 | 191 | 1 | 116 | 1 |
| 25 | 1 | | | 20 | 1 | 37 | 1 | 4 | 1 | | | 21 | 1 | 264 | 1 | 95 | 1 |
| 24 | 1 | 34 | 1 | 20 | 1 | 25 | 1 | 3 | 1 | | | 17 | 1 | 212 | 1 | 100 | 1 |
| 22 | 1 | 29 | 1 | 22 | 1 | 43 | 1 | 4 | 1 | 3 | 1 | 22 | 1 | 223 | 1 | 93 | 1 |
| 21 | 1 | 39 | 1 | 18 | 1 | 23 | 1 | 5 | 1 | | | 23 | 1 | 248 | 1 | 110 | 1 |
| 249 | 1 | | | 57 | 1 | 185 | 1 | 12 | 1 | 6 | 1 | 25 | 1 | 198 | 1 | 176 | 1 |
| 56 | 1 | | | 31 | 1 | 52 | 1 | 4 | 1 | 6 | 1 | 22 | 1 | 221 | 1 | 131 | 1 |
| 26 | 1 | | | 29 | 1 | 20 | 1 | | | 10 | 1 | 22 | 1 | 232 | 1 | 155 | 1 |
| 47 | 1 | 29 | 1 | 36 | 1 | 75 | 1 | 5 | 1 | 3 | 1 | 30 | 1 | 205 | 1 | 145 | 1 |
| 41 | 1 | 40 | 1 | 77 | 1 | 91 | 1 | 7 | 1 | | | 35 | 1 | 271 | 1 | 165 | 1 |
| 27 | 1 | 23 | 1 | 22 | 1 | 41 | 1 | 5 | 1 | 5 | 1 | 23 | 1 | 208 | 1 | 131 | 1 |
| 58 | 1 | 27 | 1 | 54 | 1 | 179 | 1 | 4 | 1 | 5 | 1 | 18 | 1 | 254 | 1 | 376 | 1 |
| 14 | 1 | 28 | 1 | 14 | 1 | 12 | 1 | 3 | 1 | | | 21 | 1 | 188 | 1 | 64 | 1 |
| 15 | 1 | 25 | 1 | 20 | 1 | 29 | 1 | | | | | 22 | 1 | 235 | 1 | 105 | 1 |
| 81 | 1 | | | 29 | 1 | 90 | 1 | 6 | 1 | 11 | 1 | 21 | 1 | 176 | 1 | 142 | 1 |
| 12 | 1 | 37 | 1 | 12 | 1 | 18 | 1 | | | 3 | 1 | 15 | 1 | 272 | 1 | 95 | 1 |
| 132 | 1 | | | 38 | 1 | 234 | 1 | 6 | 1 | 9 | 1 | 14 | 1 | 151 | 1 | 228 | 1 |
| 58 | 1 | | | 68 | 1 | 280 | 1 | 14 | 1 | 7 | 1 | 21 | 1 | 213 | 1 | 176 | 1 |
| 116 | 1 | 35 | 1 | 19 | 1 | 53 | 1 | 5 | 1 | 4 | 1 | 19 | 1 | 178 | 1 | 124 | 1 |
| 42 | 1 | | | 21 | 1 | 31 | 1 | | | 4 | 1 | 18 | 1 | 205 | 1 | 88 | 1 |
| 297 | 1 | 24 | 1 | 28 | 1 | 92 | 1 | 7 | 1 | 5 | 1 | 19 | 1 | 178 | 1 | 148 | 1 |
| 13 | 1 | | | 15 | 1 | 22 | 1 | | | 6 | 1 | 12 | 1 | 224 | 1 | 74 | 1 |
| 29 | 1 | | | 26 | 1 | 24 | 1 | 4 | 1 | 6 | 1 | 26 | 1 | 269 | 1 | 137 | 1 |
| 43 | 1 | 26 | 1 | 17 | 1 | 25 | 1 | 4 | 1 | | | 23 | 1 | 203 | 1 | 99 | 1 |
| 78 | 1 | 32 | 1 | 18 | 1 | 32 | 1 | 3 | 1 | | | 16 | 1 | 248 | 1 | 91 | 1 |
| 368 | 1 | | | 27 | 1 | 38 | 1 | 5 | 1 | 12 | 1 | 16 | 1 | 123 | 1 | 149 | 1 |
| 200 | 1 | | | 23 | 1 | 480 | 1 | 5 | 1 | 6 | 1 | 17 | 1 | 261 | 1 | 105 | 1 |

| Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13.0 | 1 | 34.0 | 1 | 15 | 1 | 12 | 1 | 4.0 | 1 | | | 29.0 | 1 | 299.0 | 1 | 65 | 1 |
| 25.0 | 1 | | | 25 | 1 | 19 | 1 | 3.00 | 1 | 3.0 | 1 | 25.0 | 1 | 243.0 | 1 | 112 | 1 |
| 15.0 | 1 | 40.0 | 1 | 23 | 1 | 12 | 1 | | | 5.0 | 1 | 29.0 | 1 | 277.0 | 1 | 105 | 1 |
| 13.0 | 1 | | | 17 | 1 | 16.0 | 1 | | | 3.0 | 1 | 24.0 | 1 | 300.0 | 1 | 72.0 | 1 |
| 21.0 | 1 | | | 35 | 1 | 10 | 1 | | | 9.0 | 1 | 29.0 | 1 | 203.0 | 1 | 127 | 1 |
| 20.0 | 1 | | | 36 | 1 | 9 | 1 | | | 11.0 | 1 | 26.0 | 1 | 219 | 1 | 148 | 1 |
| 9.0 | 1 | | | 13 | 1 | 8 | 1 | 3.0 | 1 | | | 23.0 | 1 | 286 | 1 | 55 | 1 |
| 9.0 | 1 | | | 20 | 1 | 7.0 | 1 | 4.0 | 1 | 4.0 | 1 | 17.0 | 1 | 271.0 | 1 | 73.0 | 1 |
| 13.0 | 1 | | | 15 | 1 | 9 | 1 | 3.00 | 1 | 7.0 | 1 | 15.0 | 1 | 214.0 | 1 | 70.0 | 1 |
| 24.0 | 1 | | | 31 | 1 | 11 | 1 | | | 10.0 | 1 | 23.0 | 1 | 182.0 | 1 | 115 | 1 |
| 11 | 1 | | | 16 | 1 | 8 | 1 | | | 7 | 1 | 17 | 1 | 245 | 1 | 85 | 1 |
| 10 | 1 | | | 16 | 1 | 11 | 1 | 4 | 1 | 4 | 1 | 22 | 1 | 268 | 1 | 67 | 1 |
| 15 | 1 | 32 | 1 | 27 | 1 | 9 | 1 | 5 | 1 | 7 | 1 | 26 | 1 | 235 | 1 | 108 | 1 |
| 11 | 1 | | | 13 | 1 | 9 | 1 | 4 | 1 | | | 22 | 1 | 295 | 1 | 72 | 1 |
| 15 | 1 | | | 17 | 1 | 10 | 1 | | | 5 | 1 | 26 | 1 | 291 | 1 | 75 | 1 |
| 25 | 1 | | | 22 | 1 | 21 | 1 | | | 9 | 1 | 22 | 1 | 224 | 1 | 122 | 1 |
| 9 | 1 | 39 | 1 | 23 | 1 | 10 | 1 | | | | | 24 | 1 | 308 | 1 | 80 | 1 |
| 20 | 1 | 32 | 1 | 20 | 1 | 15 | 1 | 3 | 1 | 4 | 1 | 21 | 1 | 212 | 1 | 84 | 1 |
| 7 | 1 | | | 18 | 1 | 9 | 1 | 3 | 1 | | | 25 | 1 | 258 | 1 | 71 | 1 |
| 6 | 1 | | | 12 | 1 | 9 | 1 | 4 | 1 | 7 | 1 | 23 | 1 | 225 | 1 | 56 | 1 |
| 9 | 1 | 33 | 1 | 18 | 1 | 7 | 1 | | | | | 29 | 1 | 273 | 1 | 63 | 1 |
| 6 | 1 | | | 14 | 1 | 7 | 1 | | | | | 18 | 1 | 242 | 1 | 54 | 1 |
| 14 | 1 | | | 32 | 1 | 7 | 1 | | | 9 | 1 | 29 | 1 | 235 | 1 | 115 | 1 |
| 9 | 1 | | | 22 | 1 | 8 | 1 | | | 6 | 1 | 19 | 1 | 227 | 1 | 102 | 1 |
| 8 | 1 | | | 27 | 1 | 7 | 1 | | | 11 | 1 | 22 | 1 | 158 | 1 | 118 | 1 |
| 9 | 1 | | | 21 | 1 | 4 | 1 | 3 | 1 | 7 | 1 | 21 | 1 | 122 | 1 | 108 | 1 |
| 18 | 1 | 35 | 1 | 18 | 1 | 21 | 1 | | | | | 21 | 1 | 265 | 1 | 86 | 1 |
| 10 | 1 | | | 14 | 1 | 13 | 1 | 4 | 1 | 3 | 1 | 16 | 1 | 241 | 1 | 64 | 1 |
| 8 | 1 | 25 | 1 | 19 | 1 | 8 | 1 | | | 5 | 1 | 18 | 1 | 280 | 1 | 68 | 1 |
| 10 | 1 | | | 24 | 1 | 8 | 1 | 4 | 1 | 7 | 1 | 24 | 1 | 302 | 1 | 105 | 1 |
| 9 | 1 | 26 | 1 | 17 | 1 | 9 | 1 | | | 7 | 1 | 19 | 1 | 194 | 1 | 91 | 1 |
| 12 | 1 | 37 | 1 | 22 | 1 | 10 | 1 | 4 | 1 | 4 | 1 | 25 | 1 | 257 | 1 | 89 | 1 |
| 10 | 1 | 33 | 1 | 23 | 1 | 8 | 1 | 4 | 1 | 3 | 1 | 24 | 1 | 243 | 1 | 95 | 1 |
| 12 | 1 | | | 26 | 1 | 11 | 1 | | | 7 | 1 | 26 | 1 | 231 | 1 | 114 | 1 |
| 9 | 1 | | | 26 | 1 | 11 | 1 | | | 6 | 1 | 27 | 1 | 215 | 1 | 110 | 1 |
| 9 | 1 | | | 24 | 1 | 8 | 1 | 4 | 1 | 10 | 1 | 22 | 1 | 212 | 1 | 114 | 1 |
| 12 | 1 | 23 | 1 | 28 | 1 | 16 | 1 | | | 6 | 1 | 21 | 1 | 236 | 1 | 122 | 1 |
| 9 | 1 | | | 10 | 1 | 8 | 1 | | | 5 | 1 | 16 | 1 | 235 | 1 | 45 | 1 |
| 11 | 1 | 23 | 1 | 20 | 1 | 10 | 1 | 5 | 1 | 5 | 1 | 31 | 1 | 254 | 1 | 94 | 1 |
| 6 | 1 | | | 9 | 1 | 10 | 1 | 3 | 1 | 3 | 1 | 12 | 1 | 242 | 1 | 43 | 1 |
| 7 | 1 | 28 | 1 | 14 | 1 | 8 | 1 | | | 5 | 1 | 17 | 1 | 241 | 1 | 66 | 1 |
| 5 | 1 | | | 9 | 1 | 7 | 1 | | | | | 16 | 1 | 238 | 1 | 38 | 1 |
| 13 | 1 | | | 36 | 1 | 10 | 1 | | | 9 | 1 | 26 | 1 | 177 | 1 | 182 | 1 |
| 10 | 1 | 24 | 1 | 31 | 1 | 10 | 1 | 3 | 1 | 5 | 1 | 29 | 1 | 253 | 1 | 97 | 1 |
| 6 | 1 | | | 18 | 1 | 8 | 1 | | | 4 | 1 | 19 | 1 | 186 | 1 | 83 | 1 |
| 10 | 1 | | | 28 | 1 | 8 | 1 | 3 | 1 | 8 | 1 | 21 | 1 | 255 | 1 | 110 | 1 |
| 13 | 1 | | | 13 | 1 | 13 | 1 | 3 | 1 | 5 | 1 | 15 | 1 | 208 | 1 | 70 | 1 |
| 10 | 1 | | | 14 | 1 | 11 | 1 | | | 4 | 1 | 18 | 1 | 248 | 1 | 63 | 1 |
| 8 | 1 | | | 10 | 1 | 8 | 1 | 3 | 1 | 5 | 1 | 9 | 1 | 203 | 1 | 37 | 1 |
| 12 | 1 | | | 25 | 1 | 8 | 1 | 4 | 1 | 9 | 1 | 19 | 1 | 185 | 1 | 114 | 1 |
| 9 | 1 | | | 18 | 1 | 0 | 1 | | | 15 | 1 | 7 | 1 | 93 | 1 | 122 | 1 |
| 14 | 1 | | | 26 | 1 | 6 | 1 | 3 | 1 | 10 | 1 | 20 | 1 | 189 | 1 | 100 | 1 |
| 6 | 1 | | | 9 | 1 | 5 | 1 | | | 3 | 1 | 12 | 1 | 197 | 1 | 78 | 1 |
| 9 | 1 | | | 23 | 1 | 11 | 1 | 4 | 1 | 5 | 1 | 27 | 1 | 218 | 1 | 101 | 1 |
| 13 | 1 | | | 27 | 1 | 11 | 1 | | | 10 | 1 | 17 | 1 | 185 | 1 | 129 | 1 |
| 8 | 1 | | | 8 | 1 | 6 | 1 | | | 5 | 1 | 12 | 1 | 252 | 1 | 45 | 1 |
| 7 | 1 | | | 19 | 1 | 9 | 1 | | | 11 | 1 | 12 | 1 | 252 | 1 | 83 | 1 |
| 9 | 1 | 33 | 1 | 18 | 1 | 8 | 1 | | | | | 27 | 1 | 237 | 1 | 68 | 1 |
| 8 | 1 | | | 8 | 1 | 7 | 1 | 4 | 1 | | | 15 | 1 | 265 | 1 | 44 | 1 |
| 37 | 1 | | | 15 | 1 | 10 | 1 | 4 | 1 | 8 | 1 | 29 | 1 | 272 | 1 | 75 | 1 |
| 7 | 1 | 33 | 1 | 16 | 1 | 6 | 1 | 4 | 1 | 5 | 1 | 24 | 1 | 286 | 1 | 74 | 1 |
| 18 | 1 | | | 22 | 1 | 18 | 1 | | | 10 | 1 | 17 | 1 | 129 | 1 | 148 | 1 |
| 14 | 1 | | | 26 | 1 | 16 | 1 | | | 8 | 1 | 16 | 1 | 195 | 1 | 104 | 1 |
| 9 | 1 | | | 11 | 1 | 6 | 1 | 4 | 1 | 3 | 1 | 27 | 1 | 315 | 1 | 48 | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 1 | | | 31 | 1 | 3 | 1 | | | 18 | 1 | 12 | 1 | 86 | 1 | 156 | 1 |
| 10 | 1 | | | 21 | 1 | 9 | 1 | | | 7 | 1 | 16 | 1 | 208 | 1 | 97 | 1 |
| 7 | 1 | | | 18 | 1 | 7 | 1 | 4 | 1 | 8 | 1 | 17 | 1 | 197 | 1 | 78 | 1 |
| 10 | 1 | | | 23 | 1 | 9 | 1 | 3 | 1 | 8 | 1 | 26 | 1 | 257 | 1 | 93 | 1 |
| 11 | 1 | 51 | 1 | 20 | 1 | 8 | 1 | 4 | 1 | | 1 | 29 | 1 | 288 | 1 | 68 | 1 |
| 7 | 1 | 30 | 1 | 18 | 1 | 10 | 1 | 4 | 1 | 6 | 1 | 20 | 1 | 294 | 1 | 65 | 1 |
| 14 | 1 | 32 | 1 | 34 | 1 | 9 | 1 | 4 | 1 | 8 | 1 | 27 | 1 | 276 | 1 | 130 | 1 |
| 8 | 1 | | | 27 | 1 | 5 | 1 | 5 | 1 | 12 | 1 | 15 | 1 | 142 | 1 | 118 | 1 |

| Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 699.0 | 1 | 29.0 | 1 | 22 | 1 | 105 | 1 | 8.0 | 1 | | | 18.0 | 1 | 236.0 | 1 | 100 | 1 |
| 220.0 | 1 | | | 39 | 1 | 130 | 1 | 5.00 | 1 | 11.0 | 1 | 31.0 | 1 | 153.0 | 1 | 266 | 1 |
| 272.0 | 1 | 27.0 | 1 | 51 | 1 | 31 | 1 | 10.00 | 1 | 4.0 | 1 | 18.0 | 1 | 266.0 | 1 | 109 | 1 |
| 941.0 | 1 | 39.0 | 1 | 22 | 1 | 272.0 | 1 | 5.00 | 1 | | | 18.0 | 1 | 260.0 | 1 | 128.0 | 1 |
| 276.0 | 1 | | | 22 | 1 | 62 | 1 | 18.0 | 1 | 11.0 | 1 | 16.0 | 1 | 176.0 | 1 | 180 | 1 |
| 1105.0 | 1 | 33.0 | 1 | 18 | 1 | 128 | 1 | 5.00 | 1 | | | 21.0 | 1 | 242 | 1 | 110 | 1 |
| 634.0 | 1 | 24.0 | 1 | 17 | 1 | 111 | 1 | | | 5.0 | 1 | 19.0 | 1 | 208 | 1 | 97 | 1 |
| 130.0 | 1 | 28.0 | 1 | 23 | 1 | 43.0 | 1 | 8.0 | 1 | 5.0 | 1 | 15.0 | 1 | 297.0 | 1 | 135.0 | 1 |
| 192.0 | 1 | | | 39 | 1 | 56 | 1 | | | 11.0 | 1 | 32.0 | 1 | 170.0 | 1 | 162.0 | 1 |
| 332.0 | 1 | 26.0 | 1 | 29 | 1 | 123 | 1 | 5.00 | 1 | 5.0 | 1 | 25.0 | 1 | 193.0 | 1 | 184 | 1 |
| 120 | 1 | 46 | 1 | 24 | 1 | 70 | 1 | | | 4 | 1 | 22 | 1 | 251 | 1 | 273 | 1 |
| 483 | 1 | 42 | 1 | 77 | 1 | 264 | 1 | 6 | 1 | | | 17 | 1 | 179 | 1 | 144 | 1 |
| 139 | 1 | 49 | 1 | 11 | 1 | 24 | 1 | 3 | 1 | | | 18 | 1 | 265 | 1 | 90 | 1 |
| 83 | 1 | | | 14 | 1 | 16 | 1 | | | | | | | 246 | 1 | 96 | 1 |
| 230 | 1 | | | 28 | 1 | 101 | 1 | 7 | 1 | | | 17 | 1 | 206 | 1 | 111 | 1 |
| 70 | 1 | | | 31 | 1 | 23 | 1 | | | 8 | 1 | 23 | 1 | 217 | 1 | 112 | 1 |
| 13 | 1 | 27 | 1 | 12 | 1 | 12 | 1 | | | 7 | 1 | 16 | 1 | 316 | 1 | 63 | 1 |
| 67 | 1 | 31 | 1 | 18 | 1 | 23 | 1 | 6 | 1 | | | 20 | 1 | 303 | 1 | 71 | 1 |
| 170 | 1 | | | 22 | 1 | 24 | 1 | 4 | 1 | 13 | 1 | 20 | 1 | 151 | 1 | 146 | 1 |
| 173 | 1 | | | 88 | 1 | 282 | 1 | 76 | 1 | 5 | 1 | 18 | 1 | 231 | 1 | 171 | 1 |
| 410 | 1 | | | 53 | 1 | 435 | 1 | 47 | 1 | 6 | 1 | 21 | 1 | 142 | 1 | 173 | 1 |
| 123 | 1 | | | 34 | 1 | 61 | 1 | 5 | 1 | 13 | 1 | 22 | 1 | 147 | 1 | 163 | 1 |
| 496 | 1 | | | 14 | 1 | 35 | 1 | 3 | 1 | | | 20 | 1 | 228 | 1 | 79 | 1 |
| 2183 | 1 | 22 | 1 | 21 | 1 | 90 | 1 | | | 4 | 1 | 22 | 1 | 162 | 1 | 167 | 1 |
| 1314 | 1 | | | 25 | 1 | 172 | 1 | | | 5 | 1 | 17 | 1 | 204 | 1 | 154 | 1 |

Table H3-4
AOC 4 - XRF UCL
Big Blue Mill
Kern County, California

| Antimony | D_Antimony | Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 178.0 | 1 | | | 14 | 1 | 116 | 1 | 4.0 | 1 | 10.0 | 1 | 12.0 | 1 | 224.0 | 1 | 124 | 1 |
| | | 35.0 | 1 | 26.0 | 1 | 8 | 1 | 590 | 1 | 4.00 | 1 | 7.0 | 1 | 15.0 | 1 | 207.0 | 1 | 100 | 1 |
| | | 263.0 | 1 | 27.0 | 1 | 19 | 1 | 20 | 1 | 4.00 | 1 | 4.0 | 1 | 13.0 | 1 | 241.0 | 1 | 112 | 1 |
| 30.00 | 1 | 224.0 | 1 | | | 10 | 1 | 59.0 | 1 | 3.00 | 1 | 6.0 | 1 | 11.0 | 1 | 198.0 | 1 | 82.0 | 1 |
| 142.0 | 1 | 623.0 | 1 | | | 11 | 1 | 98 | 1 | 4.0 | 1 | 6.0 | 1 | 15.0 | 1 | 174.0 | 1 | 116 | 1 |
| | | 364.0 | 1 | | | 19 | 1 | 87 | 1 | 8.00 | 1 | 9.0 | 1 | 14.0 | 1 | 249 | 1 | 209 | 1 |
| 23.0 | 1 | 425.0 | 1 | | | 15 | 1 | 64 | 1 | | | 5.0 | 1 | 16.0 | 1 | 172 | 1 | 245 | 1 |
| | | 160.0 | 1 | | | 11 | 1 | 12.0 | 1 | | | 3.0 | 1 | 15.0 | 1 | 237.0 | 1 | 75.0 | 1 |
| 414.0 | 1 | 10929.0 | 1 | 38.0 | 1 | 20 | 1 | 891 | 1 | | | | | 11.0 | 1 | 138.0 | 1 | 197.0 | 1 |
| 224.0 | 1 | 4678.0 | 1 | 28.0 | 1 | 29 | 1 | 461 | 1 | 7.00 | 1 | 5.0 | 1 | 24.0 | 1 | 187.0 | 1 | 185 | 1 |
| 1172 | 1 | 8226 | 1 | 25 | 1 | 7 | 1 | 590 | 1 | | | 5 | 1 | 7 | 1 | 196 | 1 | 82 | 1 |
| | | 250 | 1 | 50 | 1 | 32 | 1 | 31 | 1 | 16 | 1 | 9 | 1 | 37 | 1 | 247 | 1 | 444 | 1 |
| | | 104 | 1 | | | 13 | 1 | 10 | 1 | 9 | 1 | 4 | 1 | 21 | 1 | 264 | 1 | 81 | 1 |
| | | 590 | 1 | 27 | 1 | 16 | 1 | 99 | 1 | 5 | 1 | 4 | 1 | 21 | 1 | 288 | 1 | 169 | 1 |
| 8764 | 1 | 2997 | 1 | | | 17 | 1 | 249 | 1 | 0 | 1 | | | 20 | 1 | 247 | 1 | 172 | 1 |

Table H3-5a
AOC 5 - XRF UCL
Big Blue Mill
Kern County, California

| Antimony | D_Antimony | Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Silver | D_Silver | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1045.0 | 1 | | | 13 | 1 | 61 | 1 | 8.0 | 1 | 3.0 | 1 | 23.0 | 1 | | | 261.0 | 1 | 86 | 1 |
| | | 183.0 | 1 | | | 21 | 1 | 79 | 1 | 7.00 | 1 | 8.0 | 1 | 20.0 | 1 | | | 250.0 | 1 | 106 | 1 |
| | | 132.0 | 1 | | | 25 | 1 | 38 | 1 | 6.00 | 1 | 4.0 | 1 | 20.0 | 1 | | | 257.0 | 1 | 87 | 1 |
| | | 1273.0 | 1 | | | 44 | 1 | 412.0 | 1 | 16.00 | 1 | | | 23.0 | 1 | | | 186.0 | 1 | 550.0 | 1 |
| | | 65.0 | 1 | | | 11 | 1 | 8 | 1 | | | | | 16.0 | 1 | | | 192.0 | 1 | 47 | 1 |
| 79.0 | 1 | 31092.0 | 1 | 29.0 | 1 | | | 3162 | 1 | 108.00 | 1 | | | | | 68.0 | 1 | | | 98 | 1 |
| 28.0 | 1 | 1833.0 | 1 | | | 33 | 1 | 1002 | 1 | 19.0 | 1 | 18.0 | 1 | 16.0 | 1 | | | 216 | 1 | 189 | 1 |
| 95.0 | 1 | 9270.0 | 1 | | | 15 | 1 | 1229.0 | 1 | 11.0 | 1 | 12.0 | 1 | 10.0 | 1 | 34.00 | 1 | 144.0 | 1 | 101.0 | 1 |
| | | 1488.0 | 1 | 23.0 | 1 | 76 | 1 | 6956 | 1 | 10.00 | 1 | 5.0 | 1 | 11.0 | 1 | | | 189.0 | 1 | 164.0 | 1 |
| | | 27168.0 | 1 | 33.0 | 1 | | | 1801 | 1 | 693.00 | 1 | | | | | 39.00 | 1 | 98.0 | 1 | 59 | 1 |
| 32 | 1 | 10745 | 1 | 41 | 1 | 7 | 1 | 445 | 1 | | | | | 8 | 1 | 15 | 1 | | | 82 | 1 |
| | | 19793 | 1 | 37 | 1 | | | 874 | 1 | 21 | 1 | | | <11 | 1 | 17 | 1 | 114 | 1 | 23 | 1 |
| | | 1171 | 1 | | | 7 | 1 | 306 | 1 | 39 | 1 | | | 14 | 1 | 10 | 1 | 140 | 1 | 38 | 1 |
| 91 | 1 | 90189 | 1 | 46 | 1 | | | 2340 | 1 | 1458 | 1 | | | <9 | 1 | 190 | 1 | | | 151 | 1 |
| 27 | 1 | 11395 | 1 | 29 | 1 | | | 1685 | 1 | 275 | 1 | | | <11 | 1 | 19 | 1 | 145 | 1 | 64 | 1 |

Table H3-5 b
AOC 5 - LAB UCL
Big Blue Mill
Kern County, California

| Antimony | D_Antimony | Arsenic | D_Arsenic | Barium | D_Barium | Cadmium | D_Cadmium | Chromium | D_Chromium | Cobalt | D_Cobalt | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Nickel | D_Nickel | Silver | D_Silver | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.20 | 1 | 1900.0 | 1 | 54.0 | 1 | 14.00 | 1 | 8.6 | 1 | 4.8 | 1 | 87 | 1 | 13000 | 1 | 7.9 | 1 | 6.3 | 1 | 4.6 | 1 | 25.0 | 1 | 140 | 1 |
| 1.60 | 1 | 1200.0 | 1 | 41.0 | 1 | 9.10 | 1 | 5.9 | 1 | 3.5 | 1 | 40 | 1 | 7100 | 1 | 5.70 | 1 | 4.5 | 1 | 4.7 | 1 | 17.0 | 1 | 110 | 1 |
| 0.83 | 1 | 1100.0 | 1 | 57.0 | 1 | 8.50 | 1 | 6.8 | 1 | 5.1 | 1 | 7 | 1 | 66 | 1 | 7.10 | 1 | 4.7 | 1 | 0.9 | 1 | 28.0 | 1 | 64 | 1 |
| 4.50 | 1 | 15000.0 | 1 | 41.0 | 1 | 110.00 | 1 | 3.7 | 1 | 2.2 | 1 | 5 | 1 | 1200.0 | 1 | 350.00 | 1 | 1.5 | 1 | 11.0 | 1 | 20.0 | 1 | 36.0 | 1 |
| 3.3 | 1 | 19000.0 | 1 | 47.0 | 1 | 140.0 | 1 | 4.4 | 1 | 2.3 | 1 | 3 | 1 | 990 | 1 | 20.0 | 1 | | | 2.2 | 1 | 24.0 | 1 | 19 | 1 |
| 74.0 | 1 | 88000.0 | 1 | 18.0 | 1 | 630.0 | 1 | <0.5 | 1 | | | 7 | 1 | 2400 | 1 | 270.00 | 1 | | | 45.0 | 1 | 3 | 1 | 190 | 1 |
| 21.0 | 1 | 30000.0 | 1 | 45.0 | 1 | 210.0 | 1 | 4.4 | 1 | 1.4 | 1 | 28 | 1 | 2200 | 1 | 72.0 | 1 | 1.8 | 1 | 30.0 | 1 | 9 | 1 | 120 | 1 |
| 23.0 | 1 | 13000.0 | 1 | 79.0 | 1 | 91.0 | 1 | 10.0 | 1 | 6.9 | 1 | 20 | 1 | 1300.0 | 1 | 8.8 | 1 | 7.1 | 1 | 24.00 | 1 | 28.0 | 1 | 110.0 | 1 |

| Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 151.0 | 1 | | | 22 | 1 | 22 | 1 | 6.0 | 1 | 6.0 | 1 | 23.0 | 1 | 287.0 | 1 | 70 | 1 |
| 75.0 | 1 | | | 19 | 1 | 26 | 1 | | | 8.0 | 1 | 9.0 | 1 | 190.0 | 1 | 125 | 1 |
| 44.0 | 1 | | | 15 | 1 | 14 | 1 | 4.00 | 1 | 4.0 | 1 | 18.0 | 1 | 243.0 | 1 | 75 | 1 |
| 60.0 | 1 | | | 72 | 1 | 56.0 | 1 | 17.00 | 1 | 15.0 | 1 | 15.0 | 1 | 254.0 | 1 | 92.0 | 1 |
| 265.0 | 1 | | | 14 | 1 | 44 | 1 | 3.0 | 1 | 4.0 | 1 | 16.0 | 1 | 249.0 | 1 | 86 | 1 |
| 369.0 | 1 | | | 24 | 1 | 33 | 1 | | | | | 21.0 | 1 | 214 | 1 | 72 | 1 |
| 35.0 | 1 | | | 17 | 1 | 12 | 1 | 5.0 | 1 | 5.0 | 1 | 28.0 | 1 | 223 | 1 | 73 | 1 |
| 84.0 | 1 | 27.0 | 1 | 18 | 1 | 15.0 | 1 | | | | | 18.0 | 1 | 212.0 | 1 | 73.0 | 1 |
| 86.0 | 1 | 24.0 | 1 | 27 | 1 | 32 | 1 | 3.00 | 1 | | | 18.0 | 1 | 190.0 | 1 | 183.0 | 1 |
| 122.0 | 1 | 40.0 | 1 | 29 | 1 | 38 | 1 | 6.00 | 1 | | | 17.0 | 1 | 233.0 | 1 | 72 | 1 |
| 129 | 1 | | | 66 | 1 | 21 | 1 | 5 | 1 | | | 21 | 1 | 269 | 1 | 98 | 1 |
| 63 | 1 | | | 12 | 1 | 15 | 1 | 3 | 1 | | | 20 | 1 | 220 | 1 | 63 | 1 |
| 43 | 1 | | | 26 | 1 | 19 | 1 | 4 | 1 | 8 | 1 | 28 | 1 | 295 | 1 | 90 | 1 |
| 42 | 1 | 44 | 1 | 18 | 1 | 42 | 1 | 4 | 1 | 5 | 1 | 24 | 1 | 284 | 1 | 87 | 1 |
| 22 | 1 | 23 | 1 | 11 | 1 | 8 | 1 | 4 | 1 | | | 27 | 1 | 235 | 1 | 72 | 1 |
| 22 | 1 | 40 | 1 | 17 | 1 | 6 | 1 | 3 | 1 | | | 28 | 1 | 283 | 1 | 60 | 1 |

Table H3-7a
AOC 7 - XRF UCL
Big Blue Mill
Kern County, California



| Arsenic | D_Arsenic | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.0 | 1 | 11 | 1 | 6 | 1 | 3.0 | 1 | 15.0 | 1 | 289.0 | 1 | 46 | 1 |
| 6.0 | 1 | 11 | 1 | 10 | 1 | 3.00 | 1 | 14.0 | 1 | 259.0 | 1 | 33 | 1 |
| 4.0 | 1 | 23 | 1 | 8 | 1 | 3.00 | 1 | 17.0 | 1 | 228.0 | 1 | 48 | 1 |
| 7.0 | 1 | 16 | 1 | 7.0 | 1 | 3.00 | 1 | 16.0 | 1 | 254.0 | 1 | 58.0 | 1 |
| 16.0 | 1 | 20 | 1 | 6 | 1 | | | 30.0 | 1 | 339.0 | 1 | 85 | 1 |
| 22.0 | 1 | 11 | 1 | 9 | 1 | 4.00 | 1 | 20.0 | 1 | 365 | 1 | 63 | 1 |
| 21.0 | 1 | 10 | 1 | 7 | 1 | | | 22.0 | 1 | 325 | 1 | 50 | 1 |
| 8.0 | 1 | 13 | 1 | 7.0 | 1 | 3.0 | 1 | 22.0 | 1 | 268.0 | 1 | 62.0 | 1 |
| 26.0 | 1 | 18 | 1 | 9 | 1 | | | 21.0 | 1 | 293.0 | 1 | 52.0 | 1 |
| 7.0 | 1 | 19 | 1 | 8 | 1 | | | 20.0 | 1 | 323.0 | 1 | 65 | 1 |

Table H3-7b
AOC 7 - LAB UCL
Big Blue Mill
Kern County, California

| Arsenic | D_Arsenic | Barium | D_Barium | Chromium | D_Chromium | Cobalt | D_Cobalt | Copper | D_Copper | Mercury | D_Mercury | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.8 | 1 | | | 9.1 | 1 | 5.2 | 1 | 6 | 1 | 0.022 | 1 | 4.4 | 1 | 32.0 | 1 | 24 | 1 |
| 4.2 | 1 | 52.0 | 1 | 5.8 | 1 | 4.8 | 1 | 6 | 1 | 0.028 | 1 | 3.5 | 1 | 28.0 | 1 | 27 | 1 |
| 4.2 | 1 | 56.0 | 1 | 3.9 | 1 | 4.2 | 1 | 8 | 1 | 4.3 | 1 | 3.5 | 1 | 19.0 | 1 | 32 | 1 |
| 6.4 | 1 | 93.0 | 1 | 11.0 | 1 | 7.9 | 1 | 13 | 1 | 0.058 | 1 | 6.5 | 1 | 53.0 | 1 | 51.0 | 1 |
| 7.1 | 1 | 60.0 | 1 | 8.4 | 1 | 6.0 | 1 | 7 | 1 | 0.066 | 1 | 5.5 | 1 | 37.0 | 1 | 39 | 1 |
| 13.0 | 1 | 68.0 | 1 | 12.0 | 1 | 7.0 | 1 | 8 | 1 | | | 5.2 | 1 | 65 | 1 | 38 | 1 |
| 9.6 | 1 | 52.0 | 1 | 10.0 | 1 | 5.6 | 1 | 7 | 1 | | | 9.5 | 1 | 28 | 1 | 26 | 1 |
| 7.1 | 1 | 53.0 | 1 | 7.4 | 1 | 5.9 | 1 | 7 | 1 | | | 4.2 | 1 | 32.0 | 1 | 35.0 | 1 |
| 17.0 | 1 | 36 | 1 | 9.3 | 1 | 5.3 | 1 | 13 | 1 | | | 4.1 | 1 | 44.0 | 1 | 26.0 | 1 |
| | | 56.0 | 1 | 12.0 | 1 | 6.1 | 1 | 7 | 1 | 0.02 | 1 | 4.8 | 1 | 62.0 | 1 | 32 | 1 |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | UCL Statistics for Uncensored Full Data Sets | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 | Date/Time of Computation | | | ProUCL 5.12/11/2021 11:47:40 AM | | | | | | | | |
| 5 | From File | | | UCL UTL concentrations USFS Big Blue_a.xls | | | | | | | | |
| 6 | Full Precision | | | OFF | | | | | | | | |
| 7 | Confidence Coefficient | | | 95% | | | | | | | | |
| 8 | Number of Bootstrap Operations | | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | Arsenic | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | General Statistics | | | | | | | | | | | |
| 14 | Total Number of Observations | | | | | 49 | Number of Distinct Observations | | | | | 41 |
| 15 | | | | | | | Number of Missing Observations | | | | | 0 |
| 16 | Minimum | | | | | 12 | Mean | | | | | 63.43 |
| 17 | Maximum | | | | | 368 | Median | | | | | 41 |
| 18 | SD | | | | | 73.83 | Std. Error of Mean | | | | | 10.55 |
| 19 | Coefficient of Variation | | | | | 1.164 | Skewness | | | | | 2.679 |
| 20 | | | | | | | | | | | | |
| 21 | Normal GOF Test | | | | | | | | | | | |
| 22 | Shapiro Wilk Test Statistic | | | | | 0.643 | Shapiro Wilk GOF Test | | | | | |
| 23 | 5% Shapiro Wilk Critical Value | | | | | 0.947 | Data Not Normal at 5% Significance Level | | | | | |
| 24 | Lilliefors Test Statistic | | | | | 0.284 | Lilliefors GOF Test | | | | | |
| 25 | 5% Lilliefors Critical Value | | | | | 0.126 | Data Not Normal at 5% Significance Level | | | | | |
| 26 | Data Not Normal at 5% Significance Level | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | Assuming Normal Distribution | | | | | | | | | | | |
| 29 | 95% Normal UCL | | | | | | 95% UCLs (Adjusted for Skewness) | | | | | |
| 30 | 95% Student's-t UCL | | | | | 81.12 | 95% Adjusted-CLT UCL (Chen-1995) | | | | | 85.09 |
| 31 | | | | | | | 95% Modified-t UCL (Johnson-1978) | | | | | 81.79 |
| 32 | | | | | | | | | | | | |
| 33 | Gamma GOF Test | | | | | | | | | | | |
| 34 | A-D Test Statistic | | | | | 2.223 | Anderson-Darling Gamma GOF Test | | | | | |
| 35 | 5% A-D Critical Value | | | | | 0.77 | Data Not Gamma Distributed at 5% Significance Level | | | | | |
| 36 | K-S Test Statistic | | | | | 0.183 | Kolmogorov-Smirnov Gamma GOF Test | | | | | |
| 37 | 5% K-S Critical Value | | | | | 0.129 | Data Not Gamma Distributed at 5% Significance Level | | | | | |
| 38 | Data Not Gamma Distributed at 5% Significance Level | | | | | | | | | | | |
| 39 | | | | | | | | | | | | |
| 40 | Gamma Statistics | | | | | | | | | | | |
| 41 | k hat (MLE) | | | | | 1.399 | k star (bias corrected MLE) | | | | | 1.327 |
| 42 | Theta hat (MLE) | | | | | 45.35 | Theta star (bias corrected MLE) | | | | | 47.81 |
| 43 | nu hat (MLE) | | | | | 137.1 | nu star (bias corrected) | | | | | 130 |
| 44 | MLE Mean (bias corrected) | | | | | 63.43 | MLE Sd (bias corrected) | | | | | 55.07 |
| 45 | | | | | | | Approximate Chi Square Value (0.05) | | | | | 104.7 |
| 46 | Adjusted Level of Significance | | | | | 0.0451 | Adjusted Chi Square Value | | | | | 104 |
| 47 | | | | | | | | | | | | |
| 48 | Assuming Gamma Distribution | | | | | | | | | | | |
| 49 | 95% Approximate Gamma UCL (use when n>=50)) | | | | | 78.78 | 95% Adjusted Gamma UCL (use when n<50) | | | | | 79.3 |
| 50 | | | | | | | | | | | | |
| 51 | Lognormal GOF Test | | | | | | | | | | | |
| 52 | Shapiro Wilk Test Statistic | | | | | 0.937 | Shapiro Wilk Lognormal GOF Test | | | | | |
| 53 | 5% Shapiro Wilk Critical Value | | | | | 0.947 | Data Not Lognormal at 5% Significance Level | | | | | |
| 54 | Lilliefors Test Statistic | | | | | 0.109 | Lilliefors Lognormal GOF Test | | | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 55 | 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level | |
| 56 | **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| 57 | | | | |
| 58 | **Lognormal Statistics** | | | |
| 59 | Minimum of Logged Data | 2.485 | Mean of logged Data | 3.752 |
| 60 | Maximum of Logged Data | 5.908 | SD of logged Data | 0.825 |
| 61 | | | | |
| 62 | **Assuming Lognormal Distribution** | | | |
| 63 | 95% H-UCL | 77.46 | 90% Chebyshev (MVUE) UCL | 82.97 |
| 64 | 95% Chebyshev (MVUE) UCL | 93.67 | 97.5% Chebyshev (MVUE) UCL | 108.5 |
| 65 | 99% Chebyshev (MVUE) UCL | 137.7 | | |
| 66 | | | | |
| 67 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 68 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 69 | | | | |
| 70 | **Nonparametric Distribution Free UCLs** | | | |
| 71 | 95% CLT UCL | 80.78 | 95% Jackknife UCL | 81.12 |
| 72 | 95% Standard Bootstrap UCL | 80.43 | 95% Bootstrap-t UCL | 90.16 |
| 73 | 95% Hall's Bootstrap UCL | 87.54 | 95% Percentile Bootstrap UCL | 81.22 |
| 74 | 95% BCA Bootstrap UCL | 85.08 | | |
| 75 | 90% Chebyshev(Mean, Sd) UCL | 95.07 | 95% Chebyshev(Mean, Sd) UCL | 109.4 |
| 76 | 97.5% Chebyshev(Mean, Sd) UCL | 129.3 | 99% Chebyshev(Mean, Sd) UCL | 168.4 |
| 77 | | | | |
| 78 | **Suggested UCL to Use** | | | |
| 79 | 95% H-UCL | 77.46 | | |
| 80 | | | | |
| 81 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 82 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 83 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 84 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 85 | | | | |
| 86 | **ProUCL computes and outputs H-statistic based UCLs for historical reasons only.** | | | |
| 87 | **H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.** | | | |
| 88 | **It is therefore recommended to avoid the use of H-statistic based 95% UCLs.** | | | |
| 89 | **Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.** | | | |
| 90 | | | | |
| 91 | | | | |
| 92 | **Chromium** | | | |
| 93 | | | | |
| 94 | **General Statistics** | | | |
| 95 | Total Number of Observations | 26 | Number of Distinct Observations | 16 |
| 96 | | | Number of Missing Observations | 21 |
| 97 | Minimum | 21 | Mean | 29.65 |
| 98 | Maximum | 44 | Median | 28 |
| 99 | SD | 6.19 | Std. Error of Mean | 1.214 |
| 100 | Coefficient of Variation | 0.209 | Skewness | 0.74 |
| 101 | | | | |
| 102 | **Normal GOF Test** | | | |
| 103 | Shapiro Wilk Test Statistic | 0.929 | **Shapiro Wilk GOF Test** | |
| 104 | 5% Shapiro Wilk Critical Value | 0.92 | Data appear Normal at 5% Significance Level | |
| 105 | Lilliefors Test Statistic | 0.196 | **Lilliefors GOF Test** | |
| 106 | 5% Lilliefors Critical Value | 0.17 | Data Not Normal at 5% Significance Level | |
| 107 | **Data appear Approximate Normal at 5% Significance Level** | | | |
| 108 | | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 109 | **Assuming Normal Distribution** | | | |
| 110 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 111 | 95% Student's-t UCL | 31.73 | 95% Adjusted-CLT UCL (Chen-1995) | 31.84 |
| 112 | | | 95% Modified-t UCL (Johnson-1978) | 31.76 |
| 113 | | | | |
| 114 | **Gamma GOF Test** | | | |
| 115 | A-D Test Statistic | 0.503 | **Anderson-Darling Gamma GOF Test** | |
| 116 | 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 117 | K-S Test Statistic | 0.172 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 118 | 5% K-S Critical Value | 0.171 | Data Not Gamma Distributed at 5% Significance Level | |
| 119 | **Detected data follow Appr. Gamma Distribution at 5% Significance Level** | | | |
| 120 | | | | |
| 121 | **Gamma Statistics** | | | |
| 122 | k hat (MLE) | 25.3 | k star (bias corrected MLE) | 22.41 |
| 123 | Theta hat (MLE) | 1.172 | Theta star (bias corrected MLE) | 1.323 |
| 124 | nu hat (MLE) | 1316 | nu star (bias corrected) | 1165 |
| 125 | MLE Mean (bias corrected) | 29.65 | MLE Sd (bias corrected) | 6.264 |
| 126 | | | Approximate Chi Square Value (0.05) | 1087 |
| 127 | Adjusted Level of Significance | 0.0398 | Adjusted Chi Square Value | 1082 |
| 128 | | | | |
| 129 | **Assuming Gamma Distribution** | | | |
| 130 | 95% Approximate Gamma UCL (use when n>=50)) | 31.79 | 95% Adjusted Gamma UCL (use when n<50) | 31.93 |
| 131 | | | | |
| 132 | **Lognormal GOF Test** | | | |
| 133 | Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk Lognormal GOF Test** | |
| 134 | 5% Shapiro Wilk Critical Value | 0.92 | Data appear Lognormal at 5% Significance Level | |
| 135 | Lilliefors Test Statistic | 0.159 | **Lilliefors Lognormal GOF Test** | |
| 136 | 5% Lilliefors Critical Value | 0.17 | Data appear Lognormal at 5% Significance Level | |
| 137 | **Data appear Lognormal at 5% Significance Level** | | | |
| 138 | | | | |
| 139 | **Lognormal Statistics** | | | |
| 140 | Minimum of Logged Data | 3.045 | Mean of logged Data | 3.37 |
| 141 | Maximum of Logged Data | 3.784 | SD of logged Data | 0.201 |
| 142 | | | | |
| 143 | **Assuming Lognormal Distribution** | | | |
| 144 | 95% H-UCL | 31.84 | 90% Chebyshev (MVUE) UCL | 33.17 |
| 145 | 95% Chebyshev (MVUE) UCL | 34.77 | 97.5% Chebyshev (MVUE) UCL | 36.99 |
| 146 | 99% Chebyshev (MVUE) UCL | 41.36 | | |
| 147 | | | | |
| 148 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 149 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 150 | | | | |
| 151 | **Nonparametric Distribution Free UCLs** | | | |
| 152 | 95% CLT UCL | 31.65 | 95% Jackknife UCL | 31.73 |
| 153 | 95% Standard Bootstrap UCL | 31.59 | 95% Bootstrap-t UCL | 31.87 |
| 154 | 95% Hall's Bootstrap UCL | 31.86 | 95% Percentile Bootstrap UCL | 31.73 |
| 155 | 95% BCA Bootstrap UCL | 31.77 | | |
| 156 | 90% Chebyshev(Mean, Sd) UCL | 33.3 | 95% Chebyshev(Mean, Sd) UCL | 34.95 |
| 157 | 97.5% Chebyshev(Mean, Sd) UCL | 37.23 | 99% Chebyshev(Mean, Sd) UCL | 41.73 |
| 158 | | | | |
| 159 | **Suggested UCL to Use** | | | |
| 160 | 95% Student's-t UCL | 31.73 | | |
| 161 | | | | |
| 162 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 27 |
| | | Number of Missing Observations | 0 |
| Minimum | 12 | Mean | 26.51 |
| Maximum | 77 | Median | 23 |
| SD | 13.29 | Std. Error of Mean | 1.899 |
| Coefficient of Variation | 0.501 | Skewness | 2.17 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.775 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.187 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.126 | Data Not Normal at 5% Significance Level | |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 29.69 | 95% Adjusted-CLT UCL (Chen-1995) | 30.26 |
| | | 95% Modified-t UCL (Johnson-1978) | 29.79 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 1.372 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.753 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.149 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.127 | Data Not Gamma Distributed at 5% Significance Level | |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.691 | k star (bias corrected MLE) | 5.356 |
| Theta hat (MLE) | 4.658 | Theta star (bias corrected MLE) | 4.949 |
| nu hat (MLE) | 557.7 | nu star (bias corrected) | 524.9 |
| MLE Mean (bias corrected) | 26.51 | MLE Sd (bias corrected) | 11.45 |
| | | Approximate Chi Square Value (0.05) | 472.8 |
| Adjusted Level of Significance | 0.0451 | Adjusted Chi Square Value | 471.3 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 29.43 | 95% Adjusted Gamma UCL (use when n<50) | 29.53 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.941 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.121 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level | |

**Data appear Approximate Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.485 | Mean of logged Data | 3.187 |
| Maximum of Logged Data | 4.344 | SD of logged Data | 0.405 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 29.26 | 90% Chebyshev (MVUE) UCL | 30.95 |
| 95% Chebyshev (MVUE) UCL | 33.08 | 97.5% Chebyshev (MVUE) UCL | 36.04 |
| 99% Chebyshev (MVUE) UCL | 41.86 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 29.63 | 95% Jackknife UCL | 29.69 |
| 95% Standard Bootstrap UCL | 29.58 | 95% Bootstrap-t UCL | 31.19 |
| 95% Hall's Bootstrap UCL | 30.4 | 95% Percentile Bootstrap UCL | 29.67 |
| 95% BCA Bootstrap UCL | 30.51 | | |
| 90% Chebyshev(Mean, Sd) UCL | 32.21 | 95% Chebyshev(Mean, Sd) UCL | 34.79 |
| 97.5% Chebyshev(Mean, Sd) UCL | 38.37 | 99% Chebyshev(Mean, Sd) UCL | 45.4 |

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 29.69 | or 95% Modified-t UCL | 29.79 |
| or 95% H-UCL | 29.26 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**
**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**
**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**
**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**

## Lead

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 43 |
| | | Number of Missing Observations | 0 |
| Minimum | 12 | Mean | 81.45 |
| Maximum | 480 | Median | 56 |
| SD | 83.76 | Std. Error of Mean | 11.97 |
| Coefficient of Variation | 1.028 | Skewness | 2.824 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.701 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.257 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

### Assuming Normal Distribution

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 271 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 272 | 95% Student's-t UCL | 101.5 | 95% Adjusted-CLT UCL (Chen-1995) | 106.3 |
| 273 | | | 95% Modified-t UCL (Johnson-1978) | 102.3 |
| 274 | | | | |
| 275 | **Gamma GOF Test** | | | |
| 276 | A-D Test Statistic | 1.325 | **Anderson-Darling Gamma GOF Test** | |
| 277 | 5% A-D Critical Value | 0.767 | Data Not Gamma Distributed at 5% Significance Level | |
| 278 | K-S Test Statistic | 0.143 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 279 | 5% K-S Critical Value | 0.129 | Data Not Gamma Distributed at 5% Significance Level | |
| 280 | **Data Not Gamma Distributed at 5% Significance Level** | | | |
| 281 | | | | |
| 282 | **Gamma Statistics** | | | |
| 283 | k hat (MLE) | 1.577 | k star (bias corrected MLE) | 1.494 |
| 284 | Theta hat (MLE) | 51.64 | Theta star (bias corrected MLE) | 54.51 |
| 285 | nu hat (MLE) | 154.6 | nu star (bias corrected) | 146.4 |
| 286 | MLE Mean (bias corrected) | 81.45 | MLE Sd (bias corrected) | 66.63 |
| 287 | | | Approximate Chi Square Value (0.05) | 119.5 |
| 288 | Adjusted Level of Significance | 0.0451 | Adjusted Chi Square Value | 118.7 |
| 289 | | | | |
| 290 | **Assuming Gamma Distribution** | | | |
| 291 | 95% Approximate Gamma UCL (use when n>=50)) | 99.83 | 95% Adjusted Gamma UCL (use when n<50) | 100.5 |
| 292 | | | | |
| 293 | **Lognormal GOF Test** | | | |
| 294 | Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk Lognormal GOF Test** | |
| 295 | 5% Shapiro Wilk Critical Value | 0.947 | Data appear Lognormal at 5% Significance Level | |
| 296 | Lilliefors Test Statistic | 0.0902 | **Lilliefors Lognormal GOF Test** | |
| 297 | 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level | |
| 298 | **Data appear Lognormal at 5% Significance Level** | | | |
| 299 | | | | |
| 300 | **Lognormal Statistics** | | | |
| 301 | Minimum of Logged Data | 2.485 | Mean of logged Data | 4.051 |
| 302 | Maximum of Logged Data | 6.174 | SD of logged Data | 0.808 |
| 303 | | | | |
| 304 | **Assuming Lognormal Distribution** | | | |
| 305 | 95% H-UCL | 102.3 | 90% Chebyshev (MVUE) UCL | 109.6 |
| 306 | 95% Chebyshev (MVUE) UCL | 123.5 | 97.5% Chebyshev (MVUE) UCL | 142.8 |
| 307 | 99% Chebyshev (MVUE) UCL | 180.7 | | |
| 308 | | | | |
| 309 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 310 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 311 | | | | |
| 312 | **Nonparametric Distribution Free UCLs** | | | |
| 313 | 95% CLT UCL | 101.1 | 95% Jackknife UCL | 101.5 |
| 314 | 95% Standard Bootstrap UCL | 101 | 95% Bootstrap-t UCL | 110 |
| 315 | 95% Hall's Bootstrap UCL | 115.3 | 95% Percentile Bootstrap UCL | 103.7 |
| 316 | 95% BCA Bootstrap UCL | 107.3 | | |
| 317 | 90% Chebyshev(Mean, Sd) UCL | 117.3 | 95% Chebyshev(Mean, Sd) UCL | 133.6 |
| 318 | 97.5% Chebyshev(Mean, Sd) UCL | 156.2 | 99% Chebyshev(Mean, Sd) UCL | 200.5 |
| 319 | | | | |
| 320 | **Suggested UCL to Use** | | | |
| 321 | 95% H-UCL | 102.3 | | |
| 322 | | | | |
| 323 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 324 | Recommendations are based upon data size, data distribution, and skewness. | | | |

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**

**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**

**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**

**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 44 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 5 |
| Minimum | 3 | Mean | 6.341 |
| Maximum | 31 | Median | 4.5 |
| SD | 5.203 | Std. Error of Mean | 0.784 |
| Coefficient of Variation | 0.82 | Skewness | 2.936 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.664 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.944 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.261 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.132 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 7.659 | 95% Adjusted-CLT UCL (Chen-1995) | 8.002 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.717 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 2.749 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.757 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.224 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.135 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.658 | k star (bias corrected MLE) | 2.492 |
| Theta hat (MLE) | 2.386 | Theta star (bias corrected MLE) | 2.545 |
| nu hat (MLE) | 233.9 | nu star (bias corrected) | 219.3 |
| MLE Mean (bias corrected) | 6.341 | MLE Sd (bias corrected) | 4.017 |
| | | Approximate Chi Square Value (0.05) | 186 |
| Adjusted Level of Significance | 0.0445 | Adjusted Chi Square Value | 185 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 7.475 | 95% Adjusted Gamma UCL (use when n<50) | 7.517 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.853 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.944 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.185 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.132 | Data Not Lognormal at 5% Significance Level |

| | | | |
|---|---|---|---|
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.647 |
| Maximum of Logged Data | 3.434 | SD of logged Data | 0.58 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 7.311 | 90% Chebyshev (MVUE) UCL | 7.827 |
| 95% Chebyshev (MVUE) UCL | 8.601 | 97.5% Chebyshev (MVUE) UCL | 9.676 |
| 99% Chebyshev (MVUE) UCL | 11.79 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data do not follow a Discernible Distribution (0.05)** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 7.631 | 95% Jackknife UCL | 7.659 |
| 95% Standard Bootstrap UCL | 7.625 | 95% Bootstrap-t UCL | 8.261 |
| 95% Hall's Bootstrap UCL | 8.84 | 95% Percentile Bootstrap UCL | 7.75 |
| 95% BCA Bootstrap UCL | 8.068 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8.694 | 95% Chebyshev(Mean, Sd) UCL | 9.76 |
| 97.5% Chebyshev(Mean, Sd) UCL | 11.24 | 99% Chebyshev(Mean, Sd) UCL | 14.14 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Chebyshev (Mean, Sd) UCL | 9.76 | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| **Molybdenum** | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 35 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 14 |
| Minimum | 3 | Mean | 5.714 |
| Maximum | 12 | Median | 5 |
| SD | 2.504 | Std. Error of Mean | 0.423 |
| Coefficient of Variation | 0.438 | Skewness | 1.001 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.876 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.934 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.197 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.148 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 6.43 | 95% Adjusted-CLT UCL (Chen-1995) | 6.487 |
| | | 95% Modified-t UCL (Johnson-1978) | 6.442 |
| | | | |
| **Gamma GOF Test** | | | |

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.852 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.749 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.142 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.149 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data follow Appr. Gamma Distribution at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 5.937 | k star (bias corrected MLE) | 5.447 |
| Theta hat (MLE) | 0.963 | Theta star (bias corrected MLE) | 1.049 |
| nu hat (MLE) | 415.6 | nu star (bias corrected) | 381.3 |
| MLE Mean (bias corrected) | 5.714 | MLE Sd (bias corrected) | 2.448 |
| | | Approximate Chi Square Value (0.05) | 337 |
| Adjusted Level of Significance | 0.0425 | Adjusted Chi Square Value | 335.1 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 6.465 | 95% Adjusted Gamma UCL (use when n<50) | 6.503 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.919 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.934 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.137 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.148 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.656 |
| Maximum of Logged Data | 2.485 | SD of logged Data | 0.418 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 6.545 | 90% Chebyshev (MVUE) UCL | 6.953 |
| 95% Chebyshev (MVUE) UCL | 7.519 | 97.5% Chebyshev (MVUE) UCL | 8.305 |
| 99% Chebyshev (MVUE) UCL | 9.847 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 6.41 | 95% Jackknife UCL | 6.43 |
| 95% Standard Bootstrap UCL | 6.396 | 95% Bootstrap-t UCL | 6.529 |
| 95% Hall's Bootstrap UCL | 6.494 | 95% Percentile Bootstrap UCL | 6.429 |
| 95% BCA Bootstrap UCL | 6.486 | | |
| 90% Chebyshev(Mean, Sd) UCL | 6.984 | 95% Chebyshev(Mean, Sd) UCL | 7.559 |
| 97.5% Chebyshev(Mean, Sd) UCL | 8.357 | 99% Chebyshev(Mean, Sd) UCL | 9.925 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Adjusted Gamma UCL | 6.503 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |

Nickel

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 18 |
| | | Number of Missing Observations | 0 |
| Minimum | 12 | Mean | 20.82 |
| Maximum | 35 | Median | 21 |
| SD | 4.241 | Std. Error of Mean | 0.606 |
| Coefficient of Variation | 0.204 | Skewness | 0.796 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.967 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.104 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 21.83 | 95% Adjusted-CLT UCL (Chen-1995) | 21.89 |
| | | 95% Modified-t UCL (Johnson-1978) | 21.84 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.258 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0783 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.126 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 25.55 | k star (bias corrected MLE) | 24 |
| Theta hat (MLE) | 0.815 | Theta star (bias corrected MLE) | 0.867 |
| nu hat (MLE) | 2504 | nu star (bias corrected) | 2352 |
| MLE Mean (bias corrected) | 20.82 | MLE Sd (bias corrected) | 4.249 |
| | | Approximate Chi Square Value (0.05) | 2240 |
| Adjusted Level of Significance | 0.0451 | Adjusted Chi Square Value | 2237 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 21.85 | 95% Adjusted Gamma UCL (use when n<50) | 21.89 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.992 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0713 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.485 | Mean of logged Data | 3.016 |
| Maximum of Logged Data | 3.555 | SD of logged Data | 0.2 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 21.94 | 90% Chebyshev (MVUE) UCL | 22.62 |
| 95% Chebyshev (MVUE) UCL | 23.43 | 97.5% Chebyshev (MVUE) UCL | 24.56 |
| 99% Chebyshev (MVUE) UCL | 26.79 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 21.81 | 95% Jackknife UCL | 21.83 |
| 95% Standard Bootstrap UCL | 21.81 | 95% Bootstrap-t UCL | 21.93 |
| 95% Hall's Bootstrap UCL | 21.97 | 95% Percentile Bootstrap UCL | 21.84 |
| 95% BCA Bootstrap UCL | 21.84 | | |
| 90% Chebyshev(Mean, Sd) UCL | 22.63 | 95% Chebyshev(Mean, Sd) UCL | 23.46 |
| 97.5% Chebyshev(Mean, Sd) UCL | 24.6 | 99% Chebyshev(Mean, Sd) UCL | 26.84 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 21.83 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 49 | Number of Distinct Observations | 39 |
| | | Number of Missing Observations | 0 |
| Minimum | 118 | Mean | 216.5 |
| Maximum | 272 | Median | 223 |
| SD | 34.73 | Std. Error of Mean | 4.961 |
| Coefficient of Variation | 0.16 | Skewness | -0.728 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.95 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.947 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0843 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.126 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 224.8 | 95% Adjusted-CLT UCL (Chen-1995) | 224.1 |
| | | 95% Modified-t UCL (Johnson-1978) | 224.7 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.809 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.748 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.102 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.126 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 595 | | | | | k hat (MLE) | 35.02 | | | | | k star (bias corrected MLE) | 32.89 |
| 596 | | | | | Theta hat (MLE) | 6.183 | | | | | Theta star (bias corrected MLE) | 6.583 |
| 597 | | | | | nu hat (MLE) | 3432 | | | | | nu star (bias corrected) | 3223 |
| 598 | | | | | MLE Mean (bias corrected) | 216.5 | | | | | MLE Sd (bias corrected) | 37.75 |
| 599 | | | | | | | | | | | Approximate Chi Square Value (0.05) | 3092 |
| 600 | | | | | Adjusted Level of Significance | 0.0451 | | | | | Adjusted Chi Square Value | 3088 |
| 601 | | | | | | | | | | | | |
| 602 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 603 | | | | | 95% Approximate Gamma UCL (use when n>=50)) | 225.7 | | | | | 95% Adjusted Gamma UCL (use when n<50) | 226 |
| 604 | | | | | | | | | | | | |
| 605 | **Lognormal GOF Test** | | | | | | | | | | | |
| 606 | | | | | Shapiro Wilk Test Statistic | 0.894 | **Shapiro Wilk Lognormal GOF Test** | | | | | |
| 607 | | | | | 5% Shapiro Wilk Critical Value | 0.947 | Data Not Lognormal at 5% Significance Level | | | | | |
| 608 | | | | | Lilliefors Test Statistic | 0.108 | **Lilliefors Lognormal GOF Test** | | | | | |
| 609 | | | | | 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level | | | | | |
| 610 | **Data appear Approximate Lognormal at 5% Significance Level** | | | | | | | | | | | |
| 611 | | | | | | | | | | | | |
| 612 | **Lognormal Statistics** | | | | | | | | | | | |
| 613 | | | | | Minimum of Logged Data | 4.771 | | | | | Mean of logged Data | 5.363 |
| 614 | | | | | Maximum of Logged Data | 5.606 | | | | | SD of logged Data | 0.178 |
| 615 | | | | | | | | | | | | |
| 616 | **Assuming Lognormal Distribution** | | | | | | | | | | | |
| 617 | | | | | 95% H-UCL | 227 | | | | | 90% Chebyshev (MVUE) UCL | 233.4 |
| 618 | | | | | 95% Chebyshev (MVUE) UCL | 240.9 | | | | | 97.5% Chebyshev (MVUE) UCL | 251.3 |
| 619 | | | | | 99% Chebyshev (MVUE) UCL | 271.9 | | | | | | |
| 620 | | | | | | | | | | | | |
| 621 | **Nonparametric Distribution Free UCL Statistics** | | | | | | | | | | | |
| 622 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | | | | | | | | | |
| 623 | | | | | | | | | | | | |
| 624 | **Nonparametric Distribution Free UCLs** | | | | | | | | | | | |
| 625 | | | | | 95% CLT UCL | 224.7 | | | | | 95% Jackknife UCL | 224.8 |
| 626 | | | | | 95% Standard Bootstrap UCL | 224.6 | | | | | 95% Bootstrap-t UCL | 224.1 |
| 627 | | | | | 95% Hall's Bootstrap UCL | 224.2 | | | | | 95% Percentile Bootstrap UCL | 224.3 |
| 628 | | | | | 95% BCA Bootstrap UCL | 223.5 | | | | | | |
| 629 | | | | | 90% Chebyshev(Mean, Sd) UCL | 231.4 | | | | | 95% Chebyshev(Mean, Sd) UCL | 238.1 |
| 630 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 247.5 | | | | | 99% Chebyshev(Mean, Sd) UCL | 265.9 |
| 631 | | | | | | | | | | | | |
| 632 | **Suggested UCL to Use** | | | | | | | | | | | |
| 633 | | | | | 95% Student's-t UCL | 224.8 | | | | | | |
| 634 | | | | | | | | | | | | |
| 635 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 636 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 637 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 638 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 639 | | | | | | | | | | | | |
| 640 | **Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be** | | | | | | | | | | | |
| 641 | **reliable.  Chen's and Johnson's methods provide adjustments for positvely skewed data sets.** | | | | | | | | | | | |
| 642 | | | | | | | | | | | | |
| 643 | | | | | | | | | | | | |
| 644 | **Zinc** | | | | | | | | | | | |
| 645 | | | | | | | | | | | | |
| 646 | **General Statistics** | | | | | | | | | | | |
| 647 | | | | | Total Number of Observations | 49 | | | | | Number of Distinct Observations | 40 |
| 648 | | | | | | | | | | | Number of Missing Observations | 0 |

| | | | |
|---|---|---|---|
| Minimum | 64 | Mean | 132.5 |
| Maximum | 376 | Median | 127 |
| SD | 49.22 | Std. Error of Mean | 7.032 |
| Coefficient of Variation | 0.371 | Skewness | 2.647 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.807 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.947 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.132 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.126 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 144.3 | 95% Adjusted-CLT UCL (Chen-1995) | 146.9 |
| | | 95% Modified-t UCL (Johnson-1978) | 144.7 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.526 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.75 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.0892 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.127 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 9.751 | k star (bias corrected MLE) | 9.167 |
| Theta hat (MLE) | 13.59 | Theta star (bias corrected MLE) | 14.45 |
| nu hat (MLE) | 955.6 | nu star (bias corrected) | 898.4 |
| MLE Mean (bias corrected) | 132.5 | MLE Sd (bias corrected) | 43.76 |
| | | Approximate Chi Square Value (0.05) | 829.8 |
| Adjusted Level of Significance | 0.0451 | Adjusted Chi Square Value | 827.9 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 143.5 | 95% Adjusted Gamma UCL (use when n<50) | 143.8 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.97 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.947 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.0809 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.126 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 4.159 | Mean of logged Data | 4.835 |
| Maximum of Logged Data | 5.93 | SD of logged Data | 0.314 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 143.3 | 90% Chebyshev (MVUE) UCL | 150.1 |
| 95% Chebyshev (MVUE) UCL | 158.3 | 97.5% Chebyshev (MVUE) UCL | 169.7 |
| 99% Chebyshev (MVUE) UCL | 192 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 703 | **Nonparametric Distribution Free UCLs** | | | |
| 704 | 95% CLT UCL | 144.1 | 95% Jackknife UCL | 144.3 |
| 705 | 95% Standard Bootstrap UCL | 144.1 | 95% Bootstrap-t UCL | 148 |
| 706 | 95% Hall's Bootstrap UCL | 157.9 | 95% Percentile Bootstrap UCL | 144.5 |
| 707 | 95% BCA Bootstrap UCL | 147.1 | | |
| 708 | 90% Chebyshev(Mean, Sd) UCL | 153.6 | 95% Chebyshev(Mean, Sd) UCL | 163.2 |
| 709 | 97.5% Chebyshev(Mean, Sd) UCL | 176.4 | 99% Chebyshev(Mean, Sd) UCL | 202.5 |
| 710 | | | | |
| 711 | **Suggested UCL to Use** | | | |
| 712 | 95% Adjusted Gamma UCL | 143.8 | | |
| 713 | | | | |
| 714 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 715 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 716 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 717 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 718 | | | | |

## UCL Statistics for Uncensored Full Data Sets

| | | | |
|---|---|---|---|
| User Selected Options | | | |
| Date/Time of Computation | ProUCL 5.12/11/2021 11:49:05 AM | | |
| From File | UCL UTL concentrations USFS Big Blue_b.xls | | |
| Full Precision | OFF | | |
| Confidence Coefficient | 95% | | |
| Number of Bootstrap Operations | 2000 | | |

**Arsenic**

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 72 | Number of Distinct Observations | 17 |
| | | Number of Missing Observations | 0 |
| Minimum | 5 | Mean | 11.54 |
| Maximum | 37 | Median | 10 |
| SD | 5.392 | Std. Error of Mean | 0.635 |
| Coefficient of Variation | 0.467 | Skewness | 2.208 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.805 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 4.903E-13 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.182 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.104 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 12.6 | 95% Adjusted-CLT UCL (Chen-1995) | 12.76 |
| | | 95% Modified-t UCL (Johnson-1978) | 12.63 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 1.8 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.753 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.155 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.105 | Data Not Gamma Distributed at 5% Significance Level | |
| **Data Not Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 6.303 | k star (bias corrected MLE) | 6.05 |
| Theta hat (MLE) | 1.831 | Theta star (bias corrected MLE) | 1.908 |
| nu hat (MLE) | 907.7 | nu star (bias corrected) | 871.2 |
| MLE Mean (bias corrected) | 11.54 | MLE Sd (bias corrected) | 4.692 |
| | | Approximate Chi Square Value (0.05) | 803.7 |
| Adjusted Level of Significance | 0.0467 | Adjusted Chi Square Value | 802.4 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 12.51 | 95% Adjusted Gamma UCL (use when n<50) | 12.53 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk P Value | 0.0219 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.133 | **Lilliefors Lognormal GOF Test** | |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.104 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.609 | Mean of logged Data | 2.365 |
| Maximum of Logged Data | 3.611 | SD of logged Data | 0.387 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 12.45 | 90% Chebyshev (MVUE) UCL | 13.07 |
| 95% Chebyshev (MVUE) UCL | 13.8 | 97.5% Chebyshev (MVUE) UCL | 14.82 |
| 99% Chebyshev (MVUE) UCL | 16.82 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data do not follow a Discernible Distribution (0.05)** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 12.59 | 95% Jackknife UCL | 12.6 |
| 95% Standard Bootstrap UCL | 12.58 | 95% Bootstrap-t UCL | 12.88 |
| 95% Hall's Bootstrap UCL | 12.89 | 95% Percentile Bootstrap UCL | 12.6 |
| 95% BCA Bootstrap UCL | 12.82 | | |
| 90% Chebyshev(Mean, Sd) UCL | 13.45 | 95% Chebyshev(Mean, Sd) UCL | 14.31 |
| 97.5% Chebyshev(Mean, Sd) UCL | 15.51 | 99% Chebyshev(Mean, Sd) UCL | 17.86 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 12.6 | or 95% Modified-t UCL | 12.63 |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| Chromium | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 20 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 51 |
| Minimum | 23 | Mean | 32.15 |
| Maximum | 51 | Median | 32.5 |
| SD | 6.675 | Std. Error of Mean | 1.493 |
| Coefficient of Variation | 0.208 | Skewness | 0.963 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.914 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.905 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.149 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.192 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 34.73 | 95% Adjusted-CLT UCL (Chen-1995) | 34.95 |
| | | 95% Modified-t UCL (Johnson-1978) | 34.78 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.476 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.167 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.193 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 25.89 | k star (bias corrected MLE) | 22.04 |
| Theta hat (MLE) | 1.242 | Theta star (bias corrected MLE) | 1.459 |
| nu hat (MLE) | 1036 | nu star (bias corrected) | 881.7 |
| MLE Mean (bias corrected) | 32.15 | MLE Sd (bias corrected) | 6.848 |
| | | Approximate Chi Square Value (0.05) | 813.8 |
| Adjusted Level of Significance | 0.038 | Adjusted Chi Square Value | 808.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 34.83 | 95% Adjusted Gamma UCL (use when n<50) | 35.05 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.905 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.179 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.192 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.135 | Mean of logged Data | 3.451 |
| Maximum of Logged Data | 3.932 | SD of logged Data | 0.201 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 34.93 | 90% Chebyshev (MVUE) UCL | 36.49 |
| 95% Chebyshev (MVUE) UCL | 38.47 | 97.5% Chebyshev (MVUE) UCL | 41.2 |
| 99% Chebyshev (MVUE) UCL | 46.58 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 34.61 | 95% Jackknife UCL | 34.73 |
| 95% Standard Bootstrap UCL | 34.49 | 95% Bootstrap-t UCL | 35.18 |
| 95% Hall's Bootstrap UCL | 35.84 | 95% Percentile Bootstrap UCL | 34.5 |
| 95% BCA Bootstrap UCL | 34.7 | | |
| 90% Chebyshev(Mean, Sd) UCL | 36.63 | 95% Chebyshev(Mean, Sd) UCL | 38.66 |
| 97.5% Chebyshev(Mean, Sd) UCL | 41.47 | 99% Chebyshev(Mean, Sd) UCL | 47 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 34.73 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Copper**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 72 | Number of Distinct Observations | 26 |
| | | Number of Missing Observations | 0 |
| Minimum | 8 | Mean | 20.33 |
| Maximum | 36 | Median | 20 |
| SD | 7.037 | Std. Error of Mean | 0.829 |
| Coefficient of Variation | 0.346 | Skewness | 0.292 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.962 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0892 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0882 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 21.72 | 95% Adjusted-CLT UCL (Chen-1995) | 21.73 |
| | | 95% Modified-t UCL (Johnson-1978) | 21.72 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.332 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.752 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0671 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.105 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.929 | k star (bias corrected MLE) | 7.608 |
| Theta hat (MLE) | 2.565 | Theta star (bias corrected MLE) | 2.673 |
| nu hat (MLE) | 1142 | nu star (bias corrected) | 1095 |
| MLE Mean (bias corrected) | 20.33 | MLE Sd (bias corrected) | 7.372 |
| | | Approximate Chi Square Value (0.05) | 1020 |
| Adjusted Level of Significance | 0.0467 | Adjusted Chi Square Value | 1018 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 21.85 | 95% Adjusted Gamma UCL (use when n<50) | 21.88 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.0207 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0916 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Lognormal at 5% Significance Level |

**Data appear Approximate Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.079 | Mean of logged Data | 2.948 |
| Maximum of Logged Data | 3.584 | SD of logged Data | 0.373 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 22.12 | 90% Chebyshev (MVUE) UCL | 23.2 |
| 95% Chebyshev (MVUE) UCL | 24.45 | 97.5% Chebyshev (MVUE) UCL | 26.2 |

| | | | |
|---|---|---|---|
| 99% Chebyshev (MVUE) UCL | 29.63 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 21.7 | 95% Jackknife UCL | 21.72 |
| 95% Standard Bootstrap UCL | 21.69 | 95% Bootstrap-t UCL | 21.7 |
| 95% Hall's Bootstrap UCL | 21.7 | 95% Percentile Bootstrap UCL | 21.67 |
| 95% BCA Bootstrap UCL | 21.72 | | |
| 90% Chebyshev(Mean, Sd) UCL | 22.82 | 95% Chebyshev(Mean, Sd) UCL | 23.95 |
| 97.5% Chebyshev(Mean, Sd) UCL | 25.51 | 99% Chebyshev(Mean, Sd) UCL | 28.59 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 21.72 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 72 | Number of Distinct Observations | 17 |
| | | Number of Missing Observations | 0 |
| Minimum | 0 | Mean | 9.514 |
| Maximum | 21 | Median | 9 |
| SD | 3.711 | Std. Error of Mean | 0.437 |
| Coefficient of Variation | 0.39 | Skewness | 1.07 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.898 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 2.8690E-6 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.184 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 10.24 | 95% Adjusted-CLT UCL (Chen-1995) | 10.29 |
| | | 95% Modified-t UCL (Johnson-1978) | 10.25 |

**Gamma Statistics Not Available**

**Lognormal Statistics Not Available**

**Nonparametric Distribution Free UCL Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 10.23 | 95% Jackknife UCL | 10.24 |
| 95% Standard Bootstrap UCL | 10.22 | 95% Bootstrap-t UCL | 10.33 |
| 95% Hall's Bootstrap UCL | 10.32 | 95% Percentile Bootstrap UCL | 10.26 |
| 95% BCA Bootstrap UCL | 10.31 | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 271 | | | | | 90% Chebyshev(Mean, Sd) UCL | 10.83 | | | | | 95% Chebyshev(Mean, Sd) UCL | 11.42 |
| 272 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 12.25 | | | | | 99% Chebyshev(Mean, Sd) UCL | 13.87 |
| 273 | | | | | | | | | | | | |
| 274 | **Suggested UCL to Use** | | | | | | | | | | | |
| 275 | | | | | 95% Chebyshev (Mean, Sd) UCL | 11.42 | | | | | | |
| 276 | | | | | | | | | | | | |
| 277 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 278 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 279 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 280 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 281 | | | | | | | | | | | | |
| 282 | | | | | | | | | | | | |
| 283 | Mercury | | | | | | | | | | | |
| 284 | | | | | | | | | | | | |
| 285 | **General Statistics** | | | | | | | | | | | |
| 286 | | | | | Total Number of Observations | 36 | | | | | Number of Distinct Observations | 3 |
| 287 | | | | | | | | | | | Number of Missing Observations | 36 |
| 288 | | | | | Minimum | 3 | | | | | Mean | 3.722 |
| 289 | | | | | Maximum | 5 | | | | | Median | 4 |
| 290 | | | | | SD | 0.615 | | | | | Std. Error of Mean | 0.102 |
| 291 | | | | | Coefficient of Variation | 0.165 | | | | | Skewness | 0.233 |
| 292 | | | | | | | | | | | | |
| 293 | **Normal GOF Test** | | | | | | | | | | | |
| 294 | | | | | Shapiro Wilk Test Statistic | 0.757 | **Shapiro Wilk GOF Test** | | | | | |
| 295 | | | | | 5% Shapiro Wilk Critical Value | 0.935 | Data Not Normal at 5% Significance Level | | | | | |
| 296 | | | | | Lilliefors Test Statistic | 0.313 | **Lilliefors GOF Test** | | | | | |
| 297 | | | | | 5% Lilliefors Critical Value | 0.145 | Data Not Normal at 5% Significance Level | | | | | |
| 298 | **Data Not Normal at 5% Significance Level** | | | | | | | | | | | |
| 299 | | | | | | | | | | | | |
| 300 | **Assuming Normal Distribution** | | | | | | | | | | | |
| 301 | **95% Normal UCL** | | | | | | **95% UCLs (Adjusted for Skewness)** | | | | | |
| 302 | | | | | 95% Student's-t UCL | 3.895 | | | | | 95% Adjusted-CLT UCL (Chen-1995) | 3.895 |
| 303 | | | | | | | | | | | 95% Modified-t UCL (Johnson-1978) | 3.896 |
| 304 | | | | | | | | | | | | |
| 305 | **Gamma GOF Test** | | | | | | | | | | | |
| 306 | | | | | A-D Test Statistic | 4.32 | **Anderson-Darling Gamma GOF Test** | | | | | |
| 307 | | | | | 5% A-D Critical Value | 0.746 | Data Not Gamma Distributed at 5% Significance Level | | | | | |
| 308 | | | | | K-S Test Statistic | 0.331 | **Kolmogorov-Smirnov Gamma GOF Test** | | | | | |
| 309 | | | | | 5% K-S Critical Value | 0.146 | Data Not Gamma Distributed at 5% Significance Level | | | | | |
| 310 | **Data Not Gamma Distributed at 5% Significance Level** | | | | | | | | | | | |
| 311 | | | | | | | | | | | | |
| 312 | **Gamma Statistics** | | | | | | | | | | | |
| 313 | | | | | k hat (MLE) | 37.71 | | | | | k star (bias corrected MLE) | 34.59 |
| 314 | | | | | Theta hat (MLE) | 0.0987 | | | | | Theta star (bias corrected MLE) | 0.108 |
| 315 | | | | | nu hat (MLE) | 2715 | | | | | nu star (bias corrected) | 2490 |
| 316 | | | | | MLE Mean (bias corrected) | 3.722 | | | | | MLE Sd (bias corrected) | 0.633 |
| 317 | | | | | | | | | | | Approximate Chi Square Value (0.05) | 2375 |
| 318 | | | | | Adjusted Level of Significance | 0.0428 | | | | | Adjusted Chi Square Value | 2370 |
| 319 | | | | | | | | | | | | |
| 320 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 321 | | | | | 95% Approximate Gamma UCL (use when n>=50)) | 3.902 | | | | | 95% Adjusted Gamma UCL (use when n<50) | 3.911 |
| 322 | | | | | | | | | | | | |
| 323 | **Lognormal GOF Test** | | | | | | | | | | | |
| 324 | | | | | Shapiro Wilk Test Statistic | 0.75 | **Shapiro Wilk Lognormal GOF Test** | | | | | |

| | | | |
|---|---|---|---|
| 5% Shapiro Wilk Critical Value | 0.935 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.335 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.145 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.301 |
| Maximum of Logged Data | 1.609 | SD of logged Data | 0.166 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 3.908 | 90% Chebyshev (MVUE) UCL | 4.033 |
| 95% Chebyshev (MVUE) UCL | 4.174 | 97.5% Chebyshev (MVUE) UCL | 4.369 |
| 99% Chebyshev (MVUE) UCL | 4.752 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data do not follow a Discernible Distribution (0.05)** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 3.891 | 95% Jackknife UCL | 3.895 |
| 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |
| 95% BCA Bootstrap UCL | N/A | | |
| 90% Chebyshev(Mean, Sd) UCL | 4.03 | 95% Chebyshev(Mean, Sd) UCL | 4.169 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4.362 | 99% Chebyshev(Mean, Sd) UCL | 4.741 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 3.895 | or 95% Modified-t UCL | 3.896 |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| **Molybdenum** | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 60 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 12 |
| Minimum | 3 | Mean | 6.883 |
| Maximum | 18 | Median | 7 |
| SD | 3.043 | Std. Error of Mean | 0.393 |
| Coefficient of Variation | 0.442 | Skewness | 1.134 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.911 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk P Value | 1.7251E-4 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.149 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.114 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 7.54 | 95% Adjusted-CLT UCL (Chen-1995) | 7.591 |

| | | | |
|---|---|---|---|
| | | 95% Modified-t UCL (Johnson-1978) | 7.549 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.675 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.753 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.134 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.115 | Data Not Gamma Distributed at 5% Significance Level | |
| **Detected data follow Appr. Gamma Distribution at 5% Significance Level** | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 5.624 | k star (bias corrected MLE) | 5.354 |
| Theta hat (MLE) | 1.224 | Theta star (bias corrected MLE) | 1.286 |
| nu hat (MLE) | 674.9 | nu star (bias corrected) | 642.5 |
| MLE Mean (bias corrected) | 6.883 | MLE Sd (bias corrected) | 2.975 |
| | | Approximate Chi Square Value (0.05) | 584.7 |
| Adjusted Level of Significance | 0.046 | Adjusted Chi Square Value | 583.3 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 7.564 | 95% Adjusted Gamma UCL (use when n<50) | 7.581 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk P Value | 0.0432 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.117 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.114 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.838 |
| Maximum of Logged Data | 2.89 | SD of logged Data | 0.434 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 7.661 | 90% Chebyshev (MVUE) UCL | 8.091 |
| 95% Chebyshev (MVUE) UCL | 8.635 | 97.5% Chebyshev (MVUE) UCL | 9.391 |
| 99% Chebyshev (MVUE) UCL | 10.88 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 7.529 | 95% Jackknife UCL | 7.54 |
| 95% Standard Bootstrap UCL | 7.508 | 95% Bootstrap-t UCL | 7.624 |
| 95% Hall's Bootstrap UCL | 7.669 | 95% Percentile Bootstrap UCL | 7.55 |
| 95% BCA Bootstrap UCL | 7.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8.062 | 95% Chebyshev(Mean, Sd) UCL | 8.595 |
| 97.5% Chebyshev(Mean, Sd) UCL | 9.336 | 99% Chebyshev(Mean, Sd) UCL | 10.79 |
| **Suggested UCL to Use** | | | |
| 95% Approximate Gamma UCL | 7.564 | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Nickel**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 72 | Number of Distinct Observations | 18 |
| | | Number of Missing Observations | 0 |
| Minimum | 7 | Mean | 21.13 |
| Maximum | 31 | Median | 21.5 |
| SD | 5.574 | Std. Error of Mean | 0.657 |
| Coefficient of Variation | 0.264 | Skewness | -0.305 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.0403 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0869 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 22.22 | 95% Adjusted-CLT UCL (Chen-1995) | 22.18 |
| | | 95% Modified-t UCL (Johnson-1978) | 22.22 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.022 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0996 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.105 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 12.58 | k star (bias corrected MLE) | 12.07 |
| Theta hat (MLE) | 1.679 | Theta star (bias corrected MLE) | 1.751 |
| nu hat (MLE) | 1812 | nu star (bias corrected) | 1738 |
| MLE Mean (bias corrected) | 21.13 | MLE Sd (bias corrected) | 6.081 |
| | | Approximate Chi Square Value (0.05) | 1642 |
| Adjusted Level of Significance | 0.0467 | Adjusted Chi Square Value | 1640 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 22.36 | 95% Adjusted Gamma UCL (use when n<50) | 22.38 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.917 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 6.4975E-5 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.115 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.946 | Mean of logged Data | 3.01 |

| | | | |
|---|---|---|---|
| Maximum of Logged Data | 3.434 | SD of logged Data | 0.3 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 22.59 | 90% Chebyshev (MVUE) UCL | 23.51 |
| 95% Chebyshev (MVUE) UCL | 24.55 | 97.5% Chebyshev (MVUE) UCL | 25.99 |
| 99% Chebyshev (MVUE) UCL | 28.83 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 22.21 | 95% Jackknife UCL | 22.22 |
| 95% Standard Bootstrap UCL | 22.2 | 95% Bootstrap-t UCL | 22.22 |
| 95% Hall's Bootstrap UCL | 22.23 | 95% Percentile Bootstrap UCL | 22.19 |
| 95% BCA Bootstrap UCL | 22.18 | | |
| 90% Chebyshev(Mean, Sd) UCL | 23.1 | 95% Chebyshev(Mean, Sd) UCL | 23.99 |
| 97.5% Chebyshev(Mean, Sd) UCL | 25.23 | 99% Chebyshev(Mean, Sd) UCL | 27.66 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 22.22 | | |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 72 | Number of Distinct Observations | 58 |
| | | Number of Missing Observations | 0 |
| Minimum | 86 | Mean | 232.6 |
| Maximum | 315 | Median | 239.5 |
| SD | 48.59 | Std. Error of Mean | 5.726 |
| Coefficient of Variation | 0.209 | Skewness | -0.854 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.00668 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.103 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 242.1 | 95% Adjusted-CLT UCL (Chen-1995) | 241.4 |
| | | 95% Modified-t UCL (Johnson-1978) | 242 |

| | | | |
|---|---|---|---|
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 1.785 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.132 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.105 | Data Not Gamma Distributed at 5% Significance Level | |
| **Data Not Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 18.68 | k star (bias corrected MLE) | 17.91 |
| Theta hat (MLE) | 12.45 | Theta star (bias corrected MLE) | 12.99 |
| nu hat (MLE) | 2689 | nu star (bias corrected) | 2579 |
| MLE Mean (bias corrected) | 232.6 | MLE Sd (bias corrected) | 54.96 |
| | | Approximate Chi Square Value (0.05) | 2462 |
| Adjusted Level of Significance | 0.0467 | Adjusted Chi Square Value | 2459 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 243.6 | 95% Adjusted Gamma UCL (use when n<50) | 243.9 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.851 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk P Value | 8.378E-10 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.143 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.104 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 4.454 | Mean of logged Data | 5.422 |
| Maximum of Logged Data | 5.753 | SD of logged Data | 0.251 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 245.9 | 90% Chebyshev (MVUE) UCL | 254.5 |
| 95% Chebyshev (MVUE) UCL | 264 | 97.5% Chebyshev (MVUE) UCL | 277.1 |
| 99% Chebyshev (MVUE) UCL | 303 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 242 | 95% Jackknife UCL | 242.1 |
| 95% Standard Bootstrap UCL | 242 | 95% Bootstrap-t UCL | 241.9 |
| 95% Hall's Bootstrap UCL | 241.7 | 95% Percentile Bootstrap UCL | 241.7 |
| 95% BCA Bootstrap UCL | 241.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 249.8 | 95% Chebyshev(Mean, Sd) UCL | 257.5 |
| 97.5% Chebyshev(Mean, Sd) UCL | 268.3 | 99% Chebyshev(Mean, Sd) UCL | 289.6 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 242.1 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

**Zinc**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 72 | Number of Distinct Observations | 51 |
| | | Number of Missing Observations | 0 |
| Minimum | 37 | Mean | 89.53 |
| Maximum | 182 | Median | 85.5 |
| SD | 29.88 | Std. Error of Mean | 3.521 |
| Coefficient of Variation | 0.334 | Skewness | 0.494 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.967 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk P Value | 0.177 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0894 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 95.4 | 95% Adjusted-CLT UCL (Chen-1995) | 95.54 |
| | | 95% Modified-t UCL (Johnson-1978) | 95.43 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.379 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0625 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.105 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 8.89 | k star (bias corrected MLE) | 8.528 |
| Theta hat (MLE) | 10.07 | Theta star (bias corrected MLE) | 10.5 |
| nu hat (MLE) | 1280 | nu star (bias corrected) | 1228 |
| MLE Mean (bias corrected) | 89.53 | MLE Sd (bias corrected) | 30.66 |
| | | Approximate Chi Square Value (0.05) | 1148 |
| Adjusted Level of Significance | 0.0467 | Adjusted Chi Square Value | 1146 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 95.8 | 95% Adjusted Gamma UCL (use when n<50) | 95.93 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk P Value | 0.214 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.074 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.104 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 649 | **Lognormal Statistics** | | | |
| 650 | Minimum of Logged Data | 3.611 | Mean of logged Data | 4.437 |
| 651 | Maximum of Logged Data | 5.204 | SD of logged Data | 0.348 |
| 652 | | | | |
| 653 | **Assuming Lognormal Distribution** | | | |
| 654 | 95% H-UCL | 96.64 | 90% Chebyshev (MVUE) UCL | 101.1 |
| 655 | 95% Chebyshev (MVUE) UCL | 106.2 | 97.5% Chebyshev (MVUE) UCL | 113.4 |
| 656 | 99% Chebyshev (MVUE) UCL | 127.4 | | |
| 657 | | | | |
| 658 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 659 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 660 | | | | |
| 661 | **Nonparametric Distribution Free UCLs** | | | |
| 662 | 95% CLT UCL | 95.32 | 95% Jackknife UCL | 95.4 |
| 663 | 95% Standard Bootstrap UCL | 95.35 | 95% Bootstrap-t UCL | 95.55 |
| 664 | 95% Hall's Bootstrap UCL | 95.68 | 95% Percentile Bootstrap UCL | 95.11 |
| 665 | 95% BCA Bootstrap UCL | 95.21 | | |
| 666 | 90% Chebyshev(Mean, Sd) UCL | 100.1 | 95% Chebyshev(Mean, Sd) UCL | 104.9 |
| 667 | 97.5% Chebyshev(Mean, Sd) UCL | 111.5 | 99% Chebyshev(Mean, Sd) UCL | 124.6 |
| 668 | | | | |
| 669 | **Suggested UCL to Use** | | | |
| 670 | 95% Student's-t UCL | 95.4 | | |
| 671 | | | | |
| 672 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 673 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 674 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 675 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 676 | | | | |

## UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.12/11/2021 11:49:57 AM |
| From File | UCL UTL concentrations USFS Big Blue_c.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

**Arsenic**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 25 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 0 |
| Minimum | 13 | Mean | 435 |
| Maximum | 2183 | Median | 230 |
| SD | 497.7 | Std. Error of Mean | 99.54 |
| Coefficient of Variation | 1.144 | Skewness | 2.228 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.739 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.918 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.225 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.173 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

### Assuming Normal Distribution

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 605.3 | 95% Adjusted-CLT UCL (Chen-1995) | 646.1 |
| | | 95% Modified-t UCL (Johnson-1978) | 612.7 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.443 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.772 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.139 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.179 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.061 | k star (bias corrected MLE) | 0.96 |
| Theta hat (MLE) | 410 | Theta star (bias corrected MLE) | 452.9 |
| nu hat (MLE) | 53.05 | nu star (bias corrected) | 48.02 |
| MLE Mean (bias corrected) | 435 | MLE Sd (bias corrected) | 443.9 |
| | | Approximate Chi Square Value (0.05) | 33.12 |
| Adjusted Level of Significance | 0.0395 | Adjusted Chi Square Value | 32.27 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 630.8 | 95% Adjusted Gamma UCL (use when n<50) | 647.3 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.918 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0921 | **Lilliefors Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.173 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.565 | Mean of logged Data | 5.535 |
| Maximum of Logged Data | 7.688 | SD of logged Data | 1.12 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 869.1 | 90% Chebyshev (MVUE) UCL | 812.5 |
| 95% Chebyshev (MVUE) UCL | 973.8 | 97.5% Chebyshev (MVUE) UCL | 1198 |
| 99% Chebyshev (MVUE) UCL | 1637 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 598.7 | 95% Jackknife UCL | 605.3 |
| 95% Standard Bootstrap UCL | 593.4 | 95% Bootstrap-t UCL | 718 |
| 95% Hall's Bootstrap UCL | 726.9 | 95% Percentile Bootstrap UCL | 612.7 |
| 95% BCA Bootstrap UCL | 661.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 733.6 | 95% Chebyshev(Mean, Sd) UCL | 868.9 |
| 97.5% Chebyshev(Mean, Sd) UCL | 1057 | 99% Chebyshev(Mean, Sd) UCL | 1425 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 647.3 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 11 |
| Minimum | 22 | Mean | 32.54 |
| Maximum | 49 | Median | 29 |
| SD | 8.695 | Std. Error of Mean | 2.412 |
| Coefficient of Variation | 0.267 | Skewness | 0.819 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.896 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.196 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 36.84 | 95% Adjusted-CLT UCL (Chen-1995) | 37.09 |
| | | 95% Modified-t UCL (Johnson-1978) | 36.93 |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 109 | **Gamma GOF Test** | | | |
| 110 | A-D Test Statistic | 0.5 | **Anderson-Darling Gamma GOF Test** | |
| 111 | 5% A-D Critical Value | 0.733 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 112 | K-S Test Statistic | 0.184 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 113 | 5% K-S Critical Value | 0.236 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 114 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 115 | | | | |
| 116 | **Gamma Statistics** | | | |
| 117 | k hat (MLE) | 16.38 | k star (bias corrected MLE) | 12.65 |
| 118 | Theta hat (MLE) | 1.987 | Theta star (bias corrected MLE) | 2.572 |
| 119 | nu hat (MLE) | 425.8 | nu star (bias corrected) | 328.9 |
| 120 | MLE Mean (bias corrected) | 32.54 | MLE Sd (bias corrected) | 9.149 |
| 121 | | | Approximate Chi Square Value (0.05) | 287.9 |
| 122 | Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 282.4 |
| 123 | | | | |
| 124 | **Assuming Gamma Distribution** | | | |
| 125 | 95% Approximate Gamma UCL (use when n>=50)) | 37.18 | 95% Adjusted Gamma UCL (use when n<50) | 37.89 |
| 126 | | | | |
| 127 | **Lognormal GOF Test** | | | |
| 128 | Shapiro Wilk Test Statistic | 0.933 | **Shapiro Wilk Lognormal GOF Test** | |
| 129 | 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level | |
| 130 | Lilliefors Test Statistic | 0.168 | **Lilliefors Lognormal GOF Test** | |
| 131 | 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level | |
| 132 | **Data appear Lognormal at 5% Significance Level** | | | |
| 133 | | | | |
| 134 | **Lognormal Statistics** | | | |
| 135 | Minimum of Logged Data | 3.091 | Mean of logged Data | 3.452 |
| 136 | Maximum of Logged Data | 3.892 | SD of logged Data | 0.254 |
| 137 | | | | |
| 138 | **Assuming Lognormal Distribution** | | | |
| 139 | 95% H-UCL | 37.39 | 90% Chebyshev (MVUE) UCL | 39.44 |
| 140 | 95% Chebyshev (MVUE) UCL | 42.58 | 97.5% Chebyshev (MVUE) UCL | 46.94 |
| 141 | 99% Chebyshev (MVUE) UCL | 55.5 | | |
| 142 | | | | |
| 143 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 144 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 145 | | | | |
| 146 | **Nonparametric Distribution Free UCLs** | | | |
| 147 | 95% CLT UCL | 36.51 | 95% Jackknife UCL | 36.84 |
| 148 | 95% Standard Bootstrap UCL | 36.23 | 95% Bootstrap-t UCL | 37.7 |
| 149 | 95% Hall's Bootstrap UCL | 36.86 | 95% Percentile Bootstrap UCL | 36.46 |
| 150 | 95% BCA Bootstrap UCL | 36.92 | | |
| 151 | 90% Chebyshev(Mean, Sd) UCL | 39.77 | 95% Chebyshev(Mean, Sd) UCL | 43.05 |
| 152 | 97.5% Chebyshev(Mean, Sd) UCL | 47.6 | 99% Chebyshev(Mean, Sd) UCL | 56.53 |
| 153 | | | | |
| 154 | **Suggested UCL to Use** | | | |
| 155 | 95% Student's-t UCL | 36.84 | | |
| 156 | | | | |
| 157 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 158 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 159 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 160 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 161 | | | | |
| 162 | | | | |

Copper

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 25 | Number of Distinct Observations | 19 |
| | | Number of Missing Observations | 0 |
| Minimum | 11 | Mean | 30.16 |
| Maximum | 88 | Median | 23 |
| SD | 19.18 | Std. Error of Mean | 3.836 |
| Coefficient of Variation | 0.636 | Skewness | 1.847 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.79 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.918 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.206 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.173 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 36.72 | 95% Adjusted-CLT UCL (Chen-1995) | 37.98 |
| | | 95% Modified-t UCL (Johnson-1978) | 36.96 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.775 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.75 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.163 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.176 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data follow Appr. Gamma Distribution at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 3.503 | k star (bias corrected MLE) | 3.109 |
| Theta hat (MLE) | 8.609 | Theta star (bias corrected MLE) | 9.7 |
| nu hat (MLE) | 175.2 | nu star (bias corrected) | 155.5 |
| MLE Mean (bias corrected) | 30.16 | MLE Sd (bias corrected) | 17.1 |
| | | Approximate Chi Square Value (0.05) | 127.6 |
| Adjusted Level of Significance | 0.0395 | Adjusted Chi Square Value | 125.9 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 36.73 | 95% Adjusted Gamma UCL (use when n<50) | 37.24 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.918 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.129 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.173 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.398 | Mean of logged Data | 3.257 |
| Maximum of Logged Data | 4.477 | SD of logged Data | 0.533 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 37.15 | 90% Chebyshev (MVUE) UCL | 39.69 |
| 95% Chebyshev (MVUE) UCL | 44.19 | 97.5% Chebyshev (MVUE) UCL | 50.44 |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 217 | 99% Chebyshev (MVUE) UCL | 62.73 | | |
| 218 | | | | |
| 219 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 220 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 221 | | | | |
| 222 | **Nonparametric Distribution Free UCLs** | | | |
| 223 | 95% CLT UCL | 36.47 | 95% Jackknife UCL | 36.72 |
| 224 | 95% Standard Bootstrap UCL | 36.29 | 95% Bootstrap-t UCL | 39.27 |
| 225 | 95% Hall's Bootstrap UCL | 41.51 | 95% Percentile Bootstrap UCL | 36.36 |
| 226 | 95% BCA Bootstrap UCL | 37.8 | | |
| 227 | 90% Chebyshev(Mean, Sd) UCL | 41.67 | 95% Chebyshev(Mean, Sd) UCL | 46.88 |
| 228 | 97.5% Chebyshev(Mean, Sd) UCL | 54.11 | 99% Chebyshev(Mean, Sd) UCL | 68.32 |
| 229 | | | | |
| 230 | **Suggested UCL to Use** | | | |
| 231 | 95% Adjusted Gamma UCL | 37.24 | | |
| 232 | | | | |
| 233 | When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| 234 | When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| 235 | | | | |
| 236 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 237 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 238 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 239 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 240 | | | | |
| 241 | | | | |
| 242 | Lead | | | |
| 243 | | | | |
| 244 | **General Statistics** | | | |
| 245 | Total Number of Observations | 25 | Number of Distinct Observations | 23 |
| 246 | | | Number of Missing Observations | 0 |
| 247 | Minimum | 12 | Mean | 107.7 |
| 248 | Maximum | 435 | Median | 70 |
| 249 | SD | 104.9 | Std. Error of Mean | 20.99 |
| 250 | Coefficient of Variation | 0.974 | Skewness | 1.699 |
| 251 | | | | |
| 252 | **Normal GOF Test** | | | |
| 253 | Shapiro Wilk Test Statistic | 0.803 | **Shapiro Wilk GOF Test** | |
| 254 | 5% Shapiro Wilk Critical Value | 0.918 | Data Not Normal at 5% Significance Level | |
| 255 | Lilliefors Test Statistic | 0.216 | **Lilliefors GOF Test** | |
| 256 | 5% Lilliefors Critical Value | 0.173 | Data Not Normal at 5% Significance Level | |
| 257 | **Data Not Normal at 5% Significance Level** | | | |
| 258 | | | | |
| 259 | **Assuming Normal Distribution** | | | |
| 260 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 261 | 95% Student's-t UCL | 143.6 | 95% Adjusted-CLT UCL (Chen-1995) | 149.9 |
| 262 | | | 95% Modified-t UCL (Johnson-1978) | 144.8 |
| 263 | | | | |
| 264 | **Gamma GOF Test** | | | |
| 265 | A-D Test Statistic | 0.417 | **Anderson-Darling Gamma GOF Test** | |
| 266 | 5% A-D Critical Value | 0.766 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 267 | K-S Test Statistic | 0.104 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 268 | 5% K-S Critical Value | 0.178 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 269 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 270 | | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 271 | **Gamma Statistics** | | | |
| 272 | k hat (MLE) | 1.3 | k star (bias corrected MLE) | 1.171 |
| 273 | Theta hat (MLE) | 82.83 | Theta star (bias corrected MLE) | 91.98 |
| 274 | nu hat (MLE) | 65.02 | nu star (bias corrected) | 58.55 |
| 275 | MLE Mean (bias corrected) | 107.7 | MLE Sd (bias corrected) | 99.54 |
| 276 | | | Approximate Chi Square Value (0.05) | 41.96 |
| 277 | Adjusted Level of Significance | 0.0395 | Adjusted Chi Square Value | 41 |
| 278 | | | | |
| 279 | **Assuming Gamma Distribution** | | | |
| 280 | 95% Approximate Gamma UCL (use when n>=50) | 150.3 | 95% Adjusted Gamma UCL (use when n<50) | 153.8 |
| 281 | | | | |
| 282 | **Lognormal GOF Test** | | | |
| 283 | Shapiro Wilk Test Statistic | 0.97 | **Shapiro Wilk Lognormal GOF Test** | |
| 284 | 5% Shapiro Wilk Critical Value | 0.918 | Data appear Lognormal at 5% Significance Level | |
| 285 | Lilliefors Test Statistic | 0.104 | **Lilliefors Lognormal GOF Test** | |
| 286 | 5% Lilliefors Critical Value | 0.173 | Data appear Lognormal at 5% Significance Level | |
| 287 | **Data appear Lognormal at 5% Significance Level** | | | |
| 288 | | | | |
| 289 | **Lognormal Statistics** | | | |
| 290 | Minimum of Logged Data | 2.485 | Mean of logged Data | 4.248 |
| 291 | Maximum of Logged Data | 6.075 | SD of logged Data | 0.976 |
| 292 | | | | |
| 293 | **Assuming Lognormal Distribution** | | | |
| 294 | 95% H-UCL | 184 | 90% Chebyshev (MVUE) UCL | 182.3 |
| 295 | 95% Chebyshev (MVUE) UCL | 215.2 | 97.5% Chebyshev (MVUE) UCL | 260.9 |
| 296 | 99% Chebyshev (MVUE) UCL | 350.6 | | |
| 297 | | | | |
| 298 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 299 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 300 | | | | |
| 301 | **Nonparametric Distribution Free UCLs** | | | |
| 302 | 95% CLT UCL | 142.2 | 95% Jackknife UCL | 143.6 |
| 303 | 95% Standard Bootstrap UCL | 141.8 | 95% Bootstrap-t UCL | 155.2 |
| 304 | 95% Hall's Bootstrap UCL | 155.5 | 95% Percentile Bootstrap UCL | 142.2 |
| 305 | 95% BCA Bootstrap UCL | 150.6 | | |
| 306 | 90% Chebyshev(Mean, Sd) UCL | 170.7 | 95% Chebyshev(Mean, Sd) UCL | 199.2 |
| 307 | 97.5% Chebyshev(Mean, Sd) UCL | 238.8 | 99% Chebyshev(Mean, Sd) UCL | 316.5 |
| 308 | | | | |
| 309 | **Suggested UCL to Use** | | | |
| 310 | 95% Adjusted Gamma UCL | 153.8 | | |
| 311 | | | | |
| 312 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 313 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 314 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 315 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 316 | | | | |
| 317 | | | | |
| 318 | **Mercury** | | | |
| 319 | | | | |
| 320 | **General Statistics** | | | |
| 321 | Total Number of Observations | 17 | Number of Distinct Observations | 10 |
| 322 | | | Number of Missing Observations | 6 |
| 323 | Minimum | 3 | Mean | 13 |
| 324 | Maximum | 76 | Median | 6 |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 325 | SD | 19.27 | Std. Error of Mean | 4.675 |
| 326 | Coefficient of Variation | 1.483 | Skewness | 2.8 |
| 327 | | | | |
| 328 | **Normal GOF Test** | | | |
| 329 | Shapiro Wilk Test Statistic | 0.531 | **Shapiro Wilk GOF Test** | |
| 330 | 5% Shapiro Wilk Critical Value | 0.892 | Data Not Normal at 5% Significance Level | |
| 331 | Lilliefors Test Statistic | 0.385 | **Lilliefors GOF Test** | |
| 332 | 5% Lilliefors Critical Value | 0.207 | Data Not Normal at 5% Significance Level | |
| 333 | **Data Not Normal at 5% Significance Level** | | | |
| 334 | | | | |
| 335 | **Assuming Normal Distribution** | | | |
| 336 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 337 | 95% Student's-t UCL | 21.16 | 95% Adjusted-CLT UCL (Chen-1995) | 24.08 |
| 338 | | | 95% Modified-t UCL (Johnson-1978) | 21.69 |
| 339 | | | | |
| 340 | **Gamma GOF Test** | | | |
| 341 | A-D Test Statistic | 2.194 | **Anderson-Darling Gamma GOF Test** | |
| 342 | 5% A-D Critical Value | 0.764 | Data Not Gamma Distributed at 5% Significance Level | |
| 343 | K-S Test Statistic | 0.319 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 344 | 5% K-S Critical Value | 0.215 | Data Not Gamma Distributed at 5% Significance Level | |
| 345 | **Data Not Gamma Distributed at 5% Significance Level** | | | |
| 346 | | | | |
| 347 | **Gamma Statistics** | | | |
| 348 | k hat (MLE) | 1.09 | k star (bias corrected MLE) | 0.937 |
| 349 | Theta hat (MLE) | 11.92 | Theta star (bias corrected MLE) | 13.87 |
| 350 | nu hat (MLE) | 37.07 | nu star (bias corrected) | 31.86 |
| 351 | MLE Mean (bias corrected) | 13 | MLE Sd (bias corrected) | 13.43 |
| 352 | | | Approximate Chi Square Value (0.05) | 19.96 |
| 353 | Adjusted Level of Significance | 0.0346 | Adjusted Chi Square Value | 18.98 |
| 354 | | | | |
| 355 | **Assuming Gamma Distribution** | | | |
| 356 | 95% Approximate Gamma UCL (use when n>=50)) | 20.75 | 95% Adjusted Gamma UCL (use when n<50) | 21.83 |
| 357 | | | | |
| 358 | **Lognormal GOF Test** | | | |
| 359 | Shapiro Wilk Test Statistic | 0.804 | **Shapiro Wilk Lognormal GOF Test** | |
| 360 | 5% Shapiro Wilk Critical Value | 0.892 | Data Not Lognormal at 5% Significance Level | |
| 361 | Lilliefors Test Statistic | 0.247 | **Lilliefors Lognormal GOF Test** | |
| 362 | 5% Lilliefors Critical Value | 0.207 | Data Not Lognormal at 5% Significance Level | |
| 363 | **Data Not Lognormal at 5% Significance Level** | | | |
| 364 | | | | |
| 365 | **Lognormal Statistics** | | | |
| 366 | Minimum of Logged Data | 1.099 | Mean of logged Data | 2.041 |
| 367 | Maximum of Logged Data | 4.331 | SD of logged Data | 0.887 |
| 368 | | | | |
| 369 | **Assuming Lognormal Distribution** | | | |
| 370 | 95% H-UCL | 19.83 | 90% Chebyshev (MVUE) UCL | 18.82 |
| 371 | 95% Chebyshev (MVUE) UCL | 22.34 | 97.5% Chebyshev (MVUE) UCL | 27.22 |
| 372 | 99% Chebyshev (MVUE) UCL | 36.8 | | |
| 373 | | | | |
| 374 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 375 | **Data do not follow a Discernible Distribution (0.05)** | | | |
| 376 | | | | |
| 377 | **Nonparametric Distribution Free UCLs** | | | |
| 378 | 95% CLT UCL | 20.69 | 95% Jackknife UCL | 21.16 |

| | | | |
|---|---|---|---|
| 95% Standard Bootstrap UCL | 20.53 | 95% Bootstrap-t UCL | 50.79 |
| 95% Hall's Bootstrap UCL | 51.56 | 95% Percentile Bootstrap UCL | 21.18 |
| 95% BCA Bootstrap UCL | 24.71 | | |
| 90% Chebyshev(Mean, Sd) UCL | 27.02 | 95% Chebyshev(Mean, Sd) UCL | 33.38 |
| 97.5% Chebyshev(Mean, Sd) UCL | 42.19 | 99% Chebyshev(Mean, Sd) UCL | 59.51 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Chebyshev (Mean, Sd) UCL | 33.38 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Molybdenum**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 16 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 9 |
| Minimum | 4 | Mean | 7.313 |
| Maximum | 13 | Median | 5.5 |
| SD | 3.341 | Std. Error of Mean | 0.835 |
| Coefficient of Variation | 0.457 | Skewness | 0.706 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.824 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.256 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 8.777 | 95% Adjusted-CLT UCL (Chen-1995) | 8.844 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.801 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.042 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.741 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.257 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.216 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.543 | k star (bias corrected MLE) | 4.545 |
| Theta hat (MLE) | 1.319 | Theta star (bias corrected MLE) | 1.609 |
| nu hat (MLE) | 177.4 | nu star (bias corrected) | 145.4 |
| MLE Mean (bias corrected) | 7.313 | MLE Sd (bias corrected) | 3.43 |
| | | Approximate Chi Square Value (0.05) | 118.6 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 115.8 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 8.97 | 95% Adjusted Gamma UCL (use when n<50) | 9.183 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.861 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.244 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data Not Lognormal at 5% Significance Level | |

**Data Not Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.386 | Mean of logged Data | 1.897 |
| Maximum of Logged Data | 2.565 | SD of logged Data | 0.439 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 9.192 | 90% Chebyshev (MVUE) UCL | 9.748 |
| 95% Chebyshev (MVUE) UCL | 10.86 | 97.5% Chebyshev (MVUE) UCL | 12.41 |
| 99% Chebyshev (MVUE) UCL | 15.44 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 8.686 | 95% Jackknife UCL | 8.777 |
| 95% Standard Bootstrap UCL | 8.641 | 95% Bootstrap-t UCL | 8.955 |
| 95% Hall's Bootstrap UCL | 8.61 | 95% Percentile Bootstrap UCL | 8.75 |
| 95% BCA Bootstrap UCL | 8.813 | | |
| 90% Chebyshev(Mean, Sd) UCL | 9.818 | 95% Chebyshev(Mean, Sd) UCL | 10.95 |
| 97.5% Chebyshev(Mean, Sd) UCL | 12.53 | 99% Chebyshev(Mean, Sd) UCL | 15.62 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 8.777 | or 95% Modified-t UCL | 8.801 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 24 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 1 |
| Minimum | 15 | Mean | 20.25 |
| Maximum | 32 | Median | 19.5 |
| SD | 4.255 | Std. Error of Mean | 0.869 |
| Coefficient of Variation | 0.21 | Skewness | 1.569 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.843 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.916 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.174 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.177 | Data appear Normal at 5% Significance Level | |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 21.74 | 95% Adjusted-CLT UCL (Chen-1995) | 21.98 |
| | | 95% Modified-t UCL (Johnson-1978) | 21.79 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.83 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.742 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.163 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.177 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 27.25 | k star (bias corrected MLE) | 23.87 |
| Theta hat (MLE) | 0.743 | Theta star (bias corrected MLE) | 0.848 |
| nu hat (MLE) | 1308 | nu star (bias corrected) | 1146 |
| MLE Mean (bias corrected) | 20.25 | MLE Sd (bias corrected) | 4.145 |
| | | Approximate Chi Square Value (0.05) | 1068 |
| Adjusted Level of Significance | 0.0392 | Adjusted Chi Square Value | 1063 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 21.72 | 95% Adjusted Gamma UCL (use when n<50) | 21.83 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.912 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.916 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.157 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.177 | Data appear Lognormal at 5% Significance Level | |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.708 | Mean of logged Data | 2.99 |
| Maximum of Logged Data | 3.466 | SD of logged Data | 0.19 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 21.71 | 90% Chebyshev (MVUE) UCL | 22.6 |
| 95% Chebyshev (MVUE) UCL | 23.67 | 97.5% Chebyshev (MVUE) UCL | 25.17 |
| 99% Chebyshev (MVUE) UCL | 28.09 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 21.68 | 95% Jackknife UCL | 21.74 |
| 95% Standard Bootstrap UCL | 21.66 | 95% Bootstrap-t UCL | 22.26 |
| 95% Hall's Bootstrap UCL | 23.06 | 95% Percentile Bootstrap UCL | 21.63 |
| 95% BCA Bootstrap UCL | 22.04 | | |
| 90% Chebyshev(Mean, Sd) UCL | 22.86 | 95% Chebyshev(Mean, Sd) UCL | 24.04 |
| 97.5% Chebyshev(Mean, Sd) UCL | 25.67 | 99% Chebyshev(Mean, Sd) UCL | 28.89 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 21.74 | | |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Vanadium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 25 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 0 |
| Minimum | 142 | Mean | 218 |
| Maximum | 316 | Median | 217 |
| SD | 50.71 | Std. Error of Mean | 10.14 |
| Coefficient of Variation | 0.233 | Skewness | 0.213 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.96 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.918 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0989 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.173 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 235.3 | 95% Adjusted-CLT UCL (Chen-1995) | 235.1 |
| | | 95% Modified-t UCL (Johnson-1978) | 235.4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.289 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.0943 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.174 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 18.99 | k star (bias corrected MLE) | 16.74 |
| Theta hat (MLE) | 11.48 | Theta star (bias corrected MLE) | 13.02 |
| nu hat (MLE) | 949.5 | nu star (bias corrected) | 836.9 |
| MLE Mean (bias corrected) | 218 | MLE Sd (bias corrected) | 53.27 |
| | | Approximate Chi Square Value (0.05) | 770.8 |
| Adjusted Level of Significance | 0.0395 | Adjusted Chi Square Value | 766.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 236.7 | 95% Adjusted Gamma UCL (use when n<50) | 238 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.918 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0987 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.173 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.956 | Mean of logged Data | 5.358 |
| Maximum of Logged Data | 5.756 | SD of logged Data | 0.237 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 237.9 | 90% Chebyshev (MVUE) UCL | 249.4 |
| 95% Chebyshev (MVUE) UCL | 263.5 | 97.5% Chebyshev (MVUE) UCL | 283.2 |
| 99% Chebyshev (MVUE) UCL | 321.9 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 234.6 | 95% Jackknife UCL | 235.3 |
| 95% Standard Bootstrap UCL | 234 | 95% Bootstrap-t UCL | 235.8 |
| 95% Hall's Bootstrap UCL | 234.3 | 95% Percentile Bootstrap UCL | 234.7 |
| 95% BCA Bootstrap UCL | 235.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 248.4 | 95% Chebyshev(Mean, Sd) UCL | 262.2 |
| 97.5% Chebyshev(Mean, Sd) UCL | 281.3 | 99% Chebyshev(Mean, Sd) UCL | 318.9 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 235.3 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Zinc**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 25 | Number of Distinct Observations | 25 |
| | | Number of Missing Observations | 0 |
| Minimum | 63 | Mean | 139.4 |
| Maximum | 273 | Median | 135 |
| SD | 52.87 | Std. Error of Mean | 10.57 |
| Coefficient of Variation | 0.379 | Skewness | 1.003 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.914 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.918 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.138 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.173 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 157.5 | 95% Adjusted-CLT UCL (Chen-1995) | 159 |
| | | 95% Modified-t UCL (Johnson-1978) | 157.8 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.309 | **Anderson-Darling Gamma GOF Test** |

| | | | |
|---|---|---|---|
| 5% A-D Critical Value | 0.746 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.119 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.175 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 7.764 | k star (bias corrected MLE) | 6.859 |
| Theta hat (MLE) | 17.95 | Theta star (bias corrected MLE) | 20.32 |
| nu hat (MLE) | 388.2 | nu star (bias corrected) | 342.9 |
| MLE Mean (bias corrected) | 139.4 | MLE Sd (bias corrected) | 53.21 |
| | | Approximate Chi Square Value (0.05) | 301 |
| Adjusted Level of Significance | 0.0395 | Adjusted Chi Square Value | 298.4 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 158.8 | 95% Adjusted Gamma UCL (use when n<50) | 160.2 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.918 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.1 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.173 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 4.143 | Mean of logged Data | 4.871 |
| Maximum of Logged Data | 5.609 | SD of logged Data | 0.37 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 160.8 | 90% Chebyshev (MVUE) UCL | 171 |
| 95% Chebyshev (MVUE) UCL | 185.3 | 97.5% Chebyshev (MVUE) UCL | 205.3 |
| 99% Chebyshev (MVUE) UCL | 244.4 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 156.8 | 95% Jackknife UCL | 157.5 |
| 95% Standard Bootstrap UCL | 156.5 | 95% Bootstrap-t UCL | 161.5 |
| 95% Hall's Bootstrap UCL | 162.6 | 95% Percentile Bootstrap UCL | 156.2 |
| 95% BCA Bootstrap UCL | 159.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 171.1 | 95% Chebyshev(Mean, Sd) UCL | 185.4 |
| 97.5% Chebyshev(Mean, Sd) UCL | 205.4 | 99% Chebyshev(Mean, Sd) UCL | 244.6 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 157.5 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | UCL Statistics for Uncensored Full Data Sets | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 | Date/Time of Computation | | | ProUCL 5.12/11/2021 11:51:10 AM | | | | | | | | |
| 5 | From File | | | UCL UTL concentrations USFS Big Blue_d.xls | | | | | | | | |
| 6 | Full Precision | | | OFF | | | | | | | | |
| 7 | Confidence Coefficient | | | 95% | | | | | | | | |
| 8 | Number of Bootstrap Operations | | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | Antimony | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | General Statistics | | | | | | | | | | | |
| 14 | Total Number of Observations | | | | | 7 | Number of Distinct Observations | | | | | 7 |
| 15 | | | | | | | Number of Missing Observations | | | | | 8 |
| 16 | Minimum | | | | | 23 | Mean | | | | | 1538 |
| 17 | Maximum | | | | | 8764 | Median | | | | | 224 |
| 18 | SD | | | | | 3211 | Std. Error of Mean | | | | | 1214 |
| 19 | Coefficient of Variation | | | | | 2.087 | Skewness | | | | | 2.565 |
| 20 | | | | | | | | | | | | |
| 21 | **Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use** | | | | | | | | | | | |
| 22 | **guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.** | | | | | | | | | | | |
| 23 | **For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).** | | | | | | | | | | | |
| 24 | **Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1** | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 26 | **Normal GOF Test** | | | | | | | | | | | |
| 27 | Shapiro Wilk Test Statistic | | | | | 0.55 | **Shapiro Wilk GOF Test** | | | | | |
| 28 | 5% Shapiro Wilk Critical Value | | | | | 0.803 | Data Not Normal at 5% Significance Level | | | | | |
| 29 | Lilliefors Test Statistic | | | | | 0.403 | **Lilliefors GOF Test** | | | | | |
| 30 | 5% Lilliefors Critical Value | | | | | 0.304 | Data Not Normal at 5% Significance Level | | | | | |
| 31 | **Data Not Normal at 5% Significance Level** | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | **Assuming Normal Distribution** | | | | | | | | | | | |
| 34 | **95% Normal UCL** | | | | | | **95% UCLs (Adjusted for Skewness)** | | | | | |
| 35 | 95% Student's-t UCL | | | | | 3897 | 95% Adjusted-CLT UCL (Chen-1995) | | | | | 4792 |
| 36 | | | | | | | 95% Modified-t UCL (Johnson-1978) | | | | | 4093 |
| 37 | | | | | | | | | | | | |
| 38 | **Gamma GOF Test** | | | | | | | | | | | |
| 39 | A-D Test Statistic | | | | | 0.536 | **Anderson-Darling Gamma GOF Test** | | | | | |
| 40 | 5% A-D Critical Value | | | | | 0.771 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 41 | K-S Test Statistic | | | | | 0.253 | **Kolmogorov-Smirnov Gamma GOF Test** | | | | | |
| 42 | 5% K-S Critical Value | | | | | 0.332 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 43 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | | | | | | | | | |
| 44 | | | | | | | | | | | | |
| 45 | **Gamma Statistics** | | | | | | | | | | | |
| 46 | k hat (MLE) | | | | | 0.378 | k star (bias corrected MLE) | | | | | 0.311 |
| 47 | Theta hat (MLE) | | | | | 4069 | Theta star (bias corrected MLE) | | | | | 4942 |
| 48 | nu hat (MLE) | | | | | 5.293 | nu star (bias corrected) | | | | | 4.358 |
| 49 | MLE Mean (bias corrected) | | | | | 1538 | MLE Sd (bias corrected) | | | | | 2757 |
| 50 | | | | | | | Approximate Chi Square Value (0.05) | | | | | 0.868 |
| 51 | Adjusted Level of Significance | | | | | 0.0158 | Adjusted Chi Square Value | | | | | 0.495 |
| 52 | | | | | | | | | | | | |
| 53 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 54 | 95% Approximate Gamma UCL (use when n>=50) | | | | | 7724 | 95% Adjusted Gamma UCL (use when n<50) | | | | | 13537 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.956 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.139 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.135 | Mean of logged Data | 5.582 |
| Maximum of Logged Data | 9.078 | SD of logged Data | 2.073 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 836867 | 90% Chebyshev (MVUE) UCL | 3931 |
| 95% Chebyshev (MVUE) UCL | 5145 | 97.5% Chebyshev (MVUE) UCL | 6830 |
| 99% Chebyshev (MVUE) UCL | 10140 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 3535 | 95% Jackknife UCL | 3897 |
| 95% Standard Bootstrap UCL | 3378 | 95% Bootstrap-t UCL | 32057 |
| 95% Hall's Bootstrap UCL | 15636 | 95% Percentile Bootstrap UCL | 3859 |
| 95% BCA Bootstrap UCL | 5228 | | |
| 90% Chebyshev(Mean, Sd) UCL | 5179 | 95% Chebyshev(Mean, Sd) UCL | 6828 |
| 97.5% Chebyshev(Mean, Sd) UCL | 9117 | 99% Chebyshev(Mean, Sd) UCL | 13613 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 13537 | | |

**Recommended UCL exceeds the maximum observation**

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 15 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 35 | Mean | 2003 |
| Maximum | 10929 | Median | 364 |
| SD | 3371 | Std. Error of Mean | 870.4 |
| Coefficient of Variation | 1.683 | Skewness | 1.969 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.634 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.392 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.22 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 3536 | 95% Adjusted-CLT UCL (Chen-1995) | 3908 |
| | | 95% Modified-t UCL (Johnson-1978) | 3610 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 1.206 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.795 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.305 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.234 | Data Not Gamma Distributed at 5% Significance Level | |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.489 | k star (bias corrected MLE) | 0.436 |
| Theta hat (MLE) | 4094 | Theta star (bias corrected MLE) | 4596 |
| nu hat (MLE) | 14.68 | nu star (bias corrected) | 13.08 |
| MLE Mean (bias corrected) | 2003 | MLE Sd (bias corrected) | 3034 |
| | | Approximate Chi Square Value (0.05) | 5.943 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 5.362 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4407 | 95% Adjusted Gamma UCL (use when n<50) | 4885 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.924 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.201 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.555 | Mean of logged Data | 6.3 |
| Maximum of Logged Data | 9.299 | SD of logged Data | 1.671 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 12731 | 90% Chebyshev (MVUE) UCL | 4558 |
| 95% Chebyshev (MVUE) UCL | 5792 | 97.5% Chebyshev (MVUE) UCL | 7505 |
| 99% Chebyshev (MVUE) UCL | 10871 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 3435 | 95% Jackknife UCL | 3536 |
| 95% Standard Bootstrap UCL | 3342 | 95% Bootstrap-t UCL | 5258 |
| 95% Hall's Bootstrap UCL | 4139 | 95% Percentile Bootstrap UCL | 3492 |
| 95% BCA Bootstrap UCL | 3982 | | |
| 90% Chebyshev(Mean, Sd) UCL | 4614 | 95% Chebyshev(Mean, Sd) UCL | 5797 |
| 97.5% Chebyshev(Mean, Sd) UCL | 7439 | 99% Chebyshev(Mean, Sd) UCL | 10663 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 99% Chebyshev (Mean, Sd) UCL | 10663 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Chromium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 7 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 7 |
| Minimum | 25 | Mean | 31.57 |
| Maximum | 50 | Median | 27 |
| SD | 9.217 | Std. Error of Mean | 3.484 |
| Coefficient of Variation | 0.292 | Skewness | 1.738 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.735 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.365 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 38.34 | 95% Adjusted-CLT UCL (Chen-1995) | 39.75 |
| | | 95% Modified-t UCL (Johnson-1978) | 38.72 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.899 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.707 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.367 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.312 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 16.42 | k star (bias corrected MLE) | 9.478 |
| Theta hat (MLE) | 1.923 | Theta star (bias corrected MLE) | 3.331 |
| nu hat (MLE) | 229.9 | nu star (bias corrected) | 132.7 |
| MLE Mean (bias corrected) | 31.57 | MLE Sd (bias corrected) | 10.25 |
| | | Approximate Chi Square Value (0.05) | 107.1 |
| Adjusted Level of Significance | 0.0158 | Adjusted Chi Square Value | 100.1 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 39.12 | 95% Adjusted Gamma UCL (use when n<50) | 41.84 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.773 | **Shapiro Wilk Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Shapiro Wilk Critical Value | 0.803 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.35 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.304 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 3.219 | Mean of logged Data | 3.421 |
| Maximum of Logged Data | 3.912 | SD of logged Data | 0.256 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 39.43 | 90% Chebyshev (MVUE) UCL | 40.66 |
| 95% Chebyshev (MVUE) UCL | 44.81 | 97.5% Chebyshev (MVUE) UCL | 50.58 |
| 99% Chebyshev (MVUE) UCL | 61.9 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data do not follow a Discernible Distribution (0.05)** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 37.3 | 95% Jackknife UCL | 38.34 |
| 95% Standard Bootstrap UCL | 36.93 | 95% Bootstrap-t UCL | 75.36 |
| 95% Hall's Bootstrap UCL | 81.88 | 95% Percentile Bootstrap UCL | 38 |
| 95% BCA Bootstrap UCL | 38.29 | | |
| 90% Chebyshev(Mean, Sd) UCL | 42.02 | 95% Chebyshev(Mean, Sd) UCL | 46.76 |
| 97.5% Chebyshev(Mean, Sd) UCL | 53.33 | 99% Chebyshev(Mean, Sd) UCL | 66.23 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 38.34 | or 95% Modified-t UCL | 38.72 |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| Copper | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 15 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 0 |
| Minimum | 7 | Mean | 16.07 |
| Maximum | 32 | Median | 15 |
| SD | 7.096 | Std. Error of Mean | 1.832 |
| Coefficient of Variation | 0.442 | Skewness | 1.044 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.911 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.156 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 19.29 | 95% Adjusted-CLT UCL (Chen-1995) | 19.61 |

| | | | |
|---|---|---|---|
| | | 95% Modified-t UCL (Johnson-1978) | 19.38 |

### Gamma GOF Test

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.215 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.738 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.112 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.222 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.967 | k star (bias corrected MLE) | 4.818 |
| Theta hat (MLE) | 2.693 | Theta star (bias corrected MLE) | 3.335 |
| nu hat (MLE) | 179 | nu star (bias corrected) | 144.5 |
| MLE Mean (bias corrected) | 16.07 | MLE Sd (bias corrected) | 7.32 |
| | | Approximate Chi Square Value (0.05) | 117.8 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 114.8 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 19.72 | 95% Adjusted Gamma UCL (use when n<50) | 20.23 |

### Lognormal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.978 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.105 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.946 | Mean of logged Data | 2.691 |
| Maximum of Logged Data | 3.466 | SD of logged Data | 0.429 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 20.32 | 90% Chebyshev (MVUE) UCL | 21.51 |
| 95% Chebyshev (MVUE) UCL | 23.98 | 97.5% Chebyshev (MVUE) UCL | 27.41 |
| 99% Chebyshev (MVUE) UCL | 34.15 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 19.08 | 95% Jackknife UCL | 19.29 |
| 95% Standard Bootstrap UCL | 18.92 | 95% Bootstrap-t UCL | 20.47 |
| 95% Hall's Bootstrap UCL | 21.75 | 95% Percentile Bootstrap UCL | 19.2 |
| 95% BCA Bootstrap UCL | 19.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 21.56 | 95% Chebyshev(Mean, Sd) UCL | 24.05 |
| 97.5% Chebyshev(Mean, Sd) UCL | 27.51 | 99% Chebyshev(Mean, Sd) UCL | 34.3 |

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 19.29 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 15 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 10 | Mean | 225.1 |
| Maximum | 891 | Median | 98 |
| SD | 274.4 | Std. Error of Mean | 70.84 |
| Coefficient of Variation | 1.219 | Skewness | 1.409 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.766 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.321 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 349.9 | 95% Adjusted-CLT UCL (Chen-1995) | 369.2 |
| | | 95% Modified-t UCL (Johnson-1978) | 354.2 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.505 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.776 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.209 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.23 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 0.738 | k star (bias corrected MLE) | 0.635 |
| Theta hat (MLE) | 305.1 | Theta star (bias corrected MLE) | 354.6 |
| nu hat (MLE) | 22.14 | nu star (bias corrected) | 19.05 |
| MLE Mean (bias corrected) | 225.1 | MLE Sd (bias corrected) | 282.6 |
| | | Approximate Chi Square Value (0.05) | 10.15 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 9.359 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 422.4 | 95% Adjusted Gamma UCL (use when n<50) | 458.1 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.949 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.125 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.303 | Mean of logged Data | 4.604 |
| Maximum of Logged Data | 6.792 | SD of logged Data | 1.428 |
| | | | |
| **Assuming Lognormal Distribution** | | | |

| | | | |
|---|---|---|---|
| 95% H-UCL | 1043 | 90% Chebyshev (MVUE) UCL | 554.9 |
| 95% Chebyshev (MVUE) UCL | 694.9 | 97.5% Chebyshev (MVUE) UCL | 889.2 |
| 99% Chebyshev (MVUE) UCL | 1271 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 341.7 | 95% Jackknife UCL | 349.9 |
| 95% Standard Bootstrap UCL | 335.5 | 95% Bootstrap-t UCL | 402.9 |
| 95% Hall's Bootstrap UCL | 348.2 | 95% Percentile Bootstrap UCL | 344.1 |
| 95% BCA Bootstrap UCL | 372.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 437.7 | 95% Chebyshev(Mean, Sd) UCL | 533.9 |
| 97.5% Chebyshev(Mean, Sd) UCL | 667.5 | 99% Chebyshev(Mean, Sd) UCL | 930 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 458.1 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 4 |
| Minimum | 0 | Mean | 5.818 |
| Maximum | 16 | Median | 4 |
| SD | 4.191 | Std. Error of Mean | 1.264 |
| Coefficient of Variation | 0.72 | Skewness | 1.421 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.869 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.85 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.214 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.251 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 8.108 | 95% Adjusted-CLT UCL (Chen-1995) | 8.475 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.199 |

**Gamma Statistics Not Available**

**Lognormal Statistics Not Available**

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 7.897 | 95% Jackknife UCL | 8.108 |
| 95% Standard Bootstrap UCL | 7.775 | 95% Bootstrap-t UCL | 9.313 |

| | | | |
|---|---|---|---|
| 95% Hall's Bootstrap UCL | 18.46 | 95% Percentile Bootstrap UCL | 7.818 |
| 95% BCA Bootstrap UCL | 8.182 | | |
| 90% Chebyshev(Mean, Sd) UCL | 9.609 | 95% Chebyshev(Mean, Sd) UCL | 11.33 |
| 97.5% Chebyshev(Mean, Sd) UCL | 13.71 | 99% Chebyshev(Mean, Sd) UCL | 18.39 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 8.108 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Molybdenum**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 1 |
| Minimum | 3 | Mean | 5.923 |
| Maximum | 10 | Median | 5 |
| SD | 2.216 | Std. Error of Mean | 0.615 |
| Coefficient of Variation | 0.374 | Skewness | 0.711 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.903 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.2 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 7.018 | 95% Adjusted-CLT UCL (Chen-1995) | 7.064 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.039 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.42 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.735 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.176 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.237 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 8.16 | k star (bias corrected MLE) | 6.328 |
| Theta hat (MLE) | 0.726 | Theta star (bias corrected MLE) | 0.936 |
| nu hat (MLE) | 212.1 | nu star (bias corrected) | 164.5 |
| MLE Mean (bias corrected) | 5.923 | MLE Sd (bias corrected) | 2.355 |
| | | Approximate Chi Square Value (0.05) | 135.9 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 132.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 7.172 | 95% Adjusted Gamma UCL (use when n<50) | 7.374 |

| | | | |
|---|---|---|---|
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.153 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.716 |
| Maximum of Logged Data | 2.303 | SD of logged Data | 0.367 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 7.33 | 90% Chebyshev (MVUE) UCL | 7.75 |
| 95% Chebyshev (MVUE) UCL | 8.58 | 97.5% Chebyshev (MVUE) UCL | 9.732 |
| 99% Chebyshev (MVUE) UCL | 11.99 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 6.934 | 95% Jackknife UCL | 7.018 |
| 95% Standard Bootstrap UCL | 6.867 | 95% Bootstrap-t UCL | 7.191 |
| 95% Hall's Bootstrap UCL | 6.967 | 95% Percentile Bootstrap UCL | 6.923 |
| 95% BCA Bootstrap UCL | 7 | | |
| 90% Chebyshev(Mean, Sd) UCL | 7.767 | 95% Chebyshev(Mean, Sd) UCL | 8.602 |
| 97.5% Chebyshev(Mean, Sd) UCL | 9.761 | 99% Chebyshev(Mean, Sd) UCL | 12.04 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 7.018 | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| **Nickel** | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 15 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 0 |
| Minimum | 7 | Mean | 16.8 |
| Maximum | 37 | Median | 15 |
| SD | 7.193 | Std. Error of Mean | 1.857 |
| Coefficient of Variation | 0.428 | Skewness | 1.608 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.867 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.211 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Normal at 5% Significance Level | |
| **Data appear Approximate Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 20.07 | 95% Adjusted-CLT UCL (Chen-1995) | 20.68 |
| | | 95% Modified-t UCL (Johnson-1978) | 20.2 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.365 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.738 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.166 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.222 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 6.861 | k star (bias corrected MLE) | 5.533 |
| Theta hat (MLE) | 2.449 | Theta star (bias corrected MLE) | 3.036 |
| nu hat (MLE) | 205.8 | nu star (bias corrected) | 166 |
| MLE Mean (bias corrected) | 16.8 | MLE Sd (bias corrected) | 7.142 |
| | | Approximate Chi Square Value (0.05) | 137.2 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 134 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 20.33 | 95% Adjusted Gamma UCL (use when n<50) | 20.81 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.141 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.946 | Mean of logged Data | 2.747 |
| Maximum of Logged Data | 3.611 | SD of logged Data | 0.394 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 20.72 | 90% Chebyshev (MVUE) UCL | 21.97 |
| 95% Chebyshev (MVUE) UCL | 24.34 | 97.5% Chebyshev (MVUE) UCL | 27.62 |
| 99% Chebyshev (MVUE) UCL | 34.06 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 19.85 | 95% Jackknife UCL | 20.07 |
| 95% Standard Bootstrap UCL | 19.73 | 95% Bootstrap-t UCL | 21.6 |
| 95% Hall's Bootstrap UCL | 26.77 | 95% Percentile Bootstrap UCL | 20 |
| 95% BCA Bootstrap UCL | 20.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 22.37 | 95% Chebyshev(Mean, Sd) UCL | 24.9 |
| 97.5% Chebyshev(Mean, Sd) UCL | 28.4 | 99% Chebyshev(Mean, Sd) UCL | 35.28 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 20.07 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Vanadium**

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 15 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 138 | Mean | 217.9 |
| Maximum | 288 | Median | 224 |
| SD | 40.53 | Std. Error of Mean | 10.47 |
| Coefficient of Variation | 0.186 | Skewness | -0.249 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.973 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.148 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 236.4 | 95% Adjusted-CLT UCL (Chen-1995) | 234.4 |
| | | 95% Modified-t UCL (Johnson-1978) | 236.3 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.309 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.735 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.165 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.221 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 29.1 | k star (bias corrected MLE) | 23.33 |
| Theta hat (MLE) | 7.488 | Theta star (bias corrected MLE) | 9.343 |
| nu hat (MLE) | 873.1 | nu star (bias corrected) | 699.8 |
| MLE Mean (bias corrected) | 217.9 | MLE Sd (bias corrected) | 45.12 |
| | | Approximate Chi Square Value (0.05) | 639.4 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 632.3 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 238.5 | 95% Adjusted Gamma UCL (use when n<50) | 241.2 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.164 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.927 | Mean of logged Data | 5.367 |
| Maximum of Logged Data | 5.663 | SD of logged Data | 0.196 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 240.1 | 90% Chebyshev (MVUE) UCL | 251.4 |
| 95% Chebyshev (MVUE) UCL | 266.5 | 97.5% Chebyshev (MVUE) UCL | 287.4 |
| 99% Chebyshev (MVUE) UCL | 328.6 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 235.1 | 95% Jackknife UCL | 236.4 |
| 95% Standard Bootstrap UCL | 234.6 | 95% Bootstrap-t UCL | 236.3 |
| 95% Hall's Bootstrap UCL | 233.9 | 95% Percentile Bootstrap UCL | 234.2 |
| 95% BCA Bootstrap UCL | 233.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 249.3 | 95% Chebyshev(Mean, Sd) UCL | 263.6 |
| 97.5% Chebyshev(Mean, Sd) UCL | 283.3 | 99% Chebyshev(Mean, Sd) UCL | 322.1 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 236.4 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Zinc

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 15 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 75 | Mean | 159.5 |
| Maximum | 444 | Median | 124 |
| SD | 95.34 | Std. Error of Mean | 24.62 |
| Coefficient of Variation | 0.598 | Skewness | 2.032 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.788 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.188 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.22 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 202.9 | 95% Adjusted-CLT UCL (Chen-1995) | 213.8 |
| | | 95% Modified-t UCL (Johnson-1978) | 205 |

| | | | |
|---|---|---|---|
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.497 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.157 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.223 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 4.024 | k star (bias corrected MLE) | 3.264 |
| Theta hat (MLE) | 39.64 | Theta star (bias corrected MLE) | 48.88 |
| nu hat (MLE) | 120.7 | nu star (bias corrected) | 97.91 |
| MLE Mean (bias corrected) | 159.5 | MLE Sd (bias corrected) | 88.31 |
| | | Approximate Chi Square Value (0.05) | 76.09 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 73.72 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 205.3 | 95% Adjusted Gamma UCL (use when n<50) | 211.9 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.929 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.129 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 4.317 | Mean of logged Data | 4.943 |
| Maximum of Logged Data | 6.096 | SD of logged Data | 0.504 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 210.3 | 90% Chebyshev (MVUE) UCL | 221 |
| 95% Chebyshev (MVUE) UCL | 249.8 | 97.5% Chebyshev (MVUE) UCL | 289.6 |
| 99% Chebyshev (MVUE) UCL | 367.9 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 200 | 95% Jackknife UCL | 202.9 |
| 95% Standard Bootstrap UCL | 199.1 | 95% Bootstrap-t UCL | 231.8 |
| 95% Hall's Bootstrap UCL | 381.3 | 95% Percentile Bootstrap UCL | 200.3 |
| 95% BCA Bootstrap UCL | 212.7 | | |
| 90% Chebyshev(Mean, Sd) UCL | 233.4 | 95% Chebyshev(Mean, Sd) UCL | 266.8 |
| 97.5% Chebyshev(Mean, Sd) UCL | 313.3 | 99% Chebyshev(Mean, Sd) UCL | 404.5 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 202.9 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 757 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 758 | | | | | | | | | | | | |

## UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.12/11/2021 11:52:35 AM |
| From File | UCL UTL concentrations USFS Big Blue_f.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

**Antimony**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.83 | Mean | 16.3 |
| Maximum | 74 | Median | 3.9 |
| SD | 24.95 | Std. Error of Mean | 8.822 |
| Coefficient of Variation | 1.531 | Skewness | 2.194 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.679 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.307 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 33.02 | 95% Adjusted-CLT UCL (Chen-1995) | 38.13 |
| | | 95% Modified-t UCL (Johnson-1978) | 34.16 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.507 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.755 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.271 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.307 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.61 | k star (bias corrected MLE) | 0.465 |
| Theta hat (MLE) | 26.71 | Theta star (bias corrected MLE) | 35.07 |
| nu hat (MLE) | 9.767 | nu star (bias corrected) | 7.438 |
| MLE Mean (bias corrected) | 16.3 | MLE Sd (bias corrected) | 23.91 |
| | | Approximate Chi Square Value (0.05) | 2.414 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 1.755 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 50.24 | 95% Adjusted Gamma UCL (use when n<50) | 69.11 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.939 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.196 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.186 | Mean of logged Data | 1.782 |
| Maximum of Logged Data | 4.304 | SD of logged Data | 1.549 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 342 | 90% Chebyshev (MVUE) UCL | 40.71 |
| 95% Chebyshev (MVUE) UCL | 52.19 | 97.5% Chebyshev (MVUE) UCL | 68.12 |
| 99% Chebyshev (MVUE) UCL | 99.41 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 30.82 | 95% Jackknife UCL | 33.02 |
| 95% Standard Bootstrap UCL | 29.78 | 95% Bootstrap-t UCL | 59.02 |
| 95% Hall's Bootstrap UCL | 75.66 | 95% Percentile Bootstrap UCL | 30.58 |
| 95% BCA Bootstrap UCL | 38.16 | | |
| 90% Chebyshev(Mean, Sd) UCL | 42.77 | 95% Chebyshev(Mean, Sd) UCL | 54.76 |
| 97.5% Chebyshev(Mean, Sd) UCL | 71.4 | 99% Chebyshev(Mean, Sd) UCL | 104.1 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 69.11 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 1100 | Mean | 21150 |
| Maximum | 88000 | Median | 14000 |
| SD | 28851 | Std. Error of Mean | 10200 |
| Coefficient of Variation | 1.364 | Skewness | 2.185 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**

**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**

**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**

**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.721 | **Shapiro Wilk GOF Test** | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109 | | | | | 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | | | | | |
| 110 | | | | | Lilliefors Test Statistic | 0.28 | **Lilliefors GOF Test** | | | | | |
| 111 | | | | | 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level | | | | | |
| 112 | **Data appear Approximate Normal at 5% Significance Level** | | | | | | | | | | | |
| 113 | | | | | | | | | | | | |
| 114 | **Assuming Normal Distribution** | | | | | | | | | | | |
| 115 | **95% Normal UCL** | | | | | | **95% UCLs (Adjusted for Skewness)** | | | | | |
| 116 | | | | | 95% Student's-t UCL | 40475 | | | | | 95% Adjusted-CLT UCL (Chen-1995) | 46349 |
| 117 | | | | | | | | | | | 95% Modified-t UCL (Johnson-1978) | 41789 |
| 118 | | | | | | | | | | | | |
| 119 | **Gamma GOF Test** | | | | | | | | | | | |
| 120 | | | | | A-D Test Statistic | 0.371 | **Anderson-Darling Gamma GOF Test** | | | | | |
| 121 | | | | | 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 122 | | | | | K-S Test Statistic | 0.207 | **Kolmogorov-Smirnov Gamma GOF Test** | | | | | |
| 123 | | | | | 5% K-S Critical Value | 0.306 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 124 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | | | | | | | | | |
| 125 | | | | | | | | | | | | |
| 126 | **Gamma Statistics** | | | | | | | | | | | |
| 127 | | | | | k hat (MLE) | 0.659 | | | | | k star (bias corrected MLE) | 0.495 |
| 128 | | | | | Theta hat (MLE) | 32088 | | | | | Theta star (bias corrected MLE) | 42702 |
| 129 | | | | | nu hat (MLE) | 10.55 | | | | | nu star (bias corrected) | 7.925 |
| 130 | | | | | MLE Mean (bias corrected) | 21150 | | | | | MLE Sd (bias corrected) | 30053 |
| 131 | | | | | | | | | | | Approximate Chi Square Value (0.05) | 2.691 |
| 132 | | | | | Adjusted Level of Significance | 0.0195 | | | | | Adjusted Chi Square Value | 1.984 |
| 133 | | | | | | | | | | | | |
| 134 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 135 | | | | | 95% Approximate Gamma UCL (use when n>=50)) | 62274 | | | | | 95% Adjusted Gamma UCL (use when n<50) | 84491 |
| 136 | | | | | | | | | | | | |
| 137 | **Lognormal GOF Test** | | | | | | | | | | | |
| 138 | | | | | Shapiro Wilk Test Statistic | 0.902 | **Shapiro Wilk Lognormal GOF Test** | | | | | |
| 139 | | | | | 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | | | | | |
| 140 | | | | | Lilliefors Test Statistic | 0.231 | **Lilliefors Lognormal GOF Test** | | | | | |
| 141 | | | | | 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | | | | | |
| 142 | **Data appear Lognormal at 5% Significance Level** | | | | | | | | | | | |
| 143 | | | | | | | | | | | | |
| 144 | **Lognormal Statistics** | | | | | | | | | | | |
| 145 | | | | | Minimum of Logged Data | 7.003 | | | | | Mean of logged Data | 9.035 |
| 146 | | | | | Maximum of Logged Data | 11.39 | | | | | SD of logged Data | 1.624 |
| 147 | | | | | | | | | | | | |
| 148 | **Assuming Lognormal Distribution** | | | | | | | | | | | |
| 149 | | | | | 95% H-UCL | 709418 | | | | | 90% Chebyshev (MVUE) UCL | 64314 |
| 150 | | | | | 95% Chebyshev (MVUE) UCL | 82730 | | | | | 97.5% Chebyshev (MVUE) UCL | 108290 |
| 151 | | | | | 99% Chebyshev (MVUE) UCL | 158498 | | | | | | |
| 152 | | | | | | | | | | | | |
| 153 | **Nonparametric Distribution Free UCL Statistics** | | | | | | | | | | | |
| 154 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | | | | | | | | | |
| 155 | | | | | | | | | | | | |
| 156 | **Nonparametric Distribution Free UCLs** | | | | | | | | | | | |
| 157 | | | | | 95% CLT UCL | 37928 | | | | | 95% Jackknife UCL | 40475 |
| 158 | | | | | 95% Standard Bootstrap UCL | 37287 | | | | | 95% Bootstrap-t UCL | 70894 |
| 159 | | | | | 95% Hall's Bootstrap UCL | 112109 | | | | | 95% Percentile Bootstrap UCL | 38900 |
| 160 | | | | | 95% BCA Bootstrap UCL | 43263 | | | | | | |
| 161 | | | | | 90% Chebyshev(Mean, Sd) UCL | 51751 | | | | | 95% Chebyshev(Mean, Sd) UCL | 65612 |
| 162 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 84851 | | | | | 99% Chebyshev(Mean, Sd) UCL | 122643 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 40475 | | |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Barium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 0 |
| Minimum | 18 | Mean | 47.75 |
| Maximum | 79 | Median | 46 |
| SD | 17.26 | Std. Error of Mean | 6.103 |
| Coefficient of Variation | 0.361 | Skewness | 0.17 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**

**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**

**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**

**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.943 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.223 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 59.31 | 95% Adjusted-CLT UCL (Chen-1995) | 58.18 |
| | | 95% Modified-t UCL (Johnson-1978) | 59.37 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.44 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.717 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.265 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.295 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.409 | k star (bias corrected MLE) | 4.714 |
| Theta hat (MLE) | 6.445 | Theta star (bias corrected MLE) | 10.13 |
| nu hat (MLE) | 118.5 | nu star (bias corrected) | 75.42 |
| MLE Mean (bias corrected) | 47.75 | MLE Sd (bias corrected) | 21.99 |
| | | Approximate Chi Square Value (0.05) | 56.42 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 52.28 |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 217 | | | | |
| 218 | **Assuming Gamma Distribution** | | | |
| 219 | 95% Approximate Gamma UCL (use when n>=50)) | 63.83 | 95% Adjusted Gamma UCL (use when n<50) | 68.88 |
| 220 | | | | |
| 221 | **Lognormal GOF Test** | | | |
| 222 | Shapiro Wilk Test Statistic | 0.872 | **Shapiro Wilk Lognormal GOF Test** | |
| 223 | 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| 224 | Lilliefors Test Statistic | 0.297 | **Lilliefors Lognormal GOF Test** | |
| 225 | 5% Lilliefors Critical Value | 0.283 | Data Not Lognormal at 5% Significance Level | |
| 226 | **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| 227 | | | | |
| 228 | **Lognormal Statistics** | | | |
| 229 | Minimum of Logged Data | 2.89 | Mean of logged Data | 3.797 |
| 230 | Maximum of Logged Data | 4.369 | SD of logged Data | 0.425 |
| 231 | | | | |
| 232 | **Assuming Lognormal Distribution** | | | |
| 233 | 95% H-UCL | 69.81 | 90% Chebyshev (MVUE) UCL | 70.08 |
| 234 | 95% Chebyshev (MVUE) UCL | 80 | 97.5% Chebyshev (MVUE) UCL | 93.76 |
| 235 | 99% Chebyshev (MVUE) UCL | 120.8 | | |
| 236 | | | | |
| 237 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 238 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 239 | | | | |
| 240 | **Nonparametric Distribution Free UCLs** | | | |
| 241 | 95% CLT UCL | 57.79 | 95% Jackknife UCL | 59.31 |
| 242 | 95% Standard Bootstrap UCL | 57.08 | 95% Bootstrap-t UCL | 59.01 |
| 243 | 95% Hall's Bootstrap UCL | 62.74 | 95% Percentile Bootstrap UCL | 57.25 |
| 244 | 95% BCA Bootstrap UCL | 57.5 | | |
| 245 | 90% Chebyshev(Mean, Sd) UCL | 66.06 | 95% Chebyshev(Mean, Sd) UCL | 74.35 |
| 246 | 97.5% Chebyshev(Mean, Sd) UCL | 85.86 | 99% Chebyshev(Mean, Sd) UCL | 108.5 |
| 247 | | | | |
| 248 | **Suggested UCL to Use** | | | |
| 249 | 95% Student's-t UCL | 59.31 | | |
| 250 | | | | |
| 251 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 252 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 253 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 254 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 255 | | | | |
| 256 | | | | |
| 257 | Cadmium | | | |
| 258 | | | | |
| 259 | **General Statistics** | | | |
| 260 | Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| 261 | | | Number of Missing Observations | 0 |
| 262 | Minimum | 8.5 | Mean | 151.6 |
| 263 | Maximum | 630 | Median | 100.5 |
| 264 | SD | 206.2 | Std. Error of Mean | 72.89 |
| 265 | Coefficient of Variation | 1.36 | Skewness | 2.195 |
| 266 | | | | |
| 267 | **Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use** | | | |
| 268 | **guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.** | | | |
| 269 | **For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).** | | | |
| 270 | **Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1** | | | |

| | | | |
|---|---|---|---|
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.72 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.272 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level | |
| **Data appear Approximate Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 289.7 | 95% Adjusted-CLT UCL (Chen-1995) | 331.9 |
| | | 95% Modified-t UCL (Johnson-1978) | 299.1 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.372 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.751 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.208 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.306 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 0.672 | k star (bias corrected MLE) | 0.503 |
| Theta hat (MLE) | 225.5 | Theta star (bias corrected MLE) | 301.1 |
| nu hat (MLE) | 10.75 | nu star (bias corrected) | 8.054 |
| MLE Mean (bias corrected) | 151.6 | MLE Sd (bias corrected) | 213.6 |
| | | Approximate Chi Square Value (0.05) | 2.766 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 2.046 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 441.3 | 95% Adjusted Gamma UCL (use when n<50) | 596.7 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.901 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.222 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.14 | Mean of logged Data | 4.117 |
| Maximum of Logged Data | 6.446 | SD of logged Data | 1.597 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 4505 | 90% Chebyshev (MVUE) UCL | 451.6 |
| 95% Chebyshev (MVUE) UCL | 580.2 | 97.5% Chebyshev (MVUE) UCL | 758.7 |
| 99% Chebyshev (MVUE) UCL | 1109 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 271.5 | 95% Jackknife UCL | 289.7 |
| 95% Standard Bootstrap UCL | 265.6 | 95% Bootstrap-t UCL | 481 |
| 95% Hall's Bootstrap UCL | 801 | 95% Percentile Bootstrap UCL | 284 |

| | | | |
|---|---|---|---|
| 95% BCA Bootstrap UCL | 321.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 370.2 | 95% Chebyshev(Mean, Sd) UCL | 469.3 |
| 97.5% Chebyshev(Mean, Sd) UCL | 606.8 | 99% Chebyshev(Mean, Sd) UCL | 876.8 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 289.7 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 7 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 1 |
| Minimum | 3.7 | Mean | 6.257 |
| Maximum | 10 | Median | 5.9 |
| SD | 2.358 | Std. Error of Mean | 0.891 |
| Coefficient of Variation | 0.377 | Skewness | 0.639 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**

**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**

**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**

**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.919 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.213 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 7.989 | 95% Adjusted-CLT UCL (Chen-1995) | 7.953 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.025 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.302 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.709 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.232 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.312 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 8.53 | k star (bias corrected MLE) | 4.97 |
| Theta hat (MLE) | 0.734 | Theta star (bias corrected MLE) | 1.259 |
| nu hat (MLE) | 119.4 | nu star (bias corrected) | 69.58 |

| | | | | |
|---|---|---|---|---|
| 379 | MLE Mean (bias corrected) | 6.257 | MLE Sd (bias corrected) | 2.807 |
| 380 | | | Approximate Chi Square Value (0.05) | 51.38 |
| 381 | Adjusted Level of Significance | 0.0158 | Adjusted Chi Square Value | 46.69 |
| 382 | | | | |
| 383 | **Assuming Gamma Distribution** | | | |
| 384 | 95% Approximate Gamma UCL (use when n>=50)) | 8.474 | 95% Adjusted Gamma UCL (use when n<50) | 9.325 |
| 385 | | | | |
| 386 | **Lognormal GOF Test** | | | |
| 387 | Shapiro Wilk Test Statistic | 0.941 | **Shapiro Wilk Lognormal GOF Test** | |
| 388 | 5% Shapiro Wilk Critical Value | 0.803 | Data appear Lognormal at 5% Significance Level | |
| 389 | Lilliefors Test Statistic | 0.213 | **Lilliefors Lognormal GOF Test** | |
| 390 | 5% Lilliefors Critical Value | 0.304 | Data appear Lognormal at 5% Significance Level | |
| 391 | **Data appear Lognormal at 5% Significance Level** | | | |
| 392 | | | | |
| 393 | **Lognormal Statistics** | | | |
| 394 | Minimum of Logged Data | 1.308 | Mean of logged Data | 1.774 |
| 395 | Maximum of Logged Data | 2.303 | SD of logged Data | 0.372 |
| 396 | | | | |
| 397 | **Assuming Lognormal Distribution** | | | |
| 398 | 95% H-UCL | 8.929 | 90% Chebyshev (MVUE) UCL | 8.897 |
| 399 | 95% Chebyshev (MVUE) UCL | 10.1 | 97.5% Chebyshev (MVUE) UCL | 11.76 |
| 400 | 99% Chebyshev (MVUE) UCL | 15.03 | | |
| 401 | | | | |
| 402 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 403 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 404 | | | | |
| 405 | **Nonparametric Distribution Free UCLs** | | | |
| 406 | 95% CLT UCL | 7.723 | 95% Jackknife UCL | 7.989 |
| 407 | 95% Standard Bootstrap UCL | 7.586 | 95% Bootstrap-t UCL | 8.766 |
| 408 | 95% Hall's Bootstrap UCL | 8.399 | 95% Percentile Bootstrap UCL | 7.743 |
| 409 | 95% BCA Bootstrap UCL | 7.757 | | |
| 410 | 90% Chebyshev(Mean, Sd) UCL | 8.931 | 95% Chebyshev(Mean, Sd) UCL | 10.14 |
| 411 | 97.5% Chebyshev(Mean, Sd) UCL | 11.82 | 99% Chebyshev(Mean, Sd) UCL | 15.12 |
| 412 | | | | |
| 413 | **Suggested UCL to Use** | | | |
| 414 | 95% Student's-t UCL | 7.989 | | |
| 415 | | | | |
| 416 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 417 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 418 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 419 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 420 | | | | |
| 421 | | | | |
| 422 | **Cobalt** | | | |
| 423 | | | | |
| 424 | **General Statistics** | | | |
| 425 | Total Number of Observations | 7 | Number of Distinct Observations | 7 |
| 426 | | | Number of Missing Observations | 1 |
| 427 | Minimum | 1.4 | Mean | 3.743 |
| 428 | Maximum | 6.9 | Median | 3.5 |
| 429 | SD | 1.955 | Std. Error of Mean | 0.739 |
| 430 | Coefficient of Variation | 0.522 | Skewness | 0.487 |
| 431 | | | | |
| 432 | **Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use** | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 433 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. | | | |
| 434 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). | | | |
| 435 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1 | | | |
| 436 | | | | |
| 437 | **Normal GOF Test** | | | |
| 438 | Shapiro Wilk Test Statistic | 0.946 | **Shapiro Wilk GOF Test** | |
| 439 | 5% Shapiro Wilk Critical Value | 0.803 | Data appear Normal at 5% Significance Level | |
| 440 | Lilliefors Test Statistic | 0.198 | **Lilliefors GOF Test** | |
| 441 | 5% Lilliefors Critical Value | 0.304 | Data appear Normal at 5% Significance Level | |
| 442 | **Data appear Normal at 5% Significance Level** | | | |
| 443 | | | | |
| 444 | **Assuming Normal Distribution** | | | |
| 445 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 446 | 95% Student's-t UCL | 5.179 | 95% Adjusted-CLT UCL (Chen-1995) | 5.104 |
| 447 | | | 95% Modified-t UCL (Johnson-1978) | 5.202 |
| 448 | | | | |
| 449 | **Gamma GOF Test** | | | |
| 450 | A-D Test Statistic | 0.245 | **Anderson-Darling Gamma GOF Test** | |
| 451 | 5% A-D Critical Value | 0.71 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 452 | K-S Test Statistic | 0.197 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 453 | 5% K-S Critical Value | 0.313 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 454 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 455 | | | | |
| 456 | **Gamma Statistics** | | | |
| 457 | k hat (MLE) | 4.053 | k star (bias corrected MLE) | 2.411 |
| 458 | Theta hat (MLE) | 0.924 | Theta star (bias corrected MLE) | 1.552 |
| 459 | nu hat (MLE) | 56.74 | nu star (bias corrected) | 33.75 |
| 460 | MLE Mean (bias corrected) | 3.743 | MLE Sd (bias corrected) | 2.41 |
| 461 | | | Approximate Chi Square Value (0.05) | 21.47 |
| 462 | Adjusted Level of Significance | 0.0158 | Adjusted Chi Square Value | 18.57 |
| 463 | | | | |
| 464 | **Assuming Gamma Distribution** | | | |
| 465 | 95% Approximate Gamma UCL (use when n>=50)) | 5.885 | 95% Adjusted Gamma UCL (use when n<50) | 6.804 |
| 466 | | | | |
| 467 | **Lognormal GOF Test** | | | |
| 468 | Shapiro Wilk Test Statistic | 0.959 | **Shapiro Wilk Lognormal GOF Test** | |
| 469 | 5% Shapiro Wilk Critical Value | 0.803 | Data appear Lognormal at 5% Significance Level | |
| 470 | Lilliefors Test Statistic | 0.177 | **Lilliefors Lognormal GOF Test** | |
| 471 | 5% Lilliefors Critical Value | 0.304 | Data appear Lognormal at 5% Significance Level | |
| 472 | **Data appear Lognormal at 5% Significance Level** | | | |
| 473 | | | | |
| 474 | **Lognormal Statistics** | | | |
| 475 | Minimum of Logged Data | 0.336 | Mean of logged Data | 1.191 |
| 476 | Maximum of Logged Data | 1.932 | SD of logged Data | 0.564 |
| 477 | | | | |
| 478 | **Assuming Lognormal Distribution** | | | |
| 479 | 95% H-UCL | 7.012 | 90% Chebyshev (MVUE) UCL | 6.184 |
| 480 | 95% Chebyshev (MVUE) UCL | 7.28 | 97.5% Chebyshev (MVUE) UCL | 8.801 |
| 481 | 99% Chebyshev (MVUE) UCL | 11.79 | | |
| 482 | | | | |
| 483 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 484 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 485 | | | | |
| 486 | **Nonparametric Distribution Free UCLs** | | | |

| | | | |
|---|---|---|---|
| 95% CLT UCL | 4.958 | 95% Jackknife UCL | 5.179 |
| 95% Standard Bootstrap UCL | 4.871 | 95% Bootstrap-t UCL | 5.521 |
| 95% Hall's Bootstrap UCL | 4.953 | 95% Percentile Bootstrap UCL | 4.929 |
| 95% BCA Bootstrap UCL | 4.957 | | |
| 90% Chebyshev(Mean, Sd) UCL | 5.96 | 95% Chebyshev(Mean, Sd) UCL | 6.964 |
| 97.5% Chebyshev(Mean, Sd) UCL | 8.358 | 99% Chebyshev(Mean, Sd) UCL | 11.1 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 5.179 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 3 | Mean | 24.63 |
| Maximum | 87 | Median | 13.7 |
| SD | 28.37 | Std. Error of Mean | 10.03 |
| Coefficient of Variation | 1.152 | Skewness | 1.814 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.782 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.228 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level | |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 43.63 | 95% Adjusted-CLT UCL (Chen-1995) | 48 |
| | | 95% Modified-t UCL (Johnson-1978) | 44.7 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.329 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.735 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.242 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.301 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.008 | k star (bias corrected MLE) | 0.714 |
| Theta hat (MLE) | 24.42 | Theta star (bias corrected MLE) | 34.51 |
| nu hat (MLE) | 16.13 | nu star (bias corrected) | 11.42 |

| | | | |
|---|---|---|---|
| MLE Mean (bias corrected) | 24.63 | MLE Sd (bias corrected) | 29.15 |
| | | Approximate Chi Square Value (0.05) | 4.845 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 3.82 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 58.02 | 95% Adjusted Gamma UCL (use when n<50) | 73.58 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.955 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.205 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 2.632 |
| Maximum of Logged Data | 4.466 | SD of logged Data | 1.168 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 150.4 | 90% Chebyshev (MVUE) UCL | 55.17 |
| 95% Chebyshev (MVUE) UCL | 69.12 | 97.5% Chebyshev (MVUE) UCL | 88.48 |
| 99% Chebyshev (MVUE) UCL | 126.5 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 41.13 | 95% Jackknife UCL | 43.63 |
| 95% Standard Bootstrap UCL | 40.21 | 95% Bootstrap-t UCL | 63.45 |
| 95% Hall's Bootstrap UCL | 107.6 | 95% Percentile Bootstrap UCL | 40.25 |
| 95% BCA Bootstrap UCL | 46.05 | | |
| 90% Chebyshev(Mean, Sd) UCL | 54.72 | 95% Chebyshev(Mean, Sd) UCL | 68.35 |
| 97.5% Chebyshev(Mean, Sd) UCL | 87.27 | 99% Chebyshev(Mean, Sd) UCL | 124.4 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 43.63 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| Lead | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 66 | Mean | 3532 |
| Maximum | 13000 | Median | 1750 |
| SD | 4381 | Std. Error of Mean | 1549 |

| | | | |
|---|---|---|---|
| Coefficient of Variation | 1.24 | Skewness | 1.832 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.748 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.352 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data Not Normal at 5% Significance Level | |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 6466 | 95% Adjusted-CLT UCL (Chen-1995) | 7151 |
| | | 95% Modified-t UCL (Johnson-1978) | 6633 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.345 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.22 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.304 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.771 | k star (bias corrected MLE) | 0.565 |
| Theta hat (MLE) | 4582 | Theta star (bias corrected MLE) | 6250 |
| nu hat (MLE) | 12.33 | nu star (bias corrected) | 9.042 |
| MLE Mean (bias corrected) | 3532 | MLE Sd (bias corrected) | 4698 |
| | | Approximate Chi Square Value (0.05) | 3.352 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 2.538 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 9526 | 95% Adjusted Gamma UCL (use when n<50) | 12584 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.907 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.251 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.19 | Mean of logged Data | 7.396 |
| Maximum of Logged Data | 9.473 | SD of logged Data | 1.576 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 107726 | 90% Chebyshev (MVUE) UCL | 11632 |
| 95% Chebyshev (MVUE) UCL | 14930 | 97.5% Chebyshev (MVUE) UCL | 19508 |
| 99% Chebyshev (MVUE) UCL | 28501 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 6079 | 95% Jackknife UCL | 6466 |
| 95% Standard Bootstrap UCL | 5942 | 95% Bootstrap-t UCL | 16285 |
| 95% Hall's Bootstrap UCL | 22660 | 95% Percentile Bootstrap UCL | 6175 |
| 95% BCA Bootstrap UCL | 6945 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8178 | 95% Chebyshev(Mean, Sd) UCL | 10283 |
| 97.5% Chebyshev(Mean, Sd) UCL | 13204 | 99% Chebyshev(Mean, Sd) UCL | 18942 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 12584 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Mercury**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 5.7 | Mean | 92.69 |
| Maximum | 350 | Median | 14.4 |
| SD | 137.6 | Std. Error of Mean | 48.64 |
| Coefficient of Variation | 1.484 | Skewness | 1.444 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.695 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.326 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 184.8 | 95% Adjusted-CLT UCL (Chen-1995) | 199.2 |
| | | 95% Modified-t UCL (Johnson-1978) | 189 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.804 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.761 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.28 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.308 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.527 | k star (bias corrected MLE) | 0.413 |
| Theta hat (MLE) | 175.9 | Theta star (bias corrected MLE) | 224.6 |
| nu hat (MLE) | 8.433 | nu star (bias corrected) | 6.604 |
| MLE Mean (bias corrected) | 92.69 | MLE Sd (bias corrected) | 144.3 |
| | | Approximate Chi Square Value (0.05) | 1.956 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 1.382 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 313 | 95% Adjusted Gamma UCL (use when n<50) | 442.8 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.835 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.254 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.74 | Mean of logged Data | 3.334 |
| Maximum of Logged Data | 5.858 | SD of logged Data | 1.685 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 3288 | 90% Chebyshev (MVUE) UCL | 235.8 |
| 95% Chebyshev (MVUE) UCL | 304.1 | 97.5% Chebyshev (MVUE) UCL | 398.9 |
| 99% Chebyshev (MVUE) UCL | 585.1 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 172.7 | 95% Jackknife UCL | 184.8 |
| 95% Standard Bootstrap UCL | 165.9 | 95% Bootstrap-t UCL | 550.1 |
| 95% Hall's Bootstrap UCL | 801.4 | 95% Percentile Bootstrap UCL | 174.6 |
| 95% BCA Bootstrap UCL | 193.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 238.6 | 95% Chebyshev(Mean, Sd) UCL | 304.7 |
| 97.5% Chebyshev(Mean, Sd) UCL | 396.4 | 99% Chebyshev(Mean, Sd) UCL | 576.6 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 442.8 | | |

**Recommended UCL exceeds the maximum observation**

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Nickel**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 6 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 2 |
| Minimum | 1.5 | Mean | 4.317 |
| Maximum | 7.1 | Median | 4.6 |
| SD | 2.286 | Std. Error of Mean | 0.933 |
| Coefficient of Variation | 0.53 | Skewness | -0.222 |
| | | | |
| **Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use** | | | |
| **guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.** | | | |
| **For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).** | | | |
| **Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1** | | | |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.912 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.199 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 6.197 | 95% Adjusted-CLT UCL (Chen-1995) | 5.761 |
| | | 95% Modified-t UCL (Johnson-1978) | 6.183 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.457 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.701 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.269 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.334 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 3.386 | k star (bias corrected MLE) | 1.804 |
| Theta hat (MLE) | 1.275 | Theta star (bias corrected MLE) | 2.393 |
| nu hat (MLE) | 40.63 | nu star (bias corrected) | 21.65 |
| MLE Mean (bias corrected) | 4.317 | MLE Sd (bias corrected) | 3.214 |
| | | Approximate Chi Square Value (0.05) | 12.07 |
| Adjusted Level of Significance | 0.0122 | Adjusted Chi Square Value | 9.598 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 7.739 | 95% Adjusted Gamma UCL (use when n<50) | 9.735 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.285 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 0.405 | Mean of logged Data | 1.308 |
| Maximum of Logged Data | 1.96 | SD of logged Data | 0.654 |
| | | | |
| **Assuming Lognormal Distribution** | | | |

| | | | |
|---|---|---|---|
| 95% H-UCL | 11.14 | 90% Chebyshev (MVUE) UCL | 7.909 |
| 95% Chebyshev (MVUE) UCL | 9.499 | 97.5% Chebyshev (MVUE) UCL | 11.71 |
| 99% Chebyshev (MVUE) UCL | 16.04 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 5.852 | 95% Jackknife UCL | 6.197 |
| 95% Standard Bootstrap UCL | 5.698 | 95% Bootstrap-t UCL | 6.062 |
| 95% Hall's Bootstrap UCL | 5.632 | 95% Percentile Bootstrap UCL | 5.767 |
| 95% BCA Bootstrap UCL | 5.633 | | |
| 90% Chebyshev(Mean, Sd) UCL | 7.116 | 95% Chebyshev(Mean, Sd) UCL | 8.385 |
| 97.5% Chebyshev(Mean, Sd) UCL | 10.14 | 99% Chebyshev(Mean, Sd) UCL | 13.6 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 6.197 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Silver

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.85 | Mean | 15.29 |
| Maximum | 45 | Median | 7.85 |
| SD | 16.03 | Std. Error of Mean | 5.669 |
| Coefficient of Variation | 1.048 | Skewness | 1.031 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.856 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.246 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 26.03 | 95% Adjusted-CLT UCL (Chen-1995) | 26.83 |
| | | 95% Modified-t UCL (Johnson-1978) | 26.38 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.268 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.74 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.207 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.303 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.879 | k star (bias corrected MLE) | 0.633 |
| Theta hat (MLE) | 17.4 | Theta star (bias corrected MLE) | 24.17 |
| nu hat (MLE) | 14.06 | nu star (bias corrected) | 10.12 |
| MLE Mean (bias corrected) | 15.29 | MLE Sd (bias corrected) | 19.23 |
| | | Approximate Chi Square Value (0.05) | 4.019 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 3.106 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 38.52 | 95% Adjusted Gamma UCL (use when n<50) | 49.84 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.166 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.163 | Mean of logged Data | 2.06 |
| Maximum of Logged Data | 3.807 | SD of logged Data | 1.379 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 202.8 | 90% Chebyshev (MVUE) UCL | 41.99 |
| 95% Chebyshev (MVUE) UCL | 53.34 | 97.5% Chebyshev (MVUE) UCL | 69.1 |
| 99% Chebyshev (MVUE) UCL | 100.1 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 24.62 | 95% Jackknife UCL | 26.03 |
| 95% Standard Bootstrap UCL | 24.27 | 95% Bootstrap-t UCL | 29.97 |
| 95% Hall's Bootstrap UCL | 25.25 | 95% Percentile Bootstrap UCL | 25.13 |
| 95% BCA Bootstrap UCL | 25.55 | | |
| 90% Chebyshev(Mean, Sd) UCL | 32.3 | 95% Chebyshev(Mean, Sd) UCL | 40 |
| 97.5% Chebyshev(Mean, Sd) UCL | 50.7 | 99% Chebyshev(Mean, Sd) UCL | 71.7 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 26.03 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 0 |
| Minimum | 3.3 | Mean | 19.26 |
| Maximum | 28 | Median | 22 |
| SD | 9.087 | Std. Error of Mean | 3.213 |
| Coefficient of Variation | 0.472 | Skewness | -0.913 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.887 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.199 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 25.35 | 95% Adjusted-CLT UCL (Chen-1995) | 23.44 |
| | | 95% Modified-t UCL (Johnson-1978) | 25.18 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.69 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.721 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.243 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.296 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.001 | k star (bias corrected MLE) | 1.959 |
| Theta hat (MLE) | 6.42 | Theta star (bias corrected MLE) | 9.834 |
| nu hat (MLE) | 48.01 | nu star (bias corrected) | 31.34 |
| MLE Mean (bias corrected) | 19.26 | MLE Sd (bias corrected) | 13.76 |
| | | Approximate Chi Square Value (0.05) | 19.55 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 17.23 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 30.88 | 95% Adjusted Gamma UCL (use when n<50) | 35.03 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.776 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.277 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.194 | Mean of logged Data | 2.782 |

| | | | |
|---|---|---|---|
| Maximum of Logged Data | 3.332 | SD of logged Data | 0.746 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 47.4 | 90% Chebyshev (MVUE) UCL | 36.96 |
| 95% Chebyshev (MVUE) UCL | 44.42 | 97.5% Chebyshev (MVUE) UCL | 54.78 |
| 99% Chebyshev (MVUE) UCL | 75.13 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 24.55 | 95% Jackknife UCL | 25.35 |
| 95% Standard Bootstrap UCL | 24.31 | 95% Bootstrap-t UCL | 24.38 |
| 95% Hall's Bootstrap UCL | 23.46 | 95% Percentile Bootstrap UCL | 23.88 |
| 95% BCA Bootstrap UCL | 23.63 | | |
| 90% Chebyshev(Mean, Sd) UCL | 28.9 | 95% Chebyshev(Mean, Sd) UCL | 33.27 |
| 97.5% Chebyshev(Mean, Sd) UCL | 39.33 | 99% Chebyshev(Mean, Sd) UCL | 51.23 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 25.35 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Zinc

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 8 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 0 |
| Minimum | 19 | Mean | 98.63 |
| Maximum | 190 | Median | 110 |
| SD | 56.36 | Std. Error of Mean | 19.93 |
| Coefficient of Variation | 0.571 | Skewness | 0.058 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**

**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**

**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.961 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.205 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | |
|---|---|
| **95% Normal UCL** | **95% UCLs (Adjusted for Skewness)** |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 1027 | 95% Student's-t UCL | 136.4 | 95% Adjusted-CLT UCL (Chen-1995) | 131.8 |
| 1028 | | | 95% Modified-t UCL (Johnson-1978) | 136.4 |
| 1029 | | | | |
| 1030 | **Gamma GOF Test** | | | |
| 1031 | A-D Test Statistic | 0.381 | **Anderson-Darling Gamma GOF Test** | |
| 1032 | 5% A-D Critical Value | 0.723 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 1033 | K-S Test Statistic | 0.275 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 1034 | 5% K-S Critical Value | 0.297 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 1035 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 1036 | | | | |
| 1037 | **Gamma Statistics** | | | |
| 1038 | k hat (MLE) | 2.554 | k star (bias corrected MLE) | 1.68 |
| 1039 | Theta hat (MLE) | 38.61 | Theta star (bias corrected MLE) | 58.71 |
| 1040 | nu hat (MLE) | 40.87 | nu star (bias corrected) | 26.88 |
| 1041 | MLE Mean (bias corrected) | 98.63 | MLE Sd (bias corrected) | 76.09 |
| 1042 | | | Approximate Chi Square Value (0.05) | 16.06 |
| 1043 | Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 13.98 |
| 1044 | | | | |
| 1045 | **Assuming Gamma Distribution** | | | |
| 1046 | 95% Approximate Gamma UCL (use when n>=50)) | 165.1 | 95% Adjusted Gamma UCL (use when n<50) | 189.6 |
| 1047 | | | | |
| 1048 | **Lognormal GOF Test** | | | |
| 1049 | Shapiro Wilk Test Statistic | 0.893 | **Shapiro Wilk Lognormal GOF Test** | |
| 1050 | 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| 1051 | Lilliefors Test Statistic | 0.284 | **Lilliefors Lognormal GOF Test** | |
| 1052 | 5% Lilliefors Critical Value | 0.283 | Data Not Lognormal at 5% Significance Level | |
| 1053 | **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| 1054 | | | | |
| 1055 | **Lognormal Statistics** | | | |
| 1056 | Minimum of Logged Data | 2.944 | Mean of logged Data | 4.383 |
| 1057 | Maximum of Logged Data | 5.247 | SD of logged Data | 0.773 |
| 1058 | | | | |
| 1059 | **Assuming Lognormal Distribution** | | | |
| 1060 | 95% H-UCL | 251.3 | 90% Chebyshev (MVUE) UCL | 189.5 |
| 1061 | 95% Chebyshev (MVUE) UCL | 228.5 | 97.5% Chebyshev (MVUE) UCL | 282.7 |
| 1062 | 99% Chebyshev (MVUE) UCL | 389.1 | | |
| 1063 | | | | |
| 1064 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 1065 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 1066 | | | | |
| 1067 | **Nonparametric Distribution Free UCLs** | | | |
| 1068 | 95% CLT UCL | 131.4 | 95% Jackknife UCL | 136.4 |
| 1069 | 95% Standard Bootstrap UCL | 128.4 | 95% Bootstrap-t UCL | 136.7 |
| 1070 | 95% Hall's Bootstrap UCL | 132.3 | 95% Percentile Bootstrap UCL | 128.8 |
| 1071 | 95% BCA Bootstrap UCL | 129.9 | | |
| 1072 | 90% Chebyshev(Mean, Sd) UCL | 158.4 | 95% Chebyshev(Mean, Sd) UCL | 185.5 |
| 1073 | 97.5% Chebyshev(Mean, Sd) UCL | 223.1 | 99% Chebyshev(Mean, Sd) UCL | 296.9 |
| 1074 | | | | |
| 1075 | **Suggested UCL to Use** | | | |
| 1076 | 95% Student's-t UCL | 136.4 | | |
| 1077 | | | | |
| 1078 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 1079 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 1080 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1081 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 1082 | | | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | UCL Statistics for Uncensored Full Data Sets | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | User Selected Options | | | | | | | | | | | |
| 4 | Date/Time of Computation | | | ProUCL 5.12/11/2021 11:51:48 AM | | | | | | | | |
| 5 | From File | | | UCL UTL concentrations USFS Big Blue_e.xls | | | | | | | | |
| 6 | Full Precision | | | OFF | | | | | | | | |
| 7 | Confidence Coefficient | | | 95% | | | | | | | | |
| 8 | Number of Bootstrap Operations | | | 2000 | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | Antimony | | | | | | | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | General Statistics | | | | | | | | | | | |
| 14 | Total Number of Observations | | | | | 6 | Number of Distinct Observations | | | | | 6 |
| 15 | | | | | | | Number of Missing Observations | | | | | 9 |
| 16 | Minimum | | | | | 27 | Mean | | | | | 58.67 |
| 17 | Maximum | | | | | 95 | Median | | | | | 55.5 |
| 18 | SD | | | | | 32.96 | Std. Error of Mean | | | | | 13.46 |
| 19 | Coefficient of Variation | | | | | 0.562 | Skewness | | | | | 0.0889 |
| 20 | | | | | | | | | | | | |
| 21 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use | | | | | | | | | | | |
| 22 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. | | | | | | | | | | | |
| 23 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). | | | | | | | | | | | |
| 24 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1 | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 26 | Normal GOF Test | | | | | | | | | | | |
| 27 | Shapiro Wilk Test Statistic | | | | | 0.79 | Shapiro Wilk GOF Test | | | | | |
| 28 | 5% Shapiro Wilk Critical Value | | | | | 0.788 | Data appear Normal at 5% Significance Level | | | | | |
| 29 | Lilliefors Test Statistic | | | | | 0.291 | Lilliefors GOF Test | | | | | |
| 30 | 5% Lilliefors Critical Value | | | | | 0.325 | Data appear Normal at 5% Significance Level | | | | | |
| 31 | Data appear Normal at 5% Significance Level | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | Assuming Normal Distribution | | | | | | | | | | | |
| 34 | 95% Normal UCL | | | | | | 95% UCLs (Adjusted for Skewness) | | | | | |
| 35 | 95% Student's-t UCL | | | | | 85.78 | 95% Adjusted-CLT UCL (Chen-1995) | | | | | 81.32 |
| 36 | | | | | | | 95% Modified-t UCL (Johnson-1978) | | | | | 85.87 |
| 37 | | | | | | | | | | | | |
| 38 | Gamma GOF Test | | | | | | | | | | | |
| 39 | A-D Test Statistic | | | | | 0.729 | Anderson-Darling Gamma GOF Test | | | | | |
| 40 | 5% A-D Critical Value | | | | | 0.701 | Data Not Gamma Distributed at 5% Significance Level | | | | | |
| 41 | K-S Test Statistic | | | | | 0.299 | Kolmogorov-Smirnov Gamma GOF Test | | | | | |
| 42 | 5% K-S Critical Value | | | | | 0.334 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 43 | Detected data follow Appr. Gamma Distribution at 5% Significance Level | | | | | | | | | | | |
| 44 | | | | | | | | | | | | |
| 45 | Gamma Statistics | | | | | | | | | | | |
| 46 | k hat (MLE) | | | | | 3.479 | k star (bias corrected MLE) | | | | | 1.851 |
| 47 | Theta hat (MLE) | | | | | 16.86 | Theta star (bias corrected MLE) | | | | | 31.7 |
| 48 | nu hat (MLE) | | | | | 41.75 | nu star (bias corrected) | | | | | 22.21 |
| 49 | MLE Mean (bias corrected) | | | | | 58.67 | MLE Sd (bias corrected) | | | | | 43.12 |
| 50 | | | | | | | Approximate Chi Square Value (0.05) | | | | | 12.49 |
| 51 | Adjusted Level of Significance | | | | | 0.0122 | Adjusted Chi Square Value | | | | | 9.968 |
| 52 | | | | | | | | | | | | |
| 53 | Assuming Gamma Distribution | | | | | | | | | | | |
| 54 | 95% Approximate Gamma UCL (use when n>=50)) | | | | | 104.3 | 95% Adjusted Gamma UCL (use when n<50) | | | | | 130.7 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.784 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.27 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Lognormal at 5% Significance Level | |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.296 | Mean of logged Data | 3.921 |
| Maximum of Logged Data | 4.554 | SD of logged Data | 0.616 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 136.8 | 90% Chebyshev (MVUE) UCL | 103.2 |
| 95% Chebyshev (MVUE) UCL | 123.2 | 97.5% Chebyshev (MVUE) UCL | 151 |
| 99% Chebyshev (MVUE) UCL | 205.7 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 80.8 | 95% Jackknife UCL | 85.78 |
| 95% Standard Bootstrap UCL | 78.96 | 95% Bootstrap-t UCL | 92.1 |
| 95% Hall's Bootstrap UCL | 70.46 | 95% Percentile Bootstrap UCL | 79.17 |
| 95% BCA Bootstrap UCL | 78.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 99.04 | 95% Chebyshev(Mean, Sd) UCL | 117.3 |
| 97.5% Chebyshev(Mean, Sd) UCL | 142.7 | 99% Chebyshev(Mean, Sd) UCL | 192.6 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 85.78 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Arsenic**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 15 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 65 | Mean | 13789 |
| Maximum | 90189 | Median | 1833 |
| SD | 23482 | Std. Error of Mean | 6063 |
| Coefficient of Variation | 1.703 | Skewness | 2.778 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.625 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.279 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data Not Normal at 5% Significance Level | |

**Data Not Normal at 5% Significance Level**

| | | | |
|---|---|---|---|
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 24468 | 95% Adjusted-CLT UCL (Chen-1995) | 28408 |
| | | 95% Modified-t UCL (Johnson-1978) | 25193 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.402 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.809 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.205 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.236 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 0.423 | k star (bias corrected MLE) | 0.383 |
| Theta hat (MLE) | 32577 | Theta star (bias corrected MLE) | 35997 |
| nu hat (MLE) | 12.7 | nu star (bias corrected) | 11.49 |
| MLE Mean (bias corrected) | 13789 | MLE Sd (bias corrected) | 22280 |
| | | Approximate Chi Square Value (0.05) | 4.895 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 4.376 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 32378 | 95% Adjusted Gamma UCL (use when n<50) | 36217 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.949 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.168 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 4.174 | Mean of logged Data | 7.991 |
| Maximum of Logged Data | 11.41 | SD of logged Data | 2.169 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 530740 | 90% Chebyshev (MVUE) UCL | 61535 |
| 95% Chebyshev (MVUE) UCL | 79866 | 97.5% Chebyshev (MVUE) UCL | 105310 |
| 99% Chebyshev (MVUE) UCL | 155290 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 23762 | 95% Jackknife UCL | 24468 |
| 95% Standard Bootstrap UCL | 23630 | 95% Bootstrap-t UCL | 36658 |
| 95% Hall's Bootstrap UCL | 60031 | 95% Percentile Bootstrap UCL | 24951 |
| 95% BCA Bootstrap UCL | 29656 | | |
| 90% Chebyshev(Mean, Sd) UCL | 31978 | 95% Chebyshev(Mean, Sd) UCL | 40217 |
| 97.5% Chebyshev(Mean, Sd) UCL | 51652 | 99% Chebyshev(Mean, Sd) UCL | 74115 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Adjusted Gamma UCL | 36217 | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Chromium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 7 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 8 |
| Minimum | 23 | Mean | 34 |
| Maximum | 46 | Median | 33 |
| SD | 7.895 | Std. Error of Mean | 2.984 |
| Coefficient of Variation | 0.232 | Skewness | 0.245 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.975 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.165 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 39.8 | 95% Adjusted-CLT UCL (Chen-1995) | 39.2 |
| | | 95% Modified-t UCL (Johnson-1978) | 39.84 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.19 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.707 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.169 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.311 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 21.4 | k star (bias corrected MLE) | 12.33 |
| Theta hat (MLE) | 1.589 | Theta star (bias corrected MLE) | 2.758 |
| nu hat (MLE) | 299.6 | nu star (bias corrected) | 172.6 |
| MLE Mean (bias corrected) | 34 | MLE Sd (bias corrected) | 9.684 |
| | | Approximate Chi Square Value (0.05) | 143.2 |
| Adjusted Level of Significance | 0.0158 | Adjusted Chi Square Value | 135.1 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 40.98 | 95% Adjusted Gamma UCL (use when n<50) | 43.43 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.977 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.146 | **Lilliefors Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.304 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.135 | Mean of logged Data | 3.503 |
| Maximum of Logged Data | 3.829 | SD of logged Data | 0.236 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 41.63 | 90% Chebyshev (MVUE) UCL | 43.12 |
| 95% Chebyshev (MVUE) UCL | 47.25 | 97.5% Chebyshev (MVUE) UCL | 52.97 |
| 99% Chebyshev (MVUE) UCL | 64.22 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 38.91 | 95% Jackknife UCL | 39.8 |
| 95% Standard Bootstrap UCL | 38.51 | 95% Bootstrap-t UCL | 40.37 |
| 95% Hall's Bootstrap UCL | 39.99 | 95% Percentile Bootstrap UCL | 38.71 |
| 95% BCA Bootstrap UCL | 38.29 | | |
| 90% Chebyshev(Mean, Sd) UCL | 42.95 | 95% Chebyshev(Mean, Sd) UCL | 47.01 |
| 97.5% Chebyshev(Mean, Sd) UCL | 52.64 | 99% Chebyshev(Mean, Sd) UCL | 63.69 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 39.8 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 3 |
| Minimum | 7 | Mean | 25.2 |
| Maximum | 76 | Median | 18 |
| SD | 21.42 | Std. Error of Mean | 6.774 |
| Coefficient of Variation | 0.85 | Skewness | 1.701 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.82 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.204 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 37.62 | 95% Adjusted-CLT UCL (Chen-1995) | 40.23 |
| | | 95% Modified-t UCL (Johnson-1978) | 38.22 |

| | | | |
|---|---|---|---|
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.277 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.736 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.159 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.27 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 1.916 | k star (bias corrected MLE) | 1.408 |
| Theta hat (MLE) | 13.15 | Theta star (bias corrected MLE) | 17.9 |
| nu hat (MLE) | 38.32 | nu star (bias corrected) | 28.16 |
| MLE Mean (bias corrected) | 25.2 | MLE Sd (bias corrected) | 21.24 |
| | | Approximate Chi Square Value (0.05) | 17.05 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 15.57 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 41.61 | 95% Adjusted Gamma UCL (use when n<50) | 45.58 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.962 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.118 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.946 | Mean of logged Data | 2.944 |
| Maximum of Logged Data | 4.331 | SD of logged Data | 0.782 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 51.84 | 90% Chebyshev (MVUE) UCL | 43.96 |
| 95% Chebyshev (MVUE) UCL | 52.62 | 97.5% Chebyshev (MVUE) UCL | 64.63 |
| 99% Chebyshev (MVUE) UCL | 88.24 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 36.34 | 95% Jackknife UCL | 37.62 |
| 95% Standard Bootstrap UCL | 35.85 | 95% Bootstrap-t UCL | 47.3 |
| 95% Hall's Bootstrap UCL | 88.61 | 95% Percentile Bootstrap UCL | 36.8 |
| 95% BCA Bootstrap UCL | 39.9 | | |
| 90% Chebyshev(Mean, Sd) UCL | 45.52 | 95% Chebyshev(Mean, Sd) UCL | 54.73 |
| 97.5% Chebyshev(Mean, Sd) UCL | 67.5 | 99% Chebyshev(Mean, Sd) UCL | 92.6 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 37.62 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 15 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 8 | Mean | 1360 |
| Maximum | 6956 | Median | 874 |
| SD | 1812 | Std. Error of Mean | 467.8 |
| Coefficient of Variation | 1.332 | Skewness | 2.358 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.728 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.228 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 2184 | 95% Adjusted-CLT UCL (Chen-1995) | 2434 |
| | | 95% Modified-t UCL (Johnson-1978) | 2231 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.16 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.787 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.115 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.233 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 0.588 | k star (bias corrected MLE) | 0.515 |
| Theta hat (MLE) | 2312 | Theta star (bias corrected MLE) | 2640 |
| nu hat (MLE) | 17.65 | nu star (bias corrected) | 15.45 |
| MLE Mean (bias corrected) | 1360 | MLE Sd (bias corrected) | 1895 |
| | | Approximate Chi Square Value (0.05) | 7.577 |
| Adjusted Level of Significance | 0.0324 | Adjusted Chi Square Value | 6.907 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 2773 | 95% Adjusted Gamma UCL (use when n<50) | 3042 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.941 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.161 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.079 | Mean of logged Data | 6.162 |
| Maximum of Logged Data | 8.847 | SD of logged Data | 1.876 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 24048 | 90% Chebyshev (MVUE) UCL | 5710 |
| 95% Chebyshev (MVUE) UCL | 7329 | 97.5% Chebyshev (MVUE) UCL | 9576 |
| 99% Chebyshev (MVUE) UCL | 13991 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 2129 | 95% Jackknife UCL | 2184 |
| 95% Standard Bootstrap UCL | 2105 | 95% Bootstrap-t UCL | 2925 |
| 95% Hall's Bootstrap UCL | 5542 | 95% Percentile Bootstrap UCL | 2162 |
| 95% BCA Bootstrap UCL | 2337 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2763 | 95% Chebyshev(Mean, Sd) UCL | 3399 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4281 | 99% Chebyshev(Mean, Sd) UCL | 6014 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 3042 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 13 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 2 |
| Minimum | 6 | Mean | 205.5 |
| Maximum | 1458 | Median | 19 |
| SD | 423 | Std. Error of Mean | 117.3 |
| Coefficient of Variation | 2.059 | Skewness | 2.625 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.554 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.36 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 414.6 | 95% Adjusted-CLT UCL (Chen-1995) | 489.7 |
| | | 95% Modified-t UCL (Johnson-1978) | 428.8 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.358 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.812 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.297 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.253 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.388 | k star (bias corrected MLE) | 0.35 |
| Theta hat (MLE) | 529.6 | Theta star (bias corrected MLE) | 587.6 |
| nu hat (MLE) | 10.09 | nu star (bias corrected) | 9.092 |
| MLE Mean (bias corrected) | 205.5 | MLE Sd (bias corrected) | 347.4 |
| | | Approximate Chi Square Value (0.05) | 3.383 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 2.905 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 552.3 | 95% Adjusted Gamma UCL (use when n<50) | 643.1 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.239 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.792 | Mean of logged Data | 3.621 |
| Maximum of Logged Data | 7.285 | SD of logged Data | 1.833 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 2065 | 90% Chebyshev (MVUE) UCL | 414.1 |
| 95% Chebyshev (MVUE) UCL | 532.2 | 97.5% Chebyshev (MVUE) UCL | 696.1 |
| 99% Chebyshev (MVUE) UCL | 1018 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 398.4 | 95% Jackknife UCL | 414.6 |
| 95% Standard Bootstrap UCL | 395.7 | 95% Bootstrap-t UCL | 1121 |
| 95% Hall's Bootstrap UCL | 1214 | 95% Percentile Bootstrap UCL | 418.4 |
| 95% BCA Bootstrap UCL | 512.2 | | |
| 90% Chebyshev(Mean, Sd) UCL | 557.4 | 95% Chebyshev(Mean, Sd) UCL | 716.9 |
| 97.5% Chebyshev(Mean, Sd) UCL | 938.2 | 99% Chebyshev(Mean, Sd) UCL | 1373 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 99% Chebyshev (Mean, Sd) UCL | 1373 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Molybdenum**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 6 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 3 |
| Minimum | 3 | Mean | 8.333 |
| Maximum | 18 | Median | 6.5 |

| | | | |
|---|---|---|---|
| SD | 5.75 | Std. Error of Mean | 2.348 |
| Coefficient of Variation | 0.69 | Skewness | 1.077 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.893 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.219 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 13.06 | 95% Adjusted-CLT UCL (Chen-1995) | 13.3 |
| | | 95% Modified-t UCL (Johnson-1978) | 13.24 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.255 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.702 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.214 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.335 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.714 | k star (bias corrected MLE) | 1.468 |
| Theta hat (MLE) | 3.071 | Theta star (bias corrected MLE) | 5.677 |
| nu hat (MLE) | 32.56 | nu star (bias corrected) | 17.62 |
| MLE Mean (bias corrected) | 8.333 | MLE Sd (bias corrected) | 6.878 |
| | | Approximate Chi Square Value (0.05) | 9.114 |
| Adjusted Level of Significance | 0.0122 | Adjusted Chi Square Value | 7.018 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 16.11 | 95% Adjusted Gamma UCL (use when n<50) | 20.92 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.178 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.925 |
| Maximum of Logged Data | 2.89 | SD of logged Data | 0.684 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 22.56 | 90% Chebyshev (MVUE) UCL | 15.21 |
| 95% Chebyshev (MVUE) UCL | 18.34 | 97.5% Chebyshev (MVUE) UCL | 22.69 |
| 99% Chebyshev (MVUE) UCL | 31.23 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 12.19 | 95% Jackknife UCL | 13.06 |
| 95% Standard Bootstrap UCL | 11.84 | 95% Bootstrap-t UCL | 16.5 |
| 95% Hall's Bootstrap UCL | 31.31 | 95% Percentile Bootstrap UCL | 12.17 |
| 95% BCA Bootstrap UCL | 12.5 | | |
| 90% Chebyshev(Mean, Sd) UCL | 15.38 | 95% Chebyshev(Mean, Sd) UCL | 18.57 |
| 97.5% Chebyshev(Mean, Sd) UCL | 22.99 | 99% Chebyshev(Mean, Sd) UCL | 31.69 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 13.06 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Nickel**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 3 |
| Minimum | 8 | Mean | 16.1 |
| Maximum | 23 | Median | 16 |
| SD | 5.363 | Std. Error of Mean | 1.696 |
| Coefficient of Variation | 0.333 | Skewness | -0.112 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.934 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.166 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 19.21 | 95% Adjusted-CLT UCL (Chen-1995) | 18.83 |
| | | 95% Modified-t UCL (Johnson-1978) | 19.2 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.332 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.726 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.184 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 9.067 | k star (bias corrected MLE) | 6.413 |
| Theta hat (MLE) | 1.776 | Theta star (bias corrected MLE) | 2.51 |
| nu hat (MLE) | 181.3 | nu star (bias corrected) | 128.3 |
| MLE Mean (bias corrected) | 16.1 | MLE Sd (bias corrected) | 6.357 |

| | | | |
|---|---|---|---|
| | | Approximate Chi Square Value (0.05) | 103.1 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 99.19 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 20.03 | 95% Adjusted Gamma UCL (use when n<50) | 20.82 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.924 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.173 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.079 | Mean of logged Data | 2.723 |
| Maximum of Logged Data | 3.135 | SD of logged Data | 0.365 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 20.87 | 90% Chebyshev (MVUE) UCL | 21.8 |
| 95% Chebyshev (MVUE) UCL | 24.36 | 97.5% Chebyshev (MVUE) UCL | 27.91 |
| 99% Chebyshev (MVUE) UCL | 34.89 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 18.89 | 95% Jackknife UCL | 19.21 |
| 95% Standard Bootstrap UCL | 18.69 | 95% Bootstrap-t UCL | 19.11 |
| 95% Hall's Bootstrap UCL | 18.63 | 95% Percentile Bootstrap UCL | 18.8 |
| 95% BCA Bootstrap UCL | 18.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 21.19 | 95% Chebyshev(Mean, Sd) UCL | 23.49 |
| 97.5% Chebyshev(Mean, Sd) UCL | 26.69 | 99% Chebyshev(Mean, Sd) UCL | 32.98 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 19.21 | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| **Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be** | | | |
| **reliable.  Chen's and Johnson's methods provide adjustments for positvely skewed data sets.** | | | |
| | | | |
| | | | |
| Silver | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 8 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 7 |
| Minimum | 10 | Mean | 49 |
| Maximum | 190 | Median | 26.5 |
| SD | 59.96 | Std. Error of Mean | 21.2 |
| Coefficient of Variation | 1.224 | Skewness | 2.339 |

| | | | |
|---|---|---|---|
| Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1 | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.675 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.316 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 89.16 | 95% Adjusted-CLT UCL (Chen-1995) | 102.6 |
| | | 95% Modified-t UCL (Johnson-1978) | 92.09 |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.549 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.732 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.224 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.3 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 1.224 | k star (bias corrected MLE) | 0.848 |
| Theta hat (MLE) | 40.04 | Theta star (bias corrected MLE) | 57.77 |
| nu hat (MLE) | 19.58 | nu star (bias corrected) | 13.57 |
| MLE Mean (bias corrected) | 49 | MLE Sd (bias corrected) | 53.2 |
| | | Approximate Chi Square Value (0.05) | 6.279 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 5.08 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50) | 105.9 | 95% Adjusted Gamma UCL (use when n<50) | 130.9 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.195 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.303 | Mean of logged Data | 3.431 |
| Maximum of Logged Data | 5.247 | SD of logged Data | 0.954 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 160.9 | 90% Chebyshev (MVUE) UCL | 92.06 |
| 95% Chebyshev (MVUE) UCL | 113.2 | 97.5% Chebyshev (MVUE) UCL | 142.7 |
| 99% Chebyshev (MVUE) UCL | 200.4 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 83.87 | 95% Jackknife UCL | 89.16 |
| 95% Standard Bootstrap UCL | 81.8 | 95% Bootstrap-t UCL | 197.1 |
| 95% Hall's Bootstrap UCL | 236.5 | 95% Percentile Bootstrap UCL | 85.5 |
| 95% BCA Bootstrap UCL | 100.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 112.6 | 95% Chebyshev(Mean, Sd) UCL | 141.4 |
| 97.5% Chebyshev(Mean, Sd) UCL | 181.4 | 99% Chebyshev(Mean, Sd) UCL | 259.9 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 130.9 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Vanadium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 12 | Number of Distinct Observations | 12 |
| | | Number of Missing Observations | 3 |
| Minimum | 98 | Mean | 182.7 |
| Maximum | 261 | Median | 187.5 |
| SD | 55.65 | Std. Error of Mean | 16.06 |
| Coefficient of Variation | 0.305 | Skewness | 0.0729 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.935 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.167 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 211.5 | 95% Adjusted-CLT UCL (Chen-1995) | 209.5 |
| | | 95% Modified-t UCL (Johnson-1978) | 211.6 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.328 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.73 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.156 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.245 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 11.13 | k star (bias corrected MLE) | 8.401 |
| Theta hat (MLE) | 16.42 | Theta star (bias corrected MLE) | 21.74 |
| nu hat (MLE) | 267.1 | nu star (bias corrected) | 201.6 |
| MLE Mean (bias corrected) | 182.7 | MLE Sd (bias corrected) | 63.02 |
| | | Approximate Chi Square Value (0.05) | 169.8 |
| Adjusted Level of Significance | 0.029 | Adjusted Chi Square Value | 165.3 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 216.9 | 95% Adjusted Gamma UCL (use when n<50) | 222.8 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.937 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.162 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.585 | Mean of logged Data | 5.162 |
| Maximum of Logged Data | 5.565 | SD of logged Data | 0.322 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 222.1 | 90% Chebyshev (MVUE) UCL | 234.5 |
| 95% Chebyshev (MVUE) UCL | 257.9 | 97.5% Chebyshev (MVUE) UCL | 290.3 |
| 99% Chebyshev (MVUE) UCL | 354 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 209.1 | 95% Jackknife UCL | 211.5 |
| 95% Standard Bootstrap UCL | 208.2 | 95% Bootstrap-t UCL | 213.6 |
| 95% Hall's Bootstrap UCL | 208.6 | 95% Percentile Bootstrap UCL | 207.9 |
| 95% BCA Bootstrap UCL | 207.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 230.9 | 95% Chebyshev(Mean, Sd) UCL | 252.7 |
| 97.5% Chebyshev(Mean, Sd) UCL | 283 | 99% Chebyshev(Mean, Sd) UCL | 342.5 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 211.5 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 15 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 23 | Mean | 123 |
| Maximum | 550 | Median | 87 |
| SD | 126.9 | Std. Error of Mean | 32.77 |
| Coefficient of Variation | 1.032 | Skewness | 3.045 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.626 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.881 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.287 | **Lilliefors GOF Test** |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 811 | | | | | 5% Lilliefors Critical Value | 0.22 | Data Not Normal at 5% Significance Level | | | | | |
| 812 | **Data Not Normal at 5% Significance Level** | | | | | | | | | | | |
| 813 | | | | | | | | | | | | |
| 814 | **Assuming Normal Distribution** | | | | | | | | | | | |
| 815 | **95% Normal UCL** | | | | | | **95% UCLs (Adjusted for Skewness)** | | | | | |
| 816 | | | | | 95% Student's-t UCL | 180.7 | | | | | 95% Adjusted-CLT UCL (Chen-1995) | 204.4 |
| 817 | | | | | | | | | | | 95% Modified-t UCL (Johnson-1978) | 185 |
| 818 | | | | | | | | | | | | |
| 819 | **Gamma GOF Test** | | | | | | | | | | | |
| 820 | | | | | A-D Test Statistic | 0.629 | **Anderson-Darling Gamma GOF Test** | | | | | |
| 821 | | | | | 5% A-D Critical Value | 0.749 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 822 | | | | | K-S Test Statistic | 0.211 | **Kolmogorov-Smirnov Gamma GOF Test** | | | | | |
| 823 | | | | | 5% K-S Critical Value | 0.225 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 824 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | | | | | | | | | |
| 825 | | | | | | | | | | | | |
| 826 | **Gamma Statistics** | | | | | | | | | | | |
| 827 | | | | | k hat (MLE) | 1.829 | | | | | k star (bias corrected MLE) | 1.508 |
| 828 | | | | | Theta hat (MLE) | 67.24 | | | | | Theta star (bias corrected MLE) | 81.58 |
| 829 | | | | | nu hat (MLE) | 54.88 | | | | | nu star (bias corrected) | 45.23 |
| 830 | | | | | MLE Mean (bias corrected) | 123 | | | | | MLE Sd (bias corrected) | 100.2 |
| 831 | | | | | | | | | | | Approximate Chi Square Value (0.05) | 30.81 |
| 832 | | | | | Adjusted Level of Significance | 0.0324 | | | | | Adjusted Chi Square Value | 29.34 |
| 833 | | | | | | | | | | | | |
| 834 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 835 | | | | | 95% Approximate Gamma UCL (use when n>=50) | 180.6 | | | | | 95% Adjusted Gamma UCL (use when n<50) | 189.6 |
| 836 | | | | | | | | | | | | |
| 837 | **Lognormal GOF Test** | | | | | | | | | | | |
| 838 | | | | | Shapiro Wilk Test Statistic | 0.963 | **Shapiro Wilk Lognormal GOF Test** | | | | | |
| 839 | | | | | 5% Shapiro Wilk Critical Value | 0.881 | Data appear Lognormal at 5% Significance Level | | | | | |
| 840 | | | | | Lilliefors Test Statistic | 0.154 | **Lilliefors Lognormal GOF Test** | | | | | |
| 841 | | | | | 5% Lilliefors Critical Value | 0.22 | Data appear Lognormal at 5% Significance Level | | | | | |
| 842 | **Data appear Lognormal at 5% Significance Level** | | | | | | | | | | | |
| 843 | | | | | | | | | | | | |
| 844 | **Lognormal Statistics** | | | | | | | | | | | |
| 845 | | | | | Minimum of Logged Data | 3.135 | | | | | Mean of logged Data | 4.515 |
| 846 | | | | | Maximum of Logged Data | 6.31 | | | | | SD of logged Data | 0.748 |
| 847 | | | | | | | | | | | | |
| 848 | **Assuming Lognormal Distribution** | | | | | | | | | | | |
| 849 | | | | | 95% H-UCL | 194.1 | | | | | 90% Chebyshev (MVUE) UCL | 190.6 |
| 850 | | | | | 95% Chebyshev (MVUE) UCL | 223.5 | | | | | 97.5% Chebyshev (MVUE) UCL | 269.1 |
| 851 | | | | | 99% Chebyshev (MVUE) UCL | 358.7 | | | | | | |
| 852 | | | | | | | | | | | | |
| 853 | **Nonparametric Distribution Free UCL Statistics** | | | | | | | | | | | |
| 854 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | | | | | | | | | |
| 855 | | | | | | | | | | | | |
| 856 | **Nonparametric Distribution Free UCLs** | | | | | | | | | | | |
| 857 | | | | | 95% CLT UCL | 176.9 | | | | | 95% Jackknife UCL | 180.7 |
| 858 | | | | | 95% Standard Bootstrap UCL | 175.9 | | | | | 95% Bootstrap-t UCL | 259.2 |
| 859 | | | | | 95% Hall's Bootstrap UCL | 393.8 | | | | | 95% Percentile Bootstrap UCL | 180.9 |
| 860 | | | | | 95% BCA Bootstrap UCL | 214.3 | | | | | | |
| 861 | | | | | 90% Chebyshev(Mean, Sd) UCL | 221.3 | | | | | 95% Chebyshev(Mean, Sd) UCL | 265.8 |
| 862 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 327.6 | | | | | 99% Chebyshev(Mean, Sd) UCL | 449 |
| 863 | | | | | | | | | | | | |
| 864 | **Suggested UCL to Use** | | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 865 | | | | | 95% Adjusted Gamma UCL | 189.6 | | | | | | |
| 866 | | | | | | | | | | | | |
| 867 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 868 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 869 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 870 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 871 | | | | | | | | | | | | |

## UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.12/11/2021 11:53:33 AM |
| From File | UCL UTL concentrations USFS Big Blue_g.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

**Arsenic**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 16 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 22 | Mean | 100.8 |
| Maximum | 369 | Median | 69 |
| SD | 94.41 | Std. Error of Mean | 23.6 |
| Coefficient of Variation | 0.937 | Skewness | 1.984 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.76 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.25 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 142.1 | 95% Adjusted-CLT UCL (Chen-1995) | 152.1 |
| | | 95% Modified-t UCL (Johnson-1978) | 144.1 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.459 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.753 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.163 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.218 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.695 | k star (bias corrected MLE) | 1.419 |
| Theta hat (MLE) | 59.44 | Theta star (bias corrected MLE) | 71.01 |
| nu hat (MLE) | 54.24 | nu star (bias corrected) | 45.4 |
| MLE Mean (bias corrected) | 100.8 | MLE Sd (bias corrected) | 84.58 |
| | | Approximate Chi Square Value (0.05) | 30.94 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 29.59 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 147.8 | 95% Adjusted Gamma UCL (use when n<50) | 154.6 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.966 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.109 | **Lilliefors Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.091 | Mean of logged Data | 4.29 |
| Maximum of Logged Data | 5.911 | SD of logged Data | 0.807 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 167.3 | 90% Chebyshev (MVUE) UCL | 162.3 |
| 95% Chebyshev (MVUE) UCL | 191.3 | 97.5% Chebyshev (MVUE) UCL | 231.4 |
| 99% Chebyshev (MVUE) UCL | 310.3 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 139.6 | 95% Jackknife UCL | 142.1 |
| 95% Standard Bootstrap UCL | 138.2 | 95% Bootstrap-t UCL | 182 |
| 95% Hall's Bootstrap UCL | 339.7 | 95% Percentile Bootstrap UCL | 144.3 |
| 95% BCA Bootstrap UCL | 151.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 171.6 | 95% Chebyshev(Mean, Sd) UCL | 203.6 |
| 97.5% Chebyshev(Mean, Sd) UCL | 248.1 | 99% Chebyshev(Mean, Sd) UCL | 335.6 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Adjusted Gamma UCL | 154.6 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Chromium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 6 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 10 |
| Minimum | 23 | Mean | 33 |
| Maximum | 44 | Median | 33.5 |
| SD | 9.338 | Std. Error of Mean | 3.812 |
| Coefficient of Variation | 0.283 | Skewness | 0.0265 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.84 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.273 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 109 | **Assuming Normal Distribution** | | | |
| 110 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 111 | 95% Student's-t UCL | 40.68 | 95% Adjusted-CLT UCL (Chen-1995) | 39.31 |
| 112 | | | 95% Modified-t UCL (Johnson-1978) | 40.69 |
| 113 | | | | |
| 114 | **Gamma GOF Test** | | | |
| 115 | A-D Test Statistic | 0.591 | **Anderson-Darling Gamma GOF Test** | |
| 116 | 5% A-D Critical Value | 0.698 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 117 | K-S Test Statistic | 0.301 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 118 | 5% K-S Critical Value | 0.332 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 119 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 120 | | | | |
| 121 | **Gamma Statistics** | | | |
| 122 | k hat (MLE) | 14.61 | k star (bias corrected MLE) | 7.415 |
| 123 | Theta hat (MLE) | 2.259 | Theta star (bias corrected MLE) | 4.45 |
| 124 | nu hat (MLE) | 175.3 | nu star (bias corrected) | 88.98 |
| 125 | MLE Mean (bias corrected) | 33 | MLE Sd (bias corrected) | 12.12 |
| 126 | | | Approximate Chi Square Value (0.05) | 68.23 |
| 127 | Adjusted Level of Significance | 0.0122 | Adjusted Chi Square Value | 61.7 |
| 128 | | | | |
| 129 | **Assuming Gamma Distribution** | | | |
| 130 | 95% Approximate Gamma UCL (use when n>=50)) | 43.03 | 95% Adjusted Gamma UCL (use when n<50) | 47.59 |
| 131 | | | | |
| 132 | **Lognormal GOF Test** | | | |
| 133 | Shapiro Wilk Test Statistic | 0.839 | **Shapiro Wilk Lognormal GOF Test** | |
| 134 | 5% Shapiro Wilk Critical Value | 0.788 | Data appear Lognormal at 5% Significance Level | |
| 135 | Lilliefors Test Statistic | 0.283 | **Lilliefors Lognormal GOF Test** | |
| 136 | 5% Lilliefors Critical Value | 0.325 | Data appear Lognormal at 5% Significance Level | |
| 137 | **Data appear Lognormal at 5% Significance Level** | | | |
| 138 | | | | |
| 139 | **Lognormal Statistics** | | | |
| 140 | Minimum of Logged Data | 3.135 | Mean of logged Data | 3.462 |
| 141 | Maximum of Logged Data | 3.784 | SD of logged Data | 0.29 |
| 142 | | | | |
| 143 | **Assuming Lognormal Distribution** | | | |
| 144 | 95% H-UCL | 44.3 | 90% Chebyshev (MVUE) UCL | 44.75 |
| 145 | 95% Chebyshev (MVUE) UCL | 50.07 | 97.5% Chebyshev (MVUE) UCL | 57.45 |
| 146 | 99% Chebyshev (MVUE) UCL | 71.94 | | |
| 147 | | | | |
| 148 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 149 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 150 | | | | |
| 151 | **Nonparametric Distribution Free UCLs** | | | |
| 152 | 95% CLT UCL | 39.27 | 95% Jackknife UCL | 40.68 |
| 153 | 95% Standard Bootstrap UCL | 38.76 | 95% Bootstrap-t UCL | 41.18 |
| 154 | 95% Hall's Bootstrap UCL | 36.6 | 95% Percentile Bootstrap UCL | 38.67 |
| 155 | 95% BCA Bootstrap UCL | 38.5 | | |
| 156 | 90% Chebyshev(Mean, Sd) UCL | 44.44 | 95% Chebyshev(Mean, Sd) UCL | 49.62 |
| 157 | 97.5% Chebyshev(Mean, Sd) UCL | 56.81 | 99% Chebyshev(Mean, Sd) UCL | 70.93 |
| 158 | | | | |
| 159 | **Suggested UCL to Use** | | | |
| 160 | 95% Student's-t UCL | 40.68 | | |
| 161 | | | | |
| 162 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 16 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 11 | Mean | 25.44 |
| Maximum | 72 | Median | 18.5 |
| SD | 17.82 | Std. Error of Mean | 4.456 |
| Coefficient of Variation | 0.701 | Skewness | 2.117 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.681 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.296 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 33.25 | 95% Adjusted-CLT UCL (Chen-1995) | 35.29 |
| | | 95% Modified-t UCL (Johnson-1978) | 33.64 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.171 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.21 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.216 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.356 | k star (bias corrected MLE) | 2.768 |
| Theta hat (MLE) | 7.58 | Theta star (bias corrected MLE) | 9.189 |
| nu hat (MLE) | 107.4 | nu star (bias corrected) | 88.58 |
| MLE Mean (bias corrected) | 25.44 | MLE Sd (bias corrected) | 15.29 |
| | | Approximate Chi Square Value (0.05) | 67.88 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 65.82 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 33.19 | 95% Adjusted Gamma UCL (use when n<50) | 34.23 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.876 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.168 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 2.398 | Mean of logged Data | 3.08 |

| | | | |
|---|---|---|---|
| Maximum of Logged Data | 4.277 | SD of logged Data | 0.529 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 33.25 | 90% Chebyshev (MVUE) UCL | 34.96 |
| 95% Chebyshev (MVUE) UCL | 39.57 | 97.5% Chebyshev (MVUE) UCL | 45.97 |
| 99% Chebyshev (MVUE) UCL | 58.53 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 32.77 | 95% Jackknife UCL | 33.25 |
| 95% Standard Bootstrap UCL | 32.46 | 95% Bootstrap-t UCL | 46.58 |
| 95% Hall's Bootstrap UCL | 76.82 | 95% Percentile Bootstrap UCL | 33.19 |
| 95% BCA Bootstrap UCL | 35.19 | | |
| 90% Chebyshev(Mean, Sd) UCL | 38.81 | 95% Chebyshev(Mean, Sd) UCL | 44.86 |
| 97.5% Chebyshev(Mean, Sd) UCL | 53.27 | 99% Chebyshev(Mean, Sd) UCL | 69.78 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Adjusted Gamma UCL | 34.23 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| Lead | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 16 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 6 | Mean | 25.19 |
| Maximum | 56 | Median | 21.5 |
| SD | 14.36 | Std. Error of Mean | 3.591 |
| Coefficient of Variation | 0.57 | Skewness | 0.65 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.15 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 31.48 | 95% Adjusted-CLT UCL (Chen-1995) | 31.72 |
| | | 95% Modified-t UCL (Johnson-1978) | 31.58 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.175 | **Anderson-Darling Gamma GOF Test** | |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 271 | | | | | 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 272 | | | | | K-S Test Statistic | 0.114 | **Kolmogorov-Smirnov Gamma GOF Test** | | | | | |
| 273 | | | | | 5% K-S Critical Value | 0.217 | Detected data appear Gamma Distributed at 5% Significance Level | | | | | |
| 274 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | | | | | | | | | |
| 275 | | | | | | | | | | | | |
| 276 | **Gamma Statistics** | | | | | | | | | | | |
| 277 | | | | | k hat (MLE) | 3.092 | | | | | k star (bias corrected MLE) | 2.554 |
| 278 | | | | | Theta hat (MLE) | 8.145 | | | | | Theta star (bias corrected MLE) | 9.862 |
| 279 | | | | | nu hat (MLE) | 98.95 | | | | | nu star (bias corrected) | 81.73 |
| 280 | | | | | MLE Mean (bias corrected) | 25.19 | | | | | MLE Sd (bias corrected) | 15.76 |
| 281 | | | | | | | | | | | Approximate Chi Square Value (0.05) | 61.9 |
| 282 | | | | | Adjusted Level of Significance | 0.0335 | | | | | Adjusted Chi Square Value | 59.94 |
| 283 | | | | | | | | | | | | |
| 284 | **Assuming Gamma Distribution** | | | | | | | | | | | |
| 285 | | | | | 95% Approximate Gamma UCL (use when n>=50)) | 33.26 | | | | | 95% Adjusted Gamma UCL (use when n<50) | 34.35 |
| 286 | | | | | | | | | | | | |
| 287 | **Lognormal GOF Test** | | | | | | | | | | | |
| 288 | | | | | Shapiro Wilk Test Statistic | 0.97 | **Shapiro Wilk Lognormal GOF Test** | | | | | |
| 289 | | | | | 5% Shapiro Wilk Critical Value | 0.887 | Data appear Lognormal at 5% Significance Level | | | | | |
| 290 | | | | | Lilliefors Test Statistic | 0.117 | **Lilliefors Lognormal GOF Test** | | | | | |
| 291 | | | | | 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level | | | | | |
| 292 | **Data appear Lognormal at 5% Significance Level** | | | | | | | | | | | |
| 293 | | | | | | | | | | | | |
| 294 | **Lognormal Statistics** | | | | | | | | | | | |
| 295 | | | | | Minimum of Logged Data | 1.792 | | | | | Mean of logged Data | 3.056 |
| 296 | | | | | Maximum of Logged Data | 4.025 | | | | | SD of logged Data | 0.632 |
| 297 | | | | | | | | | | | | |
| 298 | **Assuming Lognormal Distribution** | | | | | | | | | | | |
| 299 | | | | | 95% H-UCL | 37.1 | | | | | 90% Chebyshev (MVUE) UCL | 38.25 |
| 300 | | | | | 95% Chebyshev (MVUE) UCL | 43.99 | | | | | 97.5% Chebyshev (MVUE) UCL | 51.97 |
| 301 | | | | | 99% Chebyshev (MVUE) UCL | 67.64 | | | | | | |
| 302 | | | | | | | | | | | | |
| 303 | **Nonparametric Distribution Free UCL Statistics** | | | | | | | | | | | |
| 304 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | | | | | | | | | |
| 305 | | | | | | | | | | | | |
| 306 | **Nonparametric Distribution Free UCLs** | | | | | | | | | | | |
| 307 | | | | | 95% CLT UCL | 31.09 | | | | | 95% Jackknife UCL | 31.48 |
| 308 | | | | | 95% Standard Bootstrap UCL | 30.85 | | | | | 95% Bootstrap-t UCL | 32.15 |
| 309 | | | | | 95% Hall's Bootstrap UCL | 31.99 | | | | | 95% Percentile Bootstrap UCL | 31 |
| 310 | | | | | 95% BCA Bootstrap UCL | 31.31 | | | | | | |
| 311 | | | | | 90% Chebyshev(Mean, Sd) UCL | 35.96 | | | | | 95% Chebyshev(Mean, Sd) UCL | 40.84 |
| 312 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 47.61 | | | | | 99% Chebyshev(Mean, Sd) UCL | 60.92 |
| 313 | | | | | | | | | | | | |
| 314 | **Suggested UCL to Use** | | | | | | | | | | | |
| 315 | | | | | 95% Student's-t UCL | 31.48 | | | | | | |
| 316 | | | | | | | | | | | | |
| 317 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 318 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 319 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 320 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 321 | | | | | | | | | | | | |
| 322 | | | | | | | | | | | | |
| 323 | **Mercury** | | | | | | | | | | | |
| 324 | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 13 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 3 |
| Minimum | 3 | Mean | 5.154 |
| Maximum | 17 | Median | 4 |
| SD | 3.716 | Std. Error of Mean | 1.031 |
| Coefficient of Variation | 0.721 | Skewness | 3.105 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.565 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.333 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data Not Normal at 5% Significance Level | |
| **Data Not Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 6.991 | 95% Adjusted-CLT UCL (Chen-1995) | 7.797 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.139 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 1.334 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.737 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.24 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.238 | Data Not Gamma Distributed at 5% Significance Level | |
| **Data Not Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 3.891 | k star (bias corrected MLE) | 3.045 |
| Theta hat (MLE) | 1.324 | Theta star (bias corrected MLE) | 1.693 |
| nu hat (MLE) | 101.2 | nu star (bias corrected) | 79.16 |
| MLE Mean (bias corrected) | 5.154 | MLE Sd (bias corrected) | 2.954 |
| | | Approximate Chi Square Value (0.05) | 59.66 |
| Adjusted Level of Significance | 0.0301 | Adjusted Chi Square Value | 57.26 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 6.838 | 95% Adjusted Gamma UCL (use when n<50) | 7.126 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.776 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.866 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.215 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.234 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.506 |
| Maximum of Logged Data | 2.833 | SD of logged Data | 0.471 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 6.685 | 90% Chebyshev (MVUE) UCL | 6.995 |
| 95% Chebyshev (MVUE) UCL | 7.902 | 97.5% Chebyshev (MVUE) UCL | 9.162 |
| 99% Chebyshev (MVUE) UCL | 11.64 | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 379 | Nonparametric Distribution Free UCL Statistics | | | |
| 380 | Data appear to follow a Discernible Distribution at 5% Significance Level | | | |
| 381 | | | | |
| 382 | Nonparametric Distribution Free UCLs | | | |
| 383 | 95% CLT UCL | 6.849 | 95% Jackknife UCL | 6.991 |
| 384 | 95% Standard Bootstrap UCL | 6.72 | 95% Bootstrap-t UCL | 10.4 |
| 385 | 95% Hall's Bootstrap UCL | 13.23 | 95% Percentile Bootstrap UCL | 7.077 |
| 386 | 95% BCA Bootstrap UCL | 7.538 | | |
| 387 | 90% Chebyshev(Mean, Sd) UCL | 8.246 | 95% Chebyshev(Mean, Sd) UCL | 9.646 |
| 388 | 97.5% Chebyshev(Mean, Sd) UCL | 11.59 | 99% Chebyshev(Mean, Sd) UCL | 15.41 |
| 389 | | | | |
| 390 | Suggested UCL to Use | | | |
| 391 | 95% Student's-t UCL | 6.991 | or 95% Modified-t UCL | 7.139 |
| 392 | or 95% H-UCL | 6.685 | | |
| 393 | | | | |
| 394 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 395 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 396 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 397 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 398 | | | | |
| 399 | ProUCL computes and outputs H-statistic based UCLs for historical reasons only. | | | |
| 400 | H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide. | | | |
| 401 | It is therefore recommended to avoid the use of H-statistic based 95% UCLs. | | | |
| 402 | Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution. | | | |
| 403 | | | | |
| 404 | | | | |
| 405 | Molybdenum | | | |
| 406 | | | | |
| 407 | General Statistics | | | |
| 408 | Total Number of Observations | 8 | Number of Distinct Observations | 5 |
| 409 | | | Number of Missing Observations | 6 |
| 410 | Minimum | 4 | Mean | 6.875 |
| 411 | Maximum | 15 | Median | 5.5 |
| 412 | SD | 3.643 | Std. Error of Mean | 1.288 |
| 413 | Coefficient of Variation | 0.53 | Skewness | 1.883 |
| 414 | | | | |
| 415 | Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use | | | |
| 416 | guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. | | | |
| 417 | For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). | | | |
| 418 | Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1 | | | |
| 419 | | | | |
| 420 | Normal GOF Test | | | |
| 421 | Shapiro Wilk Test Statistic | 0.778 | Shapiro Wilk GOF Test | |
| 422 | 5% Shapiro Wilk Critical Value | 0.818 | Data Not Normal at 5% Significance Level | |
| 423 | Lilliefors Test Statistic | 0.254 | Lilliefors GOF Test | |
| 424 | 5% Lilliefors Critical Value | 0.283 | Data appear Normal at 5% Significance Level | |
| 425 | Data appear Approximate Normal at 5% Significance Level | | | |
| 426 | | | | |
| 427 | Assuming Normal Distribution | | | |
| 428 | 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
| 429 | 95% Student's-t UCL | 9.315 | 95% Adjusted-CLT UCL (Chen-1995) | 9.91 |
| 430 | | | 95% Modified-t UCL (Johnson-1978) | 9.458 |
| 431 | | | | |
| 432 | Gamma GOF Test | | | |

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.516 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.719 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.209 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.295 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 5.336 | k star (bias corrected MLE) | 3.418 |
| Theta hat (MLE) | 1.288 | Theta star (bias corrected MLE) | 2.011 |
| nu hat (MLE) | 85.37 | nu star (bias corrected) | 54.69 |
| MLE Mean (bias corrected) | 6.875 | MLE Sd (bias corrected) | 3.719 |
| | | Approximate Chi Square Value (0.05) | 38.7 |
| Adjusted Level of Significance | 0.0195 | Adjusted Chi Square Value | 35.32 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 9.716 | 95% Adjusted Gamma UCL (use when n<50) | 10.64 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.89 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.818 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.191 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.283 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.386 | Mean of logged Data | 1.831 |
| Maximum of Logged Data | 2.708 | SD of logged Data | 0.445 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 10.09 | 90% Chebyshev (MVUE) UCL | 10.04 |
| 95% Chebyshev (MVUE) UCL | 11.51 | 97.5% Chebyshev (MVUE) UCL | 13.54 |
| 99% Chebyshev (MVUE) UCL | 17.54 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 8.993 | 95% Jackknife UCL | 9.315 |
| 95% Standard Bootstrap UCL | 8.852 | 95% Bootstrap-t UCL | 11.7 |
| 95% Hall's Bootstrap UCL | 16.42 | 95% Percentile Bootstrap UCL | 9.125 |
| 95% BCA Bootstrap UCL | 9.25 | | |
| 90% Chebyshev(Mean, Sd) UCL | 10.74 | 95% Chebyshev(Mean, Sd) UCL | 12.49 |
| 97.5% Chebyshev(Mean, Sd) UCL | 14.92 | 99% Chebyshev(Mean, Sd) UCL | 19.69 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 9.315 | | |
| | | | |
| When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test | | | |
| When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL | | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |

Nickel

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 16 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 0 |
| Minimum | 9 | Mean | 20.69 |
| Maximum | 28 | Median | 20.5 |
| SD | 5.437 | Std. Error of Mean | 1.359 |
| Coefficient of Variation | 0.263 | Skewness | -0.246 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.127 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 23.07 | 95% Adjusted-CLT UCL (Chen-1995) | 22.83 |
| | | 95% Modified-t UCL (Johnson-1978) | 23.06 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.39 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.738 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.117 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.215 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 13.51 | k star (bias corrected MLE) | 11.02 |
| Theta hat (MLE) | 1.531 | Theta star (bias corrected MLE) | 1.878 |
| nu hat (MLE) | 432.3 | nu star (bias corrected) | 352.6 |
| MLE Mean (bias corrected) | 20.69 | MLE Sd (bias corrected) | 6.233 |
| | | Approximate Chi Square Value (0.05) | 310.1 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 305.5 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 23.52 | 95% Adjusted Gamma UCL (use when n<50) | 23.87 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.896 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.125 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.197 | Mean of logged Data | 2.992 |
| Maximum of Logged Data | 3.332 | SD of logged Data | 0.296 |
| | | | |
| **Assuming Lognormal Distribution** | | | |

| | | | |
|---|---|---|---|
| 95% H-UCL | 24.02 | 90% Chebyshev (MVUE) UCL | 25.43 |
| 95% Chebyshev (MVUE) UCL | 27.54 | 97.5% Chebyshev (MVUE) UCL | 30.48 |
| 99% Chebyshev (MVUE) UCL | 36.24 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 22.92 | 95% Jackknife UCL | 23.07 |
| 95% Standard Bootstrap UCL | 22.88 | 95% Bootstrap-t UCL | 22.94 |
| 95% Hall's Bootstrap UCL | 22.9 | 95% Percentile Bootstrap UCL | 22.75 |
| 95% BCA Bootstrap UCL | 22.75 | | |
| 90% Chebyshev(Mean, Sd) UCL | 24.77 | 95% Chebyshev(Mean, Sd) UCL | 26.61 |
| 97.5% Chebyshev(Mean, Sd) UCL | 29.18 | 99% Chebyshev(Mean, Sd) UCL | 34.21 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 23.07 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 16 | Number of Distinct Observations | 15 |
| | | Number of Missing Observations | 0 |
| Minimum | 190 | Mean | 242.6 |
| Maximum | 295 | Median | 239 |
| SD | 33.93 | Std. Error of Mean | 8.481 |
| Coefficient of Variation | 0.14 | Skewness | 0.0525 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.133 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 257.4 | 95% Adjusted-CLT UCL (Chen-1995) | 256.6 |
| | | 95% Modified-t UCL (Johnson-1978) | 257.4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.294 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.735 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.136 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.214 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 53.97 | k star (bias corrected MLE) | 43.9 |
| Theta hat (MLE) | 4.494 | Theta star (bias corrected MLE) | 5.526 |
| nu hat (MLE) | 1727 | nu star (bias corrected) | 1405 |
| MLE Mean (bias corrected) | 242.6 | MLE Sd (bias corrected) | 36.61 |
| | | Approximate Chi Square Value (0.05) | 1319 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 1309 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 258.4 | 95% Adjusted Gamma UCL (use when n<50) | 260.3 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.126 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 5.247 | Mean of logged Data | 5.482 |
| Maximum of Logged Data | 5.687 | SD of logged Data | 0.141 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 258.9 | 90% Chebyshev (MVUE) UCL | 268.4 |
| 95% Chebyshev (MVUE) UCL | 280 | 97.5% Chebyshev (MVUE) UCL | 296.3 |
| 99% Chebyshev (MVUE) UCL | 328.1 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 256.5 | 95% Jackknife UCL | 257.4 |
| 95% Standard Bootstrap UCL | 256 | 95% Bootstrap-t UCL | 257.8 |
| 95% Hall's Bootstrap UCL | 257.4 | 95% Percentile Bootstrap UCL | 256.6 |
| 95% BCA Bootstrap UCL | 257.6 | | |
| 90% Chebyshev(Mean, Sd) UCL | 268 | 95% Chebyshev(Mean, Sd) UCL | 279.5 |
| 97.5% Chebyshev(Mean, Sd) UCL | 295.5 | 99% Chebyshev(Mean, Sd) UCL | 327 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 257.4 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Zinc**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 16 | Number of Distinct Observations | 13 |
| | | Number of Missing Observations | 0 |

| | | | |
|---|---|---|---|
| Minimum | 60 | Mean | 86.94 |
| Maximum | 183 | Median | 74 |
| SD | 30.13 | Std. Error of Mean | 7.534 |
| Coefficient of Variation | 0.347 | Skewness | 2.472 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.712 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.246 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data Not Normal at 5% Significance Level | |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 100.1 | 95% Adjusted-CLT UCL (Chen-1995) | 104.3 |
| | | 95% Modified-t UCL (Johnson-1978) | 100.9 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 1.17 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.738 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.221 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.215 | Data Not Gamma Distributed at 5% Significance Level | |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 12.21 | k star (bias corrected MLE) | 9.964 |
| Theta hat (MLE) | 7.119 | Theta star (bias corrected MLE) | 8.725 |
| nu hat (MLE) | 390.8 | nu star (bias corrected) | 318.8 |
| MLE Mean (bias corrected) | 86.94 | MLE Sd (bias corrected) | 27.54 |
| | | Approximate Chi Square Value (0.05) | 278.5 |
| Adjusted Level of Significance | 0.0335 | Adjusted Chi Square Value | 274.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 99.54 | 95% Adjusted Gamma UCL (use when n<50) | 101.1 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.837 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.887 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.212 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.213 | Data appear Lognormal at 5% Significance Level | |

**Data appear Approximate Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 4.094 | Mean of logged Data | 4.424 |
| Maximum of Logged Data | 5.209 | SD of logged Data | 0.277 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 98.99 | 90% Chebyshev (MVUE) UCL | 104.6 |
| 95% Chebyshev (MVUE) UCL | 112.9 | 97.5% Chebyshev (MVUE) UCL | 124.3 |
| 99% Chebyshev (MVUE) UCL | 146.8 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 703 | **Nonparametric Distribution Free UCLs** | | | |
| 704 | 95% CLT UCL | 99.33 | 95% Jackknife UCL | 100.1 |
| 705 | 95% Standard Bootstrap UCL | 98.86 | 95% Bootstrap-t UCL | 113.3 |
| 706 | 95% Hall's Bootstrap UCL | 159.9 | 95% Percentile Bootstrap UCL | 99.63 |
| 707 | 95% BCA Bootstrap UCL | 103.4 | | |
| 708 | 90% Chebyshev(Mean, Sd) UCL | 109.5 | 95% Chebyshev(Mean, Sd) UCL | 119.8 |
| 709 | 97.5% Chebyshev(Mean, Sd) UCL | 134 | 99% Chebyshev(Mean, Sd) UCL | 161.9 |
| 710 | | | | |
| 711 | **Suggested UCL to Use** | | | |
| 712 | 95% Student's-t UCL | 100.1 | or 95% Modified-t UCL | 100.9 |
| 713 | or 95% H-UCL | 98.99 | | |
| 714 | | | | |
| 715 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 716 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 717 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 718 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 719 | | | | |
| 720 | **ProUCL computes and outputs H-statistic based UCLs for historical reasons only.** | | | |
| 721 | **H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.** | | | |
| 722 | **It is therefore recommended to avoid the use of H-statistic based 95% UCLs.** | | | |
| 723 | **Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.** | | | |
| 724 | | | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 1 | **UCL Statistics for Uncensored Full Data Sets** | | | |
| 2 | | | | |
| 3 | User Selected Options | | | |
| 4 | Date/Time of Computation | ProUCL 5.12/11/2021 11:55:21 AM | | |
| 5 | From File | UCL UTL concentrations USFS Big Blue_i.xls | | |
| 6 | Full Precision | OFF | | |
| 7 | Confidence Coefficient | 95% | | |
| 8 | Number of Bootstrap Operations | 2000 | | |
| 9 | | | | |
| 10 | | | | |
| 11 | **Arsenic** | | | |
| 12 | | | | |
| 13 | **General Statistics** | | | |
| 14 | Total Number of Observations | 9 | Number of Distinct Observations | 7 |
| 15 | | | Number of Missing Observations | 0 |
| 16 | Minimum | 4.2 | Mean | 8.6 |
| 17 | Maximum | 17 | Median | 7.1 |
| 18 | SD | 4.169 | Std. Error of Mean | 1.39 |
| 19 | Coefficient of Variation | 0.485 | Skewness | 1.09 |
| 20 | | | | |
| 21 | **Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use** | | | |
| 22 | **guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.** | | | |
| 23 | **For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).** | | | |
| 24 | **Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1** | | | |
| 25 | | | | |
| 26 | **Normal GOF Test** | | | |
| 27 | Shapiro Wilk Test Statistic | 0.9 | **Shapiro Wilk GOF Test** | |
| 28 | 5% Shapiro Wilk Critical Value | 0.829 | Data appear Normal at 5% Significance Level | |
| 29 | Lilliefors Test Statistic | 0.196 | **Lilliefors GOF Test** | |
| 30 | 5% Lilliefors Critical Value | 0.274 | Data appear Normal at 5% Significance Level | |
| 31 | **Data appear Normal at 5% Significance Level** | | | |
| 32 | | | | |
| 33 | **Assuming Normal Distribution** | | | |
| 34 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 35 | 95% Student's-t UCL | 11.18 | 95% Adjusted-CLT UCL (Chen-1995) | 11.42 |
| 36 | | | 95% Modified-t UCL (Johnson-1978) | 11.27 |
| 37 | | | | |
| 38 | **Gamma GOF Test** | | | |
| 39 | A-D Test Statistic | 0.268 | **Anderson-Darling Gamma GOF Test** | |
| 40 | 5% A-D Critical Value | 0.723 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 41 | K-S Test Statistic | 0.165 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 42 | 5% K-S Critical Value | 0.28 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 43 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 44 | | | | |
| 45 | **Gamma Statistics** | | | |
| 46 | k hat (MLE) | 5.248 | k star (bias corrected MLE) | 3.573 |
| 47 | Theta hat (MLE) | 1.639 | Theta star (bias corrected MLE) | 2.407 |
| 48 | nu hat (MLE) | 94.47 | nu star (bias corrected) | 64.31 |
| 49 | MLE Mean (bias corrected) | 8.6 | MLE Sd (bias corrected) | 4.55 |
| 50 | | | Approximate Chi Square Value (0.05) | 46.86 |
| 51 | Adjusted Level of Significance | 0.0231 | Adjusted Chi Square Value | 43.74 |
| 52 | | | | |
| 53 | **Assuming Gamma Distribution** | | | |
| 54 | 95% Approximate Gamma UCL (use when n>=50)) | 11.8 | 95% Adjusted Gamma UCL (use when n<50) | 12.65 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.952 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.829 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.135 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.274 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.435 | Mean of logged Data | 2.053 |
| Maximum of Logged Data | 2.833 | SD of logged Data | 0.468 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 12.51 | 90% Chebyshev (MVUE) UCL | 12.65 |
| 95% Chebyshev (MVUE) UCL | 14.49 | 97.5% Chebyshev (MVUE) UCL | 17.04 |
| 99% Chebyshev (MVUE) UCL | 22.06 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 10.89 | 95% Jackknife UCL | 11.18 |
| 95% Standard Bootstrap UCL | 10.8 | 95% Bootstrap-t UCL | 12.48 |
| 95% Hall's Bootstrap UCL | 17.26 | 95% Percentile Bootstrap UCL | 10.81 |
| 95% BCA Bootstrap UCL | 11.22 | | |
| 90% Chebyshev(Mean, Sd) UCL | 12.77 | 95% Chebyshev(Mean, Sd) UCL | 14.66 |
| 97.5% Chebyshev(Mean, Sd) UCL | 17.28 | 99% Chebyshev(Mean, Sd) UCL | 22.43 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 11.18 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Barium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 9 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 1 |
| Minimum | 36 | Mean | 58.44 |
| Maximum | 93 | Median | 56 |
| SD | 15.48 | Std. Error of Mean | 5.159 |
| Coefficient of Variation | 0.265 | Skewness | 1.305 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.861 | **Shapiro Wilk GOF Test** | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 109 | 5% Shapiro Wilk Critical Value | 0.829 | Data appear Normal at 5% Significance Level | |
| 110 | Lilliefors Test Statistic | 0.238 | **Lilliefors GOF Test** | |
| 111 | 5% Lilliefors Critical Value | 0.274 | Data appear Normal at 5% Significance Level | |
| 112 | **Data appear Normal at 5% Significance Level** | | | |
| 113 | | | | |
| 114 | **Assuming Normal Distribution** | | | |
| 115 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 116 | 95% Student's-t UCL | 68.04 | 95% Adjusted-CLT UCL (Chen-1995) | 69.33 |
| 117 | | | 95% Modified-t UCL (Johnson-1978) | 68.41 |
| 118 | | | | |
| 119 | **Gamma GOF Test** | | | |
| 120 | A-D Test Statistic | 0.557 | **Anderson-Darling Gamma GOF Test** | |
| 121 | 5% A-D Critical Value | 0.721 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 122 | K-S Test Statistic | 0.234 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 123 | 5% K-S Critical Value | 0.279 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 124 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 125 | | | | |
| 126 | **Gamma Statistics** | | | |
| 127 | k hat (MLE) | 17.52 | k star (bias corrected MLE) | 11.76 |
| 128 | Theta hat (MLE) | 3.335 | Theta star (bias corrected MLE) | 4.971 |
| 129 | nu hat (MLE) | 315.4 | nu star (bias corrected) | 211.6 |
| 130 | MLE Mean (bias corrected) | 58.44 | MLE Sd (bias corrected) | 17.05 |
| 131 | | | Approximate Chi Square Value (0.05) | 179 |
| 132 | Adjusted Level of Significance | 0.0231 | Adjusted Chi Square Value | 172.6 |
| 133 | | | | |
| 134 | **Assuming Gamma Distribution** | | | |
| 135 | 95% Approximate Gamma UCL (use when n>=50)) | 69.11 | 95% Adjusted Gamma UCL (use when n<50) | 71.65 |
| 136 | | | | |
| 137 | **Lognormal GOF Test** | | | |
| 138 | Shapiro Wilk Test Statistic | 0.91 | **Shapiro Wilk Lognormal GOF Test** | |
| 139 | 5% Shapiro Wilk Critical Value | 0.829 | Data appear Lognormal at 5% Significance Level | |
| 140 | Lilliefors Test Statistic | 0.252 | **Lilliefors Lognormal GOF Test** | |
| 141 | 5% Lilliefors Critical Value | 0.274 | Data appear Lognormal at 5% Significance Level | |
| 142 | **Data appear Lognormal at 5% Significance Level** | | | |
| 143 | | | | |
| 144 | **Lognormal Statistics** | | | |
| 145 | Minimum of Logged Data | 3.584 | Mean of logged Data | 4.039 |
| 146 | Maximum of Logged Data | 4.533 | SD of logged Data | 0.252 |
| 147 | | | | |
| 148 | **Assuming Lognormal Distribution** | | | |
| 149 | 95% H-UCL | 69.78 | 90% Chebyshev (MVUE) UCL | 73.17 |
| 150 | 95% Chebyshev (MVUE) UCL | 79.86 | 97.5% Chebyshev (MVUE) UCL | 89.14 |
| 151 | 99% Chebyshev (MVUE) UCL | 107.4 | | |
| 152 | | | | |
| 153 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 154 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 155 | | | | |
| 156 | **Nonparametric Distribution Free UCLs** | | | |
| 157 | 95% CLT UCL | 66.93 | 95% Jackknife UCL | 68.04 |
| 158 | 95% Standard Bootstrap UCL | 66.42 | 95% Bootstrap-t UCL | 73.3 |
| 159 | 95% Hall's Bootstrap UCL | 126.6 | 95% Percentile Bootstrap UCL | 67.33 |
| 160 | 95% BCA Bootstrap UCL | 69.44 | | |
| 161 | 90% Chebyshev(Mean, Sd) UCL | 73.92 | 95% Chebyshev(Mean, Sd) UCL | 80.93 |
| 162 | 97.5% Chebyshev(Mean, Sd) UCL | 90.66 | 99% Chebyshev(Mean, Sd) UCL | 109.8 |

**Suggested UCL to Use**

| | |
|---|---|
| 95% Student's-t UCL | 68.04 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Chromium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 3.9 | Mean | 8.89 |
| Maximum | 12 | Median | 9.2 |
| SD | 2.628 | Std. Error of Mean | 0.831 |
| Coefficient of Variation | 0.296 | Skewness | -0.66 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.945 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.132 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 10.41 | 95% Adjusted-CLT UCL (Chen-1995) | 10.07 |
| | | 95% Modified-t UCL (Johnson-1978) | 10.38 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.39 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.171 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 10.32 | k star (bias corrected MLE) | 7.293 |
| Theta hat (MLE) | 0.861 | Theta star (bias corrected MLE) | 1.219 |
| nu hat (MLE) | 206.5 | nu star (bias corrected) | 145.9 |
| MLE Mean (bias corrected) | 8.89 | MLE Sd (bias corrected) | 3.292 |
| | | Approximate Chi Square Value (0.05) | 119 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 114.7 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 10.9 | 95% Adjusted Gamma UCL (use when n<50) | 11.3 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.881 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.192 | **Lilliefors Lognormal GOF Test** |

| | A B C D E | F | G H I J K | L |
|---|---|---|---|---|
| 217 | 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| 218 | **Data appear Lognormal at 5% Significance Level** | | | |
| 219 | | | | |
| 220 | **Lognormal Statistics** | | | |
| 221 | Minimum of Logged Data | 1.361 | Mean of logged Data | 2.136 |
| 222 | Maximum of Logged Data | 2.485 | SD of logged Data | 0.352 |
| 223 | | | | |
| 224 | **Assuming Lognormal Distribution** | | | |
| 225 | 95% H-UCL | 11.43 | 90% Chebyshev (MVUE) UCL | 11.96 |
| 226 | 95% Chebyshev (MVUE) UCL | 13.33 | 97.5% Chebyshev (MVUE) UCL | 15.23 |
| 227 | 99% Chebyshev (MVUE) UCL | 18.95 | | |
| 228 | | | | |
| 229 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 230 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 231 | | | | |
| 232 | **Nonparametric Distribution Free UCLs** | | | |
| 233 | 95% CLT UCL | 10.26 | 95% Jackknife UCL | 10.41 |
| 234 | 95% Standard Bootstrap UCL | 10.22 | 95% Bootstrap-t UCL | 10.22 |
| 235 | 95% Hall's Bootstrap UCL | 10.08 | 95% Percentile Bootstrap UCL | 10.09 |
| 236 | 95% BCA Bootstrap UCL | 9.98 | | |
| 237 | 90% Chebyshev(Mean, Sd) UCL | 11.38 | 95% Chebyshev(Mean, Sd) UCL | 12.51 |
| 238 | 97.5% Chebyshev(Mean, Sd) UCL | 14.08 | 99% Chebyshev(Mean, Sd) UCL | 17.16 |
| 239 | | | | |
| 240 | **Suggested UCL to Use** | | | |
| 241 | 95% Student's-t UCL | 10.41 | | |
| 242 | | | | |
| 243 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 244 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 245 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 246 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| 247 | | | | |
| 248 | **Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be** | | | |
| 249 | **reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.** | | | |
| 250 | | | | |
| 251 | | | | |
| 252 | Cobalt | | | |
| 253 | | | | |
| 254 | **General Statistics** | | | |
| 255 | Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| 256 | | | Number of Missing Observations | 0 |
| 257 | Minimum | 4.2 | Mean | 5.8 |
| 258 | Maximum | 7.9 | Median | 5.75 |
| 259 | SD | 1.065 | Std. Error of Mean | 0.337 |
| 260 | Coefficient of Variation | 0.184 | Skewness | 0.642 |
| 261 | | | | |
| 262 | **Normal GOF Test** | | | |
| 263 | Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk GOF Test** | |
| 264 | 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| 265 | Lilliefors Test Statistic | 0.189 | **Lilliefors GOF Test** | |
| 266 | 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |
| 267 | **Data appear Normal at 5% Significance Level** | | | |
| 268 | | | | |
| 269 | **Assuming Normal Distribution** | | | |
| 270 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 271 | 95% Student's-t UCL | 6.417 | 95% Adjusted-CLT UCL (Chen-1995) | 6.427 |
| 272 | | | 95% Modified-t UCL (Johnson-1978) | 6.429 |
| 273 | | | | |
| 274 | **Gamma GOF Test** | | | |
| 275 | A-D Test Statistic | 0.185 | **Anderson-Darling Gamma GOF Test** | |
| 276 | 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 277 | K-S Test Statistic | 0.162 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 278 | 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 279 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 280 | | | | |
| 281 | **Gamma Statistics** | | | |
| 282 | k hat (MLE) | 33.96 | k star (bias corrected MLE) | 23.84 |
| 283 | Theta hat (MLE) | 0.171 | Theta star (bias corrected MLE) | 0.243 |
| 284 | nu hat (MLE) | 679.1 | nu star (bias corrected) | 476.7 |
| 285 | MLE Mean (bias corrected) | 5.8 | MLE Sd (bias corrected) | 1.188 |
| 286 | | | Approximate Chi Square Value (0.05) | 427.1 |
| 287 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 418.9 |
| 288 | | | | |
| 289 | **Assuming Gamma Distribution** | | | |
| 290 | 95% Approximate Gamma UCL (use when n>=50)) | 6.474 | 95% Adjusted Gamma UCL (use when n<50) | 6.6 |
| 291 | | | | |
| 292 | **Lognormal GOF Test** | | | |
| 293 | Shapiro Wilk Test Statistic | 0.985 | **Shapiro Wilk Lognormal GOF Test** | |
| 294 | 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| 295 | Lilliefors Test Statistic | 0.159 | **Lilliefors Lognormal GOF Test** | |
| 296 | 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| 297 | **Data appear Lognormal at 5% Significance Level** | | | |
| 298 | | | | |
| 299 | **Lognormal Statistics** | | | |
| 300 | Minimum of Logged Data | 1.435 | Mean of logged Data | 1.743 |
| 301 | Maximum of Logged Data | 2.067 | SD of logged Data | 0.181 |
| 302 | | | | |
| 303 | **Assuming Lognormal Distribution** | | | |
| 304 | 95% H-UCL | 6.499 | 90% Chebyshev (MVUE) UCL | 6.796 |
| 305 | 95% Chebyshev (MVUE) UCL | 7.248 | 97.5% Chebyshev (MVUE) UCL | 7.874 |
| 306 | 99% Chebyshev (MVUE) UCL | 9.105 | | |
| 307 | | | | |
| 308 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 309 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 310 | | | | |
| 311 | **Nonparametric Distribution Free UCLs** | | | |
| 312 | 95% CLT UCL | 6.354 | 95% Jackknife UCL | 6.417 |
| 313 | 95% Standard Bootstrap UCL | 6.326 | 95% Bootstrap-t UCL | 6.549 |
| 314 | 95% Hall's Bootstrap UCL | 6.742 | 95% Percentile Bootstrap UCL | 6.33 |
| 315 | 95% BCA Bootstrap UCL | 6.38 | | |
| 316 | 90% Chebyshev(Mean, Sd) UCL | 6.81 | 95% Chebyshev(Mean, Sd) UCL | 7.267 |
| 317 | 97.5% Chebyshev(Mean, Sd) UCL | 7.902 | 99% Chebyshev(Mean, Sd) UCL | 9.15 |
| 318 | | | | |
| 319 | **Suggested UCL to Use** | | | |
| 320 | 95% Student's-t UCL | 6.417 | | |
| 321 | | | | |
| 322 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 323 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 324 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 6.1 | Mean | 8.17 |
| Maximum | 13 | Median | 7.1 |
| SD | 2.594 | Std. Error of Mean | 0.82 |
| Coefficient of Variation | 0.318 | Skewness | 1.615 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.685 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.357 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 9.674 | 95% Adjusted-CLT UCL (Chen-1995) | 9.967 |
| | | 95% Modified-t UCL (Johnson-1978) | 9.744 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.352 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.725 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.331 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.266 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 13.54 | k star (bias corrected MLE) | 9.543 |
| Theta hat (MLE) | 0.604 | Theta star (bias corrected MLE) | 0.856 |
| nu hat (MLE) | 270.7 | nu star (bias corrected) | 190.9 |
| MLE Mean (bias corrected) | 8.17 | MLE Sd (bias corrected) | 2.645 |
| | | Approximate Chi Square Value (0.05) | 159.9 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 155 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 9.752 | 95% Adjusted Gamma UCL (use when n<50) | 10.06 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.745 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.313 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.808 | Mean of logged Data | 2.063 |
| Maximum of Logged Data | 2.565 | SD of logged Data | 0.274 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 9.767 | 90% Chebyshev (MVUE) UCL | 10.27 |
| 95% Chebyshev (MVUE) UCL | 11.24 | 97.5% Chebyshev (MVUE) UCL | 12.57 |
| 99% Chebyshev (MVUE) UCL | 15.21 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 9.519 | 95% Jackknife UCL | 9.674 |
| 95% Standard Bootstrap UCL | 9.437 | 95% Bootstrap-t UCL | 14.06 |
| 95% Hall's Bootstrap UCL | 19.97 | 95% Percentile Bootstrap UCL | 9.52 |
| 95% BCA Bootstrap UCL | 9.79 | | |
| 90% Chebyshev(Mean, Sd) UCL | 10.63 | 95% Chebyshev(Mean, Sd) UCL | 11.75 |
| 97.5% Chebyshev(Mean, Sd) UCL | 13.29 | 99% Chebyshev(Mean, Sd) UCL | 16.33 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 9.674 | or 95% Modified-t UCL | 9.744 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 6 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 4 |
| Minimum | 0.02 | Mean | 0.749 |
| Maximum | 4.3 | Median | 0.043 |
| SD | 1.74 | Std. Error of Mean | 0.71 |
| Coefficient of Variation | 2.323 | Skewness | 2.449 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**
**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**
**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**
**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.506 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.486 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 2.18 | 95% Adjusted-CLT UCL (Chen-1995) | 2.676 |
| | | 95% Modified-t UCL (Johnson-1978) | 2.299 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.264 | **Anderson-Darling Gamma GOF Test** |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 433 | 5% A-D Critical Value | 0.766 | Data Not Gamma Distributed at 5% Significance Level | |
| 434 | K-S Test Statistic | 0.463 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 435 | 5% K-S Critical Value | 0.357 | Data Not Gamma Distributed at 5% Significance Level | |
| 436 | **Data Not Gamma Distributed at 5% Significance Level** | | | |
| 437 | | | | |
| 438 | **Gamma Statistics** | | | |
| 439 | k hat (MLE) | 0.302 | k star (bias corrected MLE) | 0.262 |
| 440 | Theta hat (MLE) | 2.479 | Theta star (bias corrected MLE) | 2.857 |
| 441 | nu hat (MLE) | 3.626 | nu star (bias corrected) | 3.146 |
| 442 | MLE Mean (bias corrected) | 0.749 | MLE Sd (bias corrected) | 1.463 |
| 443 | | | Approximate Chi Square Value (0.05) | 0.417 |
| 444 | Adjusted Level of Significance | 0.0122 | Adjusted Chi Square Value | 0.188 |
| 445 | | | | |
| 446 | **Assuming Gamma Distribution** | | | |
| 447 | 95% Approximate Gamma UCL (use when n>=50)) | 5.651 | 95% Adjusted Gamma UCL (use when n<50) | 12.52 |
| 448 | | | | |
| 449 | **Lognormal GOF Test** | | | |
| 450 | Shapiro Wilk Test Statistic | 0.707 | **Shapiro Wilk Lognormal GOF Test** | |
| 451 | 5% Shapiro Wilk Critical Value | 0.788 | Data Not Lognormal at 5% Significance Level | |
| 452 | Lilliefors Test Statistic | 0.363 | **Lilliefors Lognormal GOF Test** | |
| 453 | 5% Lilliefors Critical Value | 0.325 | Data Not Lognormal at 5% Significance Level | |
| 454 | **Data Not Lognormal at 5% Significance Level** | | | |
| 455 | | | | |
| 456 | **Lognormal Statistics** | | | |
| 457 | Minimum of Logged Data | -3.912 | Mean of logged Data | -2.569 |
| 458 | Maximum of Logged Data | 1.459 | SD of logged Data | 2.034 |
| 459 | | | | |
| 460 | **Assuming Lognormal Distribution** | | | |
| 461 | 95% H-UCL | 752 | 90% Chebyshev (MVUE) UCL | 1.021 |
| 462 | 95% Chebyshev (MVUE) UCL | 1.338 | 97.5% Chebyshev (MVUE) UCL | 1.778 |
| 463 | 99% Chebyshev (MVUE) UCL | 2.641 | | |
| 464 | | | | |
| 465 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 466 | **Data do not follow a Discernible Distribution (0.05)** | | | |
| 467 | | | | |
| 468 | **Nonparametric Distribution Free UCLs** | | | |
| 469 | 95% CLT UCL | 1.917 | 95% Jackknife UCL | 2.18 |
| 470 | 95% Standard Bootstrap UCL | 1.829 | 95% Bootstrap-t UCL | 80.59 |
| 471 | 95% Hall's Bootstrap UCL | 78.41 | 95% Percentile Bootstrap UCL | 2.164 |
| 472 | 95% BCA Bootstrap UCL | 2.179 | | |
| 473 | 90% Chebyshev(Mean, Sd) UCL | 2.88 | 95% Chebyshev(Mean, Sd) UCL | 3.845 |
| 474 | 97.5% Chebyshev(Mean, Sd) UCL | 5.184 | 99% Chebyshev(Mean, Sd) UCL | 7.816 |
| 475 | | | | |
| 476 | **Suggested UCL to Use** | | | |
| 477 | 95% Hall's Bootstrap UCL | 78.41 | | |
| 478 | | | | |
| 479 | **Recommended UCL exceeds the maximum observation** | | | |
| 480 | | | | |
| 481 | **In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL** | | | |
| 482 | | | | |
| 483 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 484 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 485 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| 486 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |

Nickel

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 3.5 | Mean | 5.12 |
| Maximum | 9.5 | Median | 4.6 |
| SD | 1.795 | Std. Error of Mean | 0.568 |
| Coefficient of Variation | 0.351 | Skewness | 1.824 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.818 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.216 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 6.16 | 95% Adjusted-CLT UCL (Chen-1995) | 6.404 |
| | | 95% Modified-t UCL (Johnson-1978) | 6.215 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.456 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.166 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 11.2 | k star (bias corrected MLE) | 7.904 |
| Theta hat (MLE) | 0.457 | Theta star (bias corrected MLE) | 0.648 |
| nu hat (MLE) | 223.9 | nu star (bias corrected) | 158.1 |
| MLE Mean (bias corrected) | 5.12 | MLE Sd (bias corrected) | 1.821 |
| | | Approximate Chi Square Value (0.05) | 130 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 125.6 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 6.225 | 95% Adjusted Gamma UCL (use when n<50) | 6.444 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.912 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.15 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.253 | Mean of logged Data | 1.588 |
| Maximum of Logged Data | 2.251 | SD of logged Data | 0.303 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 6.26 | 90% Chebyshev (MVUE) UCL | 6.578 |
| 95% Chebyshev (MVUE) UCL | 7.248 | 97.5% Chebyshev (MVUE) UCL | 8.178 |
| 99% Chebyshev (MVUE) UCL | 10 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 6.054 | 95% Jackknife UCL | 6.16 |
| 95% Standard Bootstrap UCL | 6.013 | 95% Bootstrap-t UCL | 7.009 |
| 95% Hall's Bootstrap UCL | 10.68 | 95% Percentile Bootstrap UCL | 6.05 |
| 95% BCA Bootstrap UCL | 6.27 | | |
| 90% Chebyshev(Mean, Sd) UCL | 6.823 | 95% Chebyshev(Mean, Sd) UCL | 7.594 |
| 97.5% Chebyshev(Mean, Sd) UCL | 8.665 | 99% Chebyshev(Mean, Sd) UCL | 10.77 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 6.16 | | |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vanadium

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 19 | Mean | 40 |
| Maximum | 65 | Median | 34.5 |
| SD | 15.49 | Std. Error of Mean | 4.899 |
| Coefficient of Variation | 0.387 | Skewness | 0.552 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.197 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 48.98 | 95% Adjusted-CLT UCL (Chen-1995) | 48.97 |
| | | 95% Modified-t UCL (Johnson-1978) | 49.12 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.307 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.727 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.179 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

| | | | |
|---|---|---|---|
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 7.499 | k star (bias corrected MLE) | 5.316 |
| Theta hat (MLE) | 5.334 | Theta star (bias corrected MLE) | 7.525 |
| nu hat (MLE) | 150 | nu star (bias corrected) | 106.3 |
| MLE Mean (bias corrected) | 40 | MLE Sd (bias corrected) | 17.35 |
| | | Approximate Chi Square Value (0.05) | 83.52 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 80.02 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 50.92 | 95% Adjusted Gamma UCL (use when n<50) | 53.15 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.954 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.154 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.944 | Mean of logged Data | 3.621 |
| Maximum of Logged Data | 4.174 | SD of logged Data | 0.392 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 52.95 | 90% Chebyshev (MVUE) UCL | 55.09 |
| 95% Chebyshev (MVUE) UCL | 61.91 | 97.5% Chebyshev (MVUE) UCL | 71.38 |
| 99% Chebyshev (MVUE) UCL | 89.98 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 48.06 | 95% Jackknife UCL | 48.98 |
| 95% Standard Bootstrap UCL | 47.66 | 95% Bootstrap-t UCL | 50.33 |
| 95% Hall's Bootstrap UCL | 49.19 | 95% Percentile Bootstrap UCL | 48 |
| 95% BCA Bootstrap UCL | 48.3 | | |
| 90% Chebyshev(Mean, Sd) UCL | 54.7 | 95% Chebyshev(Mean, Sd) UCL | 61.35 |
| 97.5% Chebyshev(Mean, Sd) UCL | 70.59 | 99% Chebyshev(Mean, Sd) UCL | 88.74 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 48.98 | | |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| **Zinc** | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |

| | | | |
|---|---|---|---|
| Minimum | 24 | Mean | 33 |
| Maximum | 51 | Median | 32 |
| SD | 8.206 | Std. Error of Mean | 2.595 |
| Coefficient of Variation | 0.249 | Skewness | 1.143 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.898 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.168 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 37.76 | 95% Adjusted-CLT UCL (Chen-1995) | 38.27 |
| | | 95% Modified-t UCL (Johnson-1978) | 37.91 |

**Gamma GOF Test**

| | | | |
|---|---|---|---|
| A-D Test Statistic | 0.343 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.184 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level | |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 19.76 | k star (bias corrected MLE) | 13.9 |
| Theta hat (MLE) | 1.67 | Theta star (bias corrected MLE) | 2.375 |
| nu hat (MLE) | 395.2 | nu star (bias corrected) | 277.9 |
| MLE Mean (bias corrected) | 33 | MLE Sd (bias corrected) | 8.852 |
| | | Approximate Chi Square Value (0.05) | 240.3 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 234.2 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 38.16 | 95% Adjusted Gamma UCL (use when n<50) | 39.16 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.938 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.173 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.178 | Mean of logged Data | 3.471 |
| Maximum of Logged Data | 3.932 | SD of logged Data | 0.234 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 38.37 | 90% Chebyshev (MVUE) UCL | 40.31 |
| 95% Chebyshev (MVUE) UCL | 43.63 | 97.5% Chebyshev (MVUE) UCL | 48.25 |
| 99% Chebyshev (MVUE) UCL | 57.31 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 703 | **Nonparametric Distribution Free UCLs** | | | | | | | | | | | |
| 704 | | | | | 95% CLT UCL | 37.27 | | | | | 95% Jackknife UCL | 37.76 |
| 705 | | | | | 95% Standard Bootstrap UCL | 37.06 | | | | | 95% Bootstrap-t UCL | 39.36 |
| 706 | | | | | 95% Hall's Bootstrap UCL | 40.36 | | | | | 95% Percentile Bootstrap UCL | 37.1 |
| 707 | | | | | 95% BCA Bootstrap UCL | 37.7 | | | | | | |
| 708 | | | | | 90% Chebyshev(Mean, Sd) UCL | 40.78 | | | | | 95% Chebyshev(Mean, Sd) UCL | 44.31 |
| 709 | | | | | 97.5% Chebyshev(Mean, Sd) UCL | 49.2 | | | | | 99% Chebyshev(Mean, Sd) UCL | 58.82 |
| 710 | | | | | | | | | | | | |
| 711 | **Suggested UCL to Use** | | | | | | | | | | | |
| 712 | | | | | 95% Student's-t UCL | 37.76 | | | | | | |
| 713 | | | | | | | | | | | | |
| 714 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 715 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 716 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 717 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 718 | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| **UCL Statistics for Uncensored Full Data Sets** | | | |
| | | | |
| User Selected Options | | | |
| Date/Time of Computation | ProUCL 5.12/11/2021 11:54:36 AM | | |
| From File | UCL UTL concentrations USFS Big Blue_h.xls | | |
| Full Precision | OFF | | |
| Confidence Coefficient | 95% | | |
| Number of Bootstrap Operations | 2000 | | |
| | | | |
| | | | |
| **Arsenic** | | | |
| | | | |
| **General Statistics** | | | |
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 4 | Mean | 12.5 |
| Maximum | 26 | Median | 8 |
| SD | 7.976 | Std. Error of Mean | 2.522 |
| Coefficient of Variation | 0.638 | Skewness | 0.704 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.845 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.314 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level | |
| **Data appear Approximate Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 17.12 | 95% Adjusted-CLT UCL (Chen-1995) | 17.25 |
| | | 95% Modified-t UCL (Johnson-1978) | 17.22 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.65 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.733 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.29 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.269 | Data Not Gamma Distributed at 5% Significance Level | |
| **Detected data follow Appr. Gamma Distribution at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 2.841 | k star (bias corrected MLE) | 2.055 |
| Theta hat (MLE) | 4.401 | Theta star (bias corrected MLE) | 6.083 |
| nu hat (MLE) | 56.81 | nu star (bias corrected) | 41.1 |
| MLE Mean (bias corrected) | 12.5 | MLE Sd (bias corrected) | 8.72 |
| | | Approximate Chi Square Value (0.05) | 27.41 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 25.48 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 18.74 | 95% Adjusted Gamma UCL (use when n<50) | 20.16 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.902 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.257 | **Lilliefors Lognormal GOF Test** | |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.386 | Mean of logged Data | 2.34 |
| Maximum of Logged Data | 3.258 | SD of logged Data | 0.645 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 21.6 | 90% Chebyshev (MVUE) UCL | 20.32 |
| 95% Chebyshev (MVUE) UCL | 23.87 | 97.5% Chebyshev (MVUE) UCL | 28.81 |
| 99% Chebyshev (MVUE) UCL | 38.5 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 16.65 | 95% Jackknife UCL | 17.12 |
| 95% Standard Bootstrap UCL | 16.3 | 95% Bootstrap-t UCL | 17.7 |
| 95% Hall's Bootstrap UCL | 15.81 | 95% Percentile Bootstrap UCL | 16.6 |
| 95% BCA Bootstrap UCL | 16.8 | | |
| 90% Chebyshev(Mean, Sd) UCL | 20.07 | 95% Chebyshev(Mean, Sd) UCL | 23.49 |
| 97.5% Chebyshev(Mean, Sd) UCL | 28.25 | 99% Chebyshev(Mean, Sd) UCL | 37.59 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 17.12 | | |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Copper

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 10 | Mean | 15.2 |
| Maximum | 23 | Median | 14.5 |
| SD | 4.614 | Std. Error of Mean | 1.459 |
| Coefficient of Variation | 0.304 | Skewness | 0.409 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.897 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.219 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | |
|---|---|
| **95% Normal UCL** | **95% UCLs (Adjusted for Skewness)** |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 109 | 95% Student's-t UCL | 17.87 | 95% Adjusted-CLT UCL (Chen-1995) | 17.8 |
| 110 | | | 95% Modified-t UCL (Johnson-1978) | 17.91 |
| 111 | | | | |
| 112 | **Gamma GOF Test** | | | |
| 113 | A-D Test Statistic | 0.528 | **Anderson-Darling Gamma GOF Test** | |
| 114 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 115 | K-S Test Statistic | 0.236 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 116 | 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 117 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 118 | | | | |
| 119 | **Gamma Statistics** | | | |
| 120 | k hat (MLE) | 12.27 | k star (bias corrected MLE) | 8.654 |
| 121 | Theta hat (MLE) | 1.239 | Theta star (bias corrected MLE) | 1.756 |
| 122 | nu hat (MLE) | 245.4 | nu star (bias corrected) | 173.1 |
| 123 | MLE Mean (bias corrected) | 15.2 | MLE Sd (bias corrected) | 5.167 |
| 124 | | | Approximate Chi Square Value (0.05) | 143.7 |
| 125 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 139 |
| 126 | | | | |
| 127 | **Assuming Gamma Distribution** | | | |
| 128 | 95% Approximate Gamma UCL (use when n>=50)) | 18.31 | 95% Adjusted Gamma UCL (use when n<50) | 18.93 |
| 129 | | | | |
| 130 | **Lognormal GOF Test** | | | |
| 131 | Shapiro Wilk Test Statistic | 0.898 | **Shapiro Wilk Lognormal GOF Test** | |
| 132 | 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| 133 | Lilliefors Test Statistic | 0.224 | **Lilliefors Lognormal GOF Test** | |
| 134 | 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| 135 | **Data appear Lognormal at 5% Significance Level** | | | |
| 136 | | | | |
| 137 | **Lognormal Statistics** | | | |
| 138 | Minimum of Logged Data | 2.303 | Mean of logged Data | 2.68 |
| 139 | Maximum of Logged Data | 3.135 | SD of logged Data | 0.303 |
| 140 | | | | |
| 141 | **Assuming Lognormal Distribution** | | | |
| 142 | 95% H-UCL | 18.64 | 90% Chebyshev (MVUE) UCL | 19.59 |
| 143 | 95% Chebyshev (MVUE) UCL | 21.58 | 97.5% Chebyshev (MVUE) UCL | 24.34 |
| 144 | 99% Chebyshev (MVUE) UCL | 29.77 | | |
| 145 | | | | |
| 146 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 147 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 148 | | | | |
| 149 | **Nonparametric Distribution Free UCLs** | | | |
| 150 | 95% CLT UCL | 17.6 | 95% Jackknife UCL | 17.87 |
| 151 | 95% Standard Bootstrap UCL | 17.53 | 95% Bootstrap-t UCL | 17.96 |
| 152 | 95% Hall's Bootstrap UCL | 17.46 | 95% Percentile Bootstrap UCL | 17.5 |
| 153 | 95% BCA Bootstrap UCL | 17.4 | | |
| 154 | 90% Chebyshev(Mean, Sd) UCL | 19.58 | 95% Chebyshev(Mean, Sd) UCL | 21.56 |
| 155 | 97.5% Chebyshev(Mean, Sd) UCL | 24.31 | 99% Chebyshev(Mean, Sd) UCL | 29.72 |
| 156 | | | | |
| 157 | **Suggested UCL to Use** | | | |
| 158 | 95% Student's-t UCL | 17.87 | | |
| 159 | | | | |
| 160 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| 161 | Recommendations are based upon data size, data distribution, and skewness. | | | |
| 162 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Lead

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 0 |
| Minimum | 6 | Mean | 7.7 |
| Maximum | 10 | Median | 7.5 |
| SD | 1.337 | Std. Error of Mean | 0.423 |
| Coefficient of Variation | 0.174 | Skewness | 0.334 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.2 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 8.475 | 95% Adjusted-CLT UCL (Chen-1995) | 8.443 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.483 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.354 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.197 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 37.19 | k star (bias corrected MLE) | 26.1 |
| Theta hat (MLE) | 0.207 | Theta star (bias corrected MLE) | 0.295 |
| nu hat (MLE) | 743.9 | nu star (bias corrected) | 522 |
| MLE Mean (bias corrected) | 7.7 | MLE Sd (bias corrected) | 1.507 |
| | | Approximate Chi Square Value (0.05) | 470 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 461.5 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 8.552 | 95% Adjusted Gamma UCL (use when n<50) | 8.711 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.934 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.182 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Lognormal Statistics**

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.792 | Mean of logged Data | 2.028 |
| Maximum of Logged Data | 2.303 | SD of logged Data | 0.173 |

**Assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% H-UCL | 8.584 | 90% Chebyshev (MVUE) UCL | 8.968 |
| 95% Chebyshev (MVUE) UCL | 9.542 | 97.5% Chebyshev (MVUE) UCL | 10.34 |
| 99% Chebyshev (MVUE) UCL | 11.9 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 8.396 | 95% Jackknife UCL | 8.475 |
| 95% Standard Bootstrap UCL | 8.36 | 95% Bootstrap-t UCL | 8.511 |
| 95% Hall's Bootstrap UCL | 8.452 | 95% Percentile Bootstrap UCL | 8.4 |
| 95% BCA Bootstrap UCL | 8.3 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8.969 | 95% Chebyshev(Mean, Sd) UCL | 9.544 |
| 97.5% Chebyshev(Mean, Sd) UCL | 10.34 | 99% Chebyshev(Mean, Sd) UCL | 11.91 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 8.475 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 6 | Number of Distinct Observations | 2 |
| | | Number of Missing Observations | 2 |
| Minimum | 3 | Mean | 3.167 |
| Maximum | 4 | Median | 3 |
| SD | 0.408 | Std. Error of Mean | 0.167 |
| Coefficient of Variation | 0.129 | Skewness | 2.449 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**

**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**

**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**

**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.496 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.492 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 3.503 | 95% Adjusted-CLT UCL (Chen-1995) | 3.619 |
| | | 95% Modified-t UCL (Johnson-1978) | 3.53 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.718 | **Anderson-Darling Gamma GOF Test** |

| | | | |
|---|---|---|---|
| 5% A-D Critical Value | 0.696 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.506 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.332 | Data Not Gamma Distributed at 5% Significance Level | |
| **Data Not Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 81.86 | k star (bias corrected MLE) | 41.04 |
| Theta hat (MLE) | 0.0387 | Theta star (bias corrected MLE) | 0.0772 |
| nu hat (MLE) | 982.4 | nu star (bias corrected) | 492.5 |
| MLE Mean (bias corrected) | 3.167 | MLE Sd (bias corrected) | 0.494 |
| | | Approximate Chi Square Value (0.05) | 442 |
| Adjusted Level of Significance | 0.0122 | Adjusted Chi Square Value | 424.6 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 3.528 | 95% Adjusted Gamma UCL (use when n<50) | 3.673 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.496 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.492 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Data Not Lognormal at 5% Significance Level | |
| **Data Not Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 1.099 | Mean of logged Data | 1.147 |
| Maximum of Logged Data | 1.386 | SD of logged Data | 0.117 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 3.513 | 90% Chebyshev (MVUE) UCL | 3.621 |
| 95% Chebyshev (MVUE) UCL | 3.827 | 97.5% Chebyshev (MVUE) UCL | 4.113 |
| 99% Chebyshev (MVUE) UCL | 4.676 | | |
| | | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data do not follow a Discernible Distribution (0.05)** | | | |
| | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 3.441 | 95% Jackknife UCL | N/A |
| 95% Standard Bootstrap UCL | N/A | 95% Bootstrap-t UCL | N/A |
| 95% Hall's Bootstrap UCL | N/A | 95% Percentile Bootstrap UCL | N/A |
| 95% BCA Bootstrap UCL | N/A | | |
| 90% Chebyshev(Mean, Sd) UCL | 3.667 | 95% Chebyshev(Mean, Sd) UCL | 3.893 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4.207 | 99% Chebyshev(Mean, Sd) UCL | 4.825 |
| | | | |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 3.503 | or 95% Modified-t UCL | 3.53 |
| | | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| | | | |
| | | | |
| **Nickel** | | | |
| | | | |

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 14 | Mean | 19.7 |
| Maximum | 30 | Median | 20 |
| SD | 4.644 | Std. Error of Mean | 1.469 |
| Coefficient of Variation | 0.236 | Skewness | 1.054 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.906 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.21 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Assuming Normal Distribution** | | | |
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 22.39 | 95% Adjusted-CLT UCL (Chen-1995) | 22.64 |
| | | 95% Modified-t UCL (Johnson-1978) | 22.47 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.328 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.177 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 21.53 | k star (bias corrected MLE) | 15.14 |
| Theta hat (MLE) | 0.915 | Theta star (bias corrected MLE) | 1.301 |
| nu hat (MLE) | 430.6 | nu star (bias corrected) | 302.8 |
| MLE Mean (bias corrected) | 19.7 | MLE Sd (bias corrected) | 5.063 |
| | | Approximate Chi Square Value (0.05) | 263.5 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 257.1 |
| | | | |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 22.64 | 95% Adjusted Gamma UCL (use when n<50) | 23.2 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.176 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 2.639 | Mean of logged Data | 2.957 |
| Maximum of Logged Data | 3.401 | SD of logged Data | 0.225 |
| | | | |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 22.77 | 90% Chebyshev (MVUE) UCL | 23.91 |
| 95% Chebyshev (MVUE) UCL | 25.82 | 97.5% Chebyshev (MVUE) UCL | 28.48 |
| 99% Chebyshev (MVUE) UCL | 33.69 | | |

**Nonparametric Distribution Free UCL Statistics**

**Data appear to follow a Discernible Distribution at 5% Significance Level**

**Nonparametric Distribution Free UCLs**

| | | | |
|---|---|---|---|
| 95% CLT UCL | 22.12 | 95% Jackknife UCL | 22.39 |
| 95% Standard Bootstrap UCL | 21.94 | 95% Bootstrap-t UCL | 23.19 |
| 95% Hall's Bootstrap UCL | 23.96 | 95% Percentile Bootstrap UCL | 22.2 |
| 95% BCA Bootstrap UCL | 22.3 | | |
| 90% Chebyshev(Mean, Sd) UCL | 24.11 | 95% Chebyshev(Mean, Sd) UCL | 26.1 |
| 97.5% Chebyshev(Mean, Sd) UCL | 28.87 | 99% Chebyshev(Mean, Sd) UCL | 34.31 |

**Suggested UCL to Use**

| | | | |
|---|---|---|---|
| 95% Student's-t UCL | 22.39 | | |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Vanadium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 228 | Mean | 294.3 |
| Maximum | 365 | Median | 291 |
| SD | 43.14 | Std. Error of Mean | 13.64 |
| Coefficient of Variation | 0.147 | Skewness | 0.132 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.972 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.147 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 319.3 | 95% Adjusted-CLT UCL (Chen-1995) | 317.3 |
| | | 95% Modified-t UCL (Johnson-1978) | 319.4 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.209 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.724 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.165 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 51.43 | k star (bias corrected MLE) | 36.07 |
| Theta hat (MLE) | 5.722 | Theta star (bias corrected MLE) | 8.159 |
| nu hat (MLE) | 1029 | nu star (bias corrected) | 721.4 |
| MLE Mean (bias corrected) | 294.3 | MLE Sd (bias corrected) | 49 |

| | | | |
|---|---|---|---|
| | | Approximate Chi Square Value (0.05) | 660.1 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 649.9 |
| **Assuming Gamma Distribution** | | | |
| 95% Approximate Gamma UCL (use when n>=50)) | 321.6 | 95% Adjusted Gamma UCL (use when n<50) | 326.7 |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.974 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.157 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| **Lognormal Statistics** | | | |
| Minimum of Logged Data | 5.429 | Mean of logged Data | 5.675 |
| Maximum of Logged Data | 5.9 | SD of logged Data | 0.148 |
| **Assuming Lognormal Distribution** | | | |
| 95% H-UCL | 322.5 | 90% Chebyshev (MVUE) UCL | 335.6 |
| 95% Chebyshev (MVUE) UCL | 354.3 | 97.5% Chebyshev (MVUE) UCL | 380.3 |
| 99% Chebyshev (MVUE) UCL | 431.3 | | |
| **Nonparametric Distribution Free UCL Statistics** | | | |
| **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| **Nonparametric Distribution Free UCLs** | | | |
| 95% CLT UCL | 316.7 | 95% Jackknife UCL | 319.3 |
| 95% Standard Bootstrap UCL | 315.1 | 95% Bootstrap-t UCL | 320 |
| 95% Hall's Bootstrap UCL | 317.1 | 95% Percentile Bootstrap UCL | 316.8 |
| 95% BCA Bootstrap UCL | 316.7 | | |
| 90% Chebyshev(Mean, Sd) UCL | 335.2 | 95% Chebyshev(Mean, Sd) UCL | 353.8 |
| 97.5% Chebyshev(Mean, Sd) UCL | 379.5 | 99% Chebyshev(Mean, Sd) UCL | 430 |
| **Suggested UCL to Use** | | | |
| 95% Student's-t UCL | 319.3 | | |
| Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | |
| Recommendations are based upon data size, data distribution, and skewness. | | | |
| These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | |
| However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | |
| **Zinc** | | | |
| **General Statistics** | | | |
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 33 | Mean | 56.2 |
| Maximum | 85 | Median | 55 |
| SD | 13.97 | Std. Error of Mean | 4.417 |
| Coefficient of Variation | 0.249 | Skewness | 0.544 |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk GOF Test** | |

| | A B C D E | F | G H I J K | L |
|---|---|---|---|---|
| 487 | 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level | |
| 488 | Lilliefors Test Statistic | 0.164 | **Lilliefors GOF Test** | |
| 489 | 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level | |
| 490 | **Data appear Normal at 5% Significance Level** | | | |
| 491 | | | | |
| 492 | **Assuming Normal Distribution** | | | |
| 493 | **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 494 | 95% Student's-t UCL | 64.3 | 95% Adjusted-CLT UCL (Chen-1995) | 64.28 |
| 495 | | | 95% Modified-t UCL (Johnson-1978) | 64.42 |
| 496 | | | | |
| 497 | **Gamma GOF Test** | | | |
| 498 | A-D Test Statistic | 0.241 | **Anderson-Darling Gamma GOF Test** | |
| 499 | 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 500 | K-S Test Statistic | 0.139 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 501 | 5% K-S Critical Value | 0.266 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 502 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 503 | | | | |
| 504 | **Gamma Statistics** | | | |
| 505 | k hat (MLE) | 17.91 | k star (bias corrected MLE) | 12.6 |
| 506 | Theta hat (MLE) | 3.138 | Theta star (bias corrected MLE) | 4.459 |
| 507 | nu hat (MLE) | 358.2 | nu star (bias corrected) | 252 |
| 508 | MLE Mean (bias corrected) | 56.2 | MLE Sd (bias corrected) | 15.83 |
| 509 | | | Approximate Chi Square Value (0.05) | 216.3 |
| 510 | Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 210.5 |
| 511 | | | | |
| 512 | **Assuming Gamma Distribution** | | | |
| 513 | 95% Approximate Gamma UCL (use when n>=50)) | 65.49 | 95% Adjusted Gamma UCL (use when n<50) | 67.28 |
| 514 | | | | |
| 515 | **Lognormal GOF Test** | | | |
| 516 | Shapiro Wilk Test Statistic | 0.965 | **Shapiro Wilk Lognormal GOF Test** | |
| 517 | 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| 518 | Lilliefors Test Statistic | 0.148 | **Lilliefors Lognormal GOF Test** | |
| 519 | 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |
| 520 | **Data appear Lognormal at 5% Significance Level** | | | |
| 521 | | | | |
| 522 | **Lognormal Statistics** | | | |
| 523 | Minimum of Logged Data | 3.497 | Mean of logged Data | 4.001 |
| 524 | Maximum of Logged Data | 4.443 | SD of logged Data | 0.253 |
| 525 | | | | |
| 526 | **Assuming Lognormal Distribution** | | | |
| 527 | 95% H-UCL | 66.39 | 90% Chebyshev (MVUE) UCL | 69.8 |
| 528 | 95% Chebyshev (MVUE) UCL | 75.94 | 97.5% Chebyshev (MVUE) UCL | 84.47 |
| 529 | 99% Chebyshev (MVUE) UCL | 101.2 | | |
| 530 | | | | |
| 531 | **Nonparametric Distribution Free UCL Statistics** | | | |
| 532 | **Data appear to follow a Discernible Distribution at 5% Significance Level** | | | |
| 533 | | | | |
| 534 | **Nonparametric Distribution Free UCLs** | | | |
| 535 | 95% CLT UCL | 63.46 | 95% Jackknife UCL | 64.3 |
| 536 | 95% Standard Bootstrap UCL | 62.95 | 95% Bootstrap-t UCL | 65.11 |
| 537 | 95% Hall's Bootstrap UCL | 67.47 | 95% Percentile Bootstrap UCL | 63.2 |
| 538 | 95% BCA Bootstrap UCL | 63.5 | | |
| 539 | 90% Chebyshev(Mean, Sd) UCL | 69.45 | 95% Chebyshev(Mean, Sd) UCL | 75.45 |
| 540 | 97.5% Chebyshev(Mean, Sd) UCL | 83.78 | 99% Chebyshev(Mean, Sd) UCL | 100.1 |

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 541 | | | | | | | | | | | | |
| 542 | **Suggested UCL to Use** | | | | | | | | | | | |
| 543 | 95% Student's-t UCL | | | | | 64.3 | | | | | | |
| 544 | | | | | | | | | | | | |
| 545 | Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. | | | | | | | | | | | |
| 546 | Recommendations are based upon data size, data distribution, and skewness. | | | | | | | | | | | |
| 547 | These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006). | | | | | | | | | | | |
| 548 | However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician. | | | | | | | | | | | |
| 549 | | | | | | | | | | | | |

Background UTL
Big Blue Mill
Kern County, Californias

| Arsenic | D_Arsenic | Chromium | D_Chromium | Copper | D_Copper | Lead | D_Lead | Mercury | D_Mercury | Molybdenum | D_Molybdenum | Nickel | D_Nickel | Vanadium | D_Vanadium | Zinc | D_Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17.0 | 1 | 28.0 | 1 | 27 | 1 | 57 | 1 | | | 4.0 | 1 | 23.0 | 1 | 227.0 | 1 | 137 | 1 |
| 8.0 | 1 | 26.0 | 1 | 24 | 1 | 74 | 1 | 5.00 | 1 | 4.0 | 1 | 15.0 | 1 | 274.0 | 1 | 94 | 1 |
| 19.0 | 1 | | | 14 | 1 | 38 | 1 | 5.00 | 1 | 4.0 | 1 | 20.0 | 1 | 242.0 | 1 | 112 | 1 |
| 11.0 | 1 | | | 17 | 1 | 25.0 | 1 | | | 6.0 | 1 | 12.0 | 1 | 133.0 | 1 | 135.0 | 1 |
| 12.0 | 1 | 33.0 | 1 | 20 | 1 | 25 | 1 | 4.0 | 1 | 4.0 | 1 | 15.0 | 1 | 220.0 | 1 | 112 | 1 |
| 13.0 | 1 | | | 10 | 1 | 23 | 1 | | | 7.0 | 1 | 13.0 | 1 | 199 | 1 | 84 | 1 |
| 12.0 | 1 | | | 18 | 1 | 67 | 1 | | | 3.0 | 1 | 13.0 | 1 | 203 | 1 | 88 | 1 |
| 11.0 | 1 | | | 37 | 1 | 66.0 | 1 | | | 11.0 | 1 | 13.0 | 1 | 149.0 | 1 | 172.0 | 1 |
| 16.0 | 1 | | | 36 | 1 | 64 | 1 | | | 16.0 | 1 | 14.0 | 1 | 111.0 | 1 | 236.0 | 1 |
| 17.0 | 1 | | | 14 | 1 | 23 | 1 | | | 7.0 | 1 | 14.0 | 1 | 198.0 | 1 | 103 | 1 |
| 13 | 1 | 27 | 1 | 16 | 1 | 43 | 1 | 3 | 1 | 4 | 1 | 13 | 1 | 194 | 1 | 109 | 1 |
| 16 | 1 | | | 16 | 1 | 32 | 1 | | | 7 | 1 | 14 | 1 | 229 | 1 | 101 | 1 |
| 15 | 1 | | | 17 | 1 | 33 | 1 | 4 | 1 | 6 | 1 | 16 | 1 | 204 | 1 | 115 | 1 |
| 13 | 1 | | | 24 | 1 | 45 | 1 | 4 | 1 | 13 | 1 | 19 | 1 | 214 | 1 | 162 | 1 |
| 15 | 1 | 36 | 1 | 19 | 1 | 43 | 1 | 4 | 1 | 4 | 1 | 24 | 1 | 226 | 1 | 109 | 1 |
| 38 | 1 | | | 20 | 1 | 29 | 1 | 6 | 1 | 33 | 1 | | | 114 | 1 | 213 | 1 |
| 16 | 1 | | | 14 | 1 | 22 | 1 | | | 6 | 1 | 17 | 1 | 163 | 1 | 111 | 1 |
| 20 | 1 | | | 21 | 1 | 36 | 1 | 6 | 1 | 6 | 1 | 16 | 1 | 236 | 1 | 108 | 1 |
| 17 | 1 | 25 | 1 | 21 | 1 | 36 | 1 | 3 | 1 | 5 | 1 | 18 | 1 | 199 | 1 | 106 | 1 |
| 15 | 1 | | | 17 | 1 | 27 | 1 | 3 | 1 | 3 | 1 | 14 | 1 | 229 | 1 | 98 | 1 |
| 19 | 1 | 24 | 1 | 26 | 1 | 59 | 1 | 3 | 1 | 6 | 1 | 13 | 1 | 209 | 1 | 128 | 1 |

## Background Statistics for Uncensored Full Data Sets

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.12/11/2021 11:39:03 AM |
| From File | C:\Users\Oscar\Documents\ECM Consultants\Project Files\US Forest Service\Big Blue\UCL UTL concentrations |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Coverage | 95% |
| New or Future K Observations | 1 |
| Number of Bootstrap Operations | 2000 |

**Arsenic**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 10 |
| Minimum | 8 | First Quartile | 13 |
| Second Largest | 20 | Median | 15 |
| Maximum | 38 | Third Quartile | 17 |
| Mean | 15.86 | SD | 5.902 |
| Coefficient of Variation | 0.372 | Skewness | 2.714 |
| Mean of logged Data | 2.714 | SD of logged Data | 0.305 |

**Critical Values for Background Threshold Values (BTVs)**

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.728 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.233 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 29.85 | 90% Percentile (z) | 23.42 |
| 95% UPL (t) | 26.28 | 95% Percentile (z) | 25.56 |
| 95% USL | 31.09 | 99% Percentile (z) | 29.59 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.813 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.18 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.189 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 10.33 | k star (bias corrected MLE) | 8.89 |
| Theta hat (MLE) | 1.534 | Theta star (bias corrected MLE) | 1.784 |
| nu hat (MLE) | 434.1 | nu star (bias corrected) | 373.4 |
| MLE Mean (bias corrected) | 15.86 | MLE Sd (bias corrected) | 5.318 |

**Background Statistics Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 25.78 | 90% Percentile | 22.94 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 25.78 | 95% Percentile | 25.5 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 30.24 | 99% Percentile | 30.77 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 30.4 | | |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 55 | 95% WH USL | 31.89 | 95% HW USL | 32.14 |
| 56 | | | | |
| 57 | **Lognormal GOF Test** | | | |
| 58 | Shapiro Wilk Test Statistic | 0.908 | **Shapiro Wilk Lognormal GOF Test** | |
| 59 | 5% Shapiro Wilk Critical Value | 0.908 | Data Not Lognormal at 5% Significance Level | |
| 60 | Lilliefors Test Statistic | 0.158 | **Lilliefors Lognormal GOF Test** | |
| 61 | 5% Lilliefors Critical Value | 0.188 | Data appear Lognormal at 5% Significance Level | |
| 62 | **Data appear Approximate Lognormal at 5% Significance Level** | | | |
| 63 | | | | |
| 64 | **Background Statistics assuming Lognormal Distribution** | | | |
| 65 | 95% UTL with 95% Coverage | 31.14 | 90% Percentile (z) | 22.33 |
| 66 | 95% UPL (t) | 25.88 | 95% Percentile (z) | 24.95 |
| 67 | 95% USL | 33.2 | 99% Percentile (z) | 30.72 |
| 68 | | | | |
| 69 | **Nonparametric Distribution Free Background Statistics** | | | |
| 70 | **Data appear Approximate Gamma Distribution at 5% Significance Level** | | | |
| 71 | | | | |
| 72 | **Nonparametric Upper Limits for Background Threshold Values** | | | |
| 73 | Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 38 |
| 74 | Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| 75 | | | Approximate Sample Size needed to achieve specified CC | 59 |
| 76 | 95% Percentile Bootstrap UTL with 95% Coverage | 38 | 95% BCA Bootstrap UTL with 95% Coverage | 38 |
| 77 | 95% UPL | 36.2 | 90% Percentile | 19 |
| 78 | 90% Chebyshev UPL | 33.98 | 95% Percentile | 20 |
| 79 | 95% Chebyshev UPL | 42.19 | 99% Percentile | 34.4 |
| 80 | 95% USL | 38 | | |
| 81 | | | | |
| 82 | Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. | | | |
| 83 | Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers | | | |
| 84 | and consists of observations collected from clean unimpacted locations. | | | |
| 85 | The use of USL tends to provide a balance between false positives and false negatives provided the data | | | |
| 86 | represents a background data set and when many onsite observations need to be compared with the BTV. | | | |
| 87 | | | | |
| 88 | Chromium | | | |
| 89 | | | | |
| 90 | General Statistics | | | |
| 91 | Total Number of Observations | 7 | Number of Distinct Observations | 7 |
| 92 | | | Number of Missing Observations | 14 |
| 93 | Minimum | 24 | First Quartile | 25.5 |
| 94 | Second Largest | 33 | Median | 27 |
| 95 | Maximum | 36 | Third Quartile | 30.5 |
| 96 | Mean | 28.43 | SD | 4.429 |
| 97 | Coefficient of Variation | 0.156 | Skewness | 1.034 |
| 98 | Mean of logged Data | 3.338 | SD of logged Data | 0.149 |
| 99 | | | | |
| 100 | **Critical Values for Background Threshold Values (BTVs)** | | | |
| 101 | Tolerance Factor K (For UTL) | 3.399 | d2max (for USL) | 1.938 |
| 102 | | | | |
| 103 | **Normal GOF Test** | | | |
| 104 | Shapiro Wilk Test Statistic | 0.881 | **Shapiro Wilk GOF Test** | |
| 105 | 5% Shapiro Wilk Critical Value | 0.803 | Data appear Normal at 5% Significance Level | |
| 106 | Lilliefors Test Statistic | 0.253 | **Lilliefors GOF Test** | |
| 107 | 5% Lilliefors Critical Value | 0.304 | Data appear Normal at 5% Significance Level | |
| 108 | **Data appear Normal at 5% Significance Level** | | | |

| | | | |
|---|---|---|---|
| **Background Statistics Assuming Normal Distribution** | | | |
| 95% UTL with 95% Coverage | 43.48 | 90% Percentile (z) | 34.1 |
| 95% UPL (t) | 37.63 | 95% Percentile (z) | 35.71 |
| 95% USL | 37.01 | 99% Percentile (z) | 38.73 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.43 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.708 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.239 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.311 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 51.14 | k star (bias corrected MLE) | 29.32 |
| Theta hat (MLE) | 0.556 | Theta star (bias corrected MLE) | 0.97 |
| nu hat (MLE) | 715.9 | nu star (bias corrected) | 410.4 |
| MLE Mean (bias corrected) | 28.43 | MLE Sd (bias corrected) | 5.251 |
| | | | |
| **Background Statistics Assuming Gamma Distribution** | | | |
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 38.09 | 90% Percentile | 35.33 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 38.15 | 95% Percentile | 37.58 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 45.41 | 99% Percentile | 42.05 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 45.71 | | |
| 95% WH USL | 37.37 | 95% HW USL | 37.42 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.904 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.803 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.229 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.304 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Background Statistics assuming Lognormal Distribution** | | | |
| 95% UTL with 95% Coverage | 46.73 | 90% Percentile (z) | 34.08 |
| 95% UPL (t) | 38.37 | 95% Percentile (z) | 35.97 |
| 95% USL | 37.58 | 99% Percentile (z) | 39.82 |
| | | | |
| **Nonparametric Distribution Free Background Statistics** | | | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Nonparametric Upper Limits for Background Threshold Values** | | | |
| Order of Statistic, r | 7 | 95% UTL with 95% Coverage | 36 |
| Approx, f used to compute achieved CC | 0.368 | Approximate Actual Confidence Coefficient achieved by UTL | 0.302 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 36 | 95% BCA Bootstrap UTL with 95% Coverage | 36 |
| 95% UPL | 36 | 90% Percentile | 34.2 |
| 90% Chebyshev UPL | 42.63 | 95% Percentile | 35.1 |
| 95% Chebyshev UPL | 49.07 | 99% Percentile | 35.82 |
| 95% USL | 36 | | |
| | | | |
| Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. | | | |
| Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers | | | |
| and consists of observations collected from clean unimpacted locations. | | | |

The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

### Copper

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 13 |
| Minimum | 10 | First Quartile | 16 |
| Second Largest | 36 | Median | 19 |
| Maximum | 37 | Third Quartile | 24 |
| Mean | 20.38 | SD | 6.83 |
| Coefficient of Variation | 0.335 | Skewness | 1.173 |
| Mean of logged Data | 2.966 | SD of logged Data | 0.315 |

#### Critical Values for Background Threshold Values (BTVs)

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.896 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.178 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

#### Background Statistics Assuming Normal Distribution

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 36.57 | 90% Percentile (z) | 29.13 |
| 95% UPL (t) | 32.44 | 95% Percentile (z) | 31.62 |
| 95% USL | 38 | 99% Percentile (z) | 36.27 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.412 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.135 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.189 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 10.44 | k star (bias corrected MLE) | 8.976 |
| Theta hat (MLE) | 1.953 | Theta star (bias corrected MLE) | 2.271 |
| nu hat (MLE) | 438.3 | nu star (bias corrected) | 377 |
| MLE Mean (bias corrected) | 20.38 | MLE Sd (bias corrected) | 6.803 |

#### Background Statistics Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 33.13 | 90% Percentile | 29.44 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 33.28 | 95% Percentile | 32.71 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 38.84 | 99% Percentile | 39.44 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 39.29 | | |
| 95% WH USL | 40.96 | 95% HW USL | 41.55 |

#### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.967 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.116 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

**Background Statistics assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 41.01 | 90% Percentile (z) | 29.08 |
| 95% UPL (t) | 33.88 | 95% Percentile (z) | 32.62 |
| 95% USL | 43.81 | 99% Percentile (z) | 40.44 |

**Nonparametric Distribution Free Background Statistics**

**Data appear Approximate Normal at 5% Significance Level**

**Nonparametric Upper Limits for Background Threshold Values**

| | | | |
|---|---|---|---|
| Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 37 |
| Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 37 | 95% BCA Bootstrap UTL with 95% Coverage | 37 |
| 95% UPL | 36.9 | 90% Percentile | 27 |
| 90% Chebyshev UPL | 41.35 | 95% Percentile | 36 |
| 95% Chebyshev UPL | 50.85 | 99% Percentile | 36.8 |
| 95% USL | 37 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

**Lead**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 17 |
| Minimum | 22 | First Quartile | 27 |
| Second Largest | 67 | Median | 36 |
| Maximum | 74 | Third Quartile | 57 |
| Mean | 41.29 | SD | 16.71 |
| Coefficient of Variation | 0.405 | Skewness | 0.637 |
| Mean of logged Data | 3.645 | SD of logged Data | 0.397 |

**Critical Values for Background Threshold Values (BTVs)**

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.898 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.149 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data appear Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 80.91 | 90% Percentile (z) | 62.7 |
| 95% UPL (t) | 70.79 | 95% Percentile (z) | 68.78 |
| 95% USL | 84.41 | 99% Percentile (z) | 80.17 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.574 | **Anderson-Darling Gamma GOF Test** |

| | | | | |
|---|---|---|---|---|
| 271 | 5% A-D Critical Value | 0.744 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 272 | K-S Test Statistic | 0.13 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 273 | 5% K-S Critical Value | 0.19 | Detected data appear Gamma Distributed at 5% Significance Level | |
| 274 | **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| 275 | | | | |
| 276 | **Gamma Statistics** | | | |
| 277 | k hat (MLE) | 6.749 | k star (bias corrected MLE) | 5.817 |
| 278 | Theta hat (MLE) | 6.117 | Theta star (bias corrected MLE) | 7.098 |
| 279 | nu hat (MLE) | 283.5 | nu star (bias corrected) | 244.3 |
| 280 | MLE Mean (bias corrected) | 41.29 | MLE Sd (bias corrected) | 17.12 |
| 281 | | | | |
| 282 | **Background Statistics Assuming Gamma Distribution** | | | |
| 283 | 95% Wilson Hilferty (WH) Approx. Gamma UPL | 74.17 | 90% Percentile | 64.18 |
| 284 | 95% Hawkins Wixley (HW) Approx. Gamma UPL | 74.81 | 95% Percentile | 72.87 |
| 285 | 95% WH Approx. Gamma UTL with 95% Coverage | 89.75 | 99% Percentile | 91.11 |
| 286 | 95% HW Approx. Gamma UTL with 95% Coverage | 91.48 | | |
| 287 | 95% WH USL | 95.6 | 95% HW USL | 97.84 |
| 288 | | | | |
| 289 | **Lognormal GOF Test** | | | |
| 290 | Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk Lognormal GOF Test** | |
| 291 | 5% Shapiro Wilk Critical Value | 0.908 | Data appear Lognormal at 5% Significance Level | |
| 292 | Lilliefors Test Statistic | 0.128 | **Lilliefors Lognormal GOF Test** | |
| 293 | 5% Lilliefors Critical Value | 0.188 | Data appear Lognormal at 5% Significance Level | |
| 294 | **Data appear Lognormal at 5% Significance Level** | | | |
| 295 | | | | |
| 296 | **Background Statistics assuming Lognormal Distribution** | | | |
| 297 | 95% UTL with 95% Coverage | 98.16 | 90% Percentile (z) | 63.67 |
| 298 | 95% UPL (t) | 77.17 | 95% Percentile (z) | 73.56 |
| 299 | 95% USL | 106.7 | 99% Percentile (z) | 96.44 |
| 300 | | | | |
| 301 | **Nonparametric Distribution Free Background Statistics** | | | |
| 302 | **Data appear Approximate Normal at 5% Significance Level** | | | |
| 303 | | | | |
| 304 | **Nonparametric Upper Limits for Background Threshold Values** | | | |
| 305 | Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 74 |
| 306 | Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| 307 | | | Approximate Sample Size needed to achieve specified CC | 59 |
| 308 | 95% Percentile Bootstrap UTL with 95% Coverage | 74 | 95% BCA Bootstrap UTL with 95% Coverage | 74 |
| 309 | 95% UPL | 73.3 | 90% Percentile | 66 |
| 310 | 90% Chebyshev UPL | 92.6 | 95% Percentile | 67 |
| 311 | 95% Chebyshev UPL | 115.8 | 99% Percentile | 72.6 |
| 312 | 95% USL | 74 | | |
| 313 | | | | |
| 314 | Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20. | | | |
| 315 | Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers | | | |
| 316 | and consists of observations collected from clean unimpacted locations. | | | |
| 317 | The use of USL tends to provide a balance between false positives and false negatives provided the data | | | |
| 318 | represents a background data set and when many onsite observations need to be compared with the BTV. | | | |
| 319 | | | | |
| 320 | **Mercury** | | | |
| 321 | | | | |
| 322 | **General Statistics** | | | |
| 323 | Total Number of Observations | 12 | Number of Distinct Observations | 4 |
| 324 | | | Number of Missing Observations | 9 |

| | | | |
|---|---|---|---|
| Minimum | 3 | First Quartile | 3 |
| Second Largest | 6 | Median | 4 |
| Maximum | 6 | Third Quartile | 5 |
| Mean | 4.167 | SD | 1.115 |
| Coefficient of Variation | 0.268 | Skewness | 0.56 |
| Mean of logged Data | 1.395 | SD of logged Data | 0.263 |
| | | | |
| **Critical Values for Background Threshold Values (BTVs)** | | | |
| Tolerance Factor K (For UTL) | 2.736 | d2max (for USL) | 2.285 |
| | | | |
| **Normal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.859 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.226 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.243 | Data appear Normal at 5% Significance Level | |
| **Data appear Normal at 5% Significance Level** | | | |
| | | | |
| **Background Statistics Assuming Normal Distribution** | | | |
| 95% UTL with 95% Coverage | 7.216 | 90% Percentile (z) | 5.595 |
| 95% UPL (t) | 6.25 | 95% Percentile (z) | 6 |
| 95% USL | 6.714 | 99% Percentile (z) | 6.76 |
| | | | |
| **Gamma GOF Test** | | | |
| A-D Test Statistic | 0.681 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.731 | Detected data appear Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.209 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.245 | Detected data appear Gamma Distributed at 5% Significance Level | |
| **Detected data appear Gamma Distributed at 5% Significance Level** | | | |
| | | | |
| **Gamma Statistics** | | | |
| k hat (MLE) | 15.82 | k star (bias corrected MLE) | 11.92 |
| Theta hat (MLE) | 0.263 | Theta star (bias corrected MLE) | 0.35 |
| nu hat (MLE) | 379.6 | nu star (bias corrected) | 286 |
| MLE Mean (bias corrected) | 4.167 | MLE Sd (bias corrected) | 1.207 |
| | | | |
| **Background Statistics Assuming Gamma Distribution** | | | |
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 6.448 | 90% Percentile | 5.769 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 6.48 | 95% Percentile | 6.33 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 7.803 | 99% Percentile | 7.475 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 7.906 | | |
| 95% WH USL | 7.076 | 95% HW USL | 7.137 |
| | | | |
| **Lognormal GOF Test** | | | |
| Shapiro Wilk Test Statistic | 0.867 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.859 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.204 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.243 | Data appear Lognormal at 5% Significance Level | |
| **Data appear Lognormal at 5% Significance Level** | | | |
| | | | |
| **Background Statistics assuming Lognormal Distribution** | | | |
| 95% UTL with 95% Coverage | 8.278 | 90% Percentile (z) | 5.65 |
| 95% UPL (t) | 6.593 | 95% Percentile (z) | 6.216 |
| 95% USL | 7.353 | 99% Percentile (z) | 7.434 |

**Nonparametric Distribution Free Background Statistics**

**Data appear Normal at 5% Significance Level**

**Nonparametric Upper Limits for Background Threshold Values**

| | | | |
|---|---|---|---|
| Order of Statistic, r | 12 | 95% UTL with 95% Coverage | 6 |
| Approx, f used to compute achieved CC | 0.632 | Approximate Actual Confidence Coefficient achieved by UTL | 0.46 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 6 | 95% BCA Bootstrap UTL with 95% Coverage | 6 |
| 95% UPL | 6 | 90% Percentile | 5.9 |
| 90% Chebyshev UPL | 7.647 | 95% Percentile | 6 |
| 95% Chebyshev UPL | 9.224 | 99% Percentile | 6 |
| 95% USL | 6 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

**Molybdenum**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 9 |
| Minimum | 3 | First Quartile | 4 |
| Second Largest | 16 | Median | 6 |
| Maximum | 33 | Third Quartile | 7 |
| Mean | 7.571 | SD | 6.698 |
| Coefficient of Variation | 0.885 | Skewness | 3.079 |
| Mean of logged Data | 1.817 | SD of logged Data | 0.586 |

**Critical Values for Background Threshold Values (BTVs)**

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.608 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.344 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 23.45 | 90% Percentile (z) | 16.15 |
| 95% UPL (t) | 19.39 | 95% Percentile (z) | 18.59 |
| 95% USL | 24.85 | 99% Percentile (z) | 23.15 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.517 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.275 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.191 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.563 | k star (bias corrected MLE) | 2.229 |

| | | | |
|---|---|---|---|
| Theta hat (MLE) | 2.954 | Theta star (bias corrected MLE) | 3.397 |
| nu hat (MLE) | 107.7 | nu star (bias corrected) | 93.61 |
| MLE Mean (bias corrected) | 7.571 | MLE Sd (bias corrected) | 5.072 |

**Background Statistics Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 17.64 | 90% Percentile | 14.36 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 17.51 | 95% Percentile | 17.36 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 23.27 | 99% Percentile | 23.98 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 23.47 | | |
| 95% WH USL | 25.46 | 95% HW USL | 25.85 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.869 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.222 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

**Background Statistics assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 24.7 | 90% Percentile (z) | 13.04 |
| 95% UPL (t) | 17.32 | 95% Percentile (z) | 16.13 |
| 95% USL | 27.92 | 99% Percentile (z) | 24.06 |

**Nonparametric Distribution Free Background Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Upper Limits for Background Threshold Values**

| | | | |
|---|---|---|---|
| Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 33 |
| Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 33 | 95% BCA Bootstrap UTL with 95% Coverage | 33 |
| 95% UPL | 31.3 | 90% Percentile | 13 |
| 90% Chebyshev UPL | 28.14 | 95% Percentile | 16 |
| 95% Chebyshev UPL | 37.45 | 99% Percentile | 29.6 |
| 95% USL | 33 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

**Nickel**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 20 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 1 |
| Minimum | 12 | First Quartile | 13 |
| Second Largest | 23 | Median | 14.5 |
| Maximum | 24 | Third Quartile | 17.25 |
| Mean | 15.8 | SD | 3.412 |
| Coefficient of Variation | 0.216 | Skewness | 1.259 |
| Mean of logged Data | 2.74 | SD of logged Data | 0.199 |

| | A–E | F | G–K | L |
|---|---|---|---|---|
| 487 | **Critical Values for Background Threshold Values (BTVs)** | | | |
| 488 | Tolerance Factor K (For UTL) | 2.396 | d2max (for USL) | 2.557 |
| 489 | | | | |
| 490 | **Normal GOF Test** | | | |
| 491 | Shapiro Wilk Test Statistic | 0.85 | **Shapiro Wilk GOF Test** | |
| 492 | 5% Shapiro Wilk Critical Value | 0.905 | Data Not Normal at 5% Significance Level | |
| 493 | Lilliefors Test Statistic | 0.201 | **Lilliefors GOF Test** | |
| 494 | 5% Lilliefors Critical Value | 0.192 | Data Not Normal at 5% Significance Level | |
| 495 | **Data Not Normal at 5% Significance Level** | | | |
| 496 | | | | |
| 497 | **Background Statistics Assuming Normal Distribution** | | | |
| 498 | 95% UTL with 95% Coverage | 23.98 | 90% Percentile (z) | 20.17 |
| 499 | 95% UPL (t) | 21.85 | 95% Percentile (z) | 21.41 |
| 500 | 95% USL | 24.52 | 99% Percentile (z) | 23.74 |
| 501 | | | | |
| 502 | **Gamma GOF Test** | | | |
| 503 | A-D Test Statistic | 0.929 | **Anderson-Darling Gamma GOF Test** | |
| 504 | 5% A-D Critical Value | 0.74 | Data Not Gamma Distributed at 5% Significance Level | |
| 505 | K-S Test Statistic | 0.202 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 506 | 5% K-S Critical Value | 0.193 | Data Not Gamma Distributed at 5% Significance Level | |
| 507 | **Data Not Gamma Distributed at 5% Significance Level** | | | |
| 508 | | | | |
| 509 | **Gamma Statistics** | | | |
| 510 | k hat (MLE) | 25.44 | k star (bias corrected MLE) | 21.65 |
| 511 | Theta hat (MLE) | 0.621 | Theta star (bias corrected MLE) | 0.73 |
| 512 | nu hat (MLE) | 1017 | nu star (bias corrected) | 866.1 |
| 513 | MLE Mean (bias corrected) | 15.8 | MLE Sd (bias corrected) | 3.395 |
| 514 | | | | |
| 515 | **Background Statistics Assuming Gamma Distribution** | | | |
| 516 | 95% Wilson Hilferty (WH) Approx. Gamma UPL | 21.94 | 90% Percentile | 20.28 |
| 517 | 95% Hawkins Wixley (HW) Approx. Gamma UPL | 21.96 | 95% Percentile | 21.77 |
| 518 | 95% WH Approx. Gamma UTL with 95% Coverage | 24.54 | 99% Percentile | 24.75 |
| 519 | 95% HW Approx. Gamma UTL with 95% Coverage | 24.63 | | |
| 520 | 95% WH USL | 25.24 | 95% HW USL | 25.35 |
| 521 | | | | |
| 522 | **Lognormal GOF Test** | | | |
| 523 | Shapiro Wilk Test Statistic | 0.893 | **Shapiro Wilk Lognormal GOF Test** | |
| 524 | 5% Shapiro Wilk Critical Value | 0.905 | Data Not Lognormal at 5% Significance Level | |
| 525 | Lilliefors Test Statistic | 0.195 | **Lilliefors Lognormal GOF Test** | |
| 526 | 5% Lilliefors Critical Value | 0.192 | Data Not Lognormal at 5% Significance Level | |
| 527 | **Data Not Lognormal at 5% Significance Level** | | | |
| 528 | | | | |
| 529 | **Background Statistics assuming Lognormal Distribution** | | | |
| 530 | 95% UTL with 95% Coverage | 24.93 | 90% Percentile (z) | 19.98 |
| 531 | 95% UPL (t) | 22.03 | 95% Percentile (z) | 21.48 |
| 532 | 95% USL | 25.74 | 99% Percentile (z) | 24.59 |
| 533 | | | | |
| 534 | **Nonparametric Distribution Free Background Statistics** | | | |
| 535 | **Data do not follow a Discernible Distribution (0.05)** | | | |
| 536 | | | | |
| 537 | **Nonparametric Upper Limits for Background Threshold Values** | | | |
| 538 | Order of Statistic, r | 20 | 95% UTL with 95% Coverage | 24 |
| 539 | Approx, f used to compute achieved CC | 1.053 | Approximate Actual Confidence Coefficient achieved by UTL | 0.642 |
| 540 | | | Approximate Sample Size needed to achieve specified CC | 59 |

| | | | |
|---|---|---|---|
| 95% Percentile Bootstrap UTL with 95% Coverage | 24 | 95% BCA Bootstrap UTL with 95% Coverage | 24 |
| 95% UPL | 23.95 | 90% Percentile | 20.3 |
| 90% Chebyshev UPL | 26.29 | 95% Percentile | 23.05 |
| 95% Chebyshev UPL | 31.04 | 99% Percentile | 23.81 |
| 95% USL | 24 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

**Vanadium**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 19 |
| Minimum | 111 | First Quartile | 194 |
| Second Largest | 242 | Median | 204 |
| Maximum | 274 | Third Quartile | 227 |
| Mean | 198.7 | SD | 42.49 |
| Coefficient of Variation | 0.214 | Skewness | -0.765 |
| Mean of logged Data | 5.266 | SD of logged Data | 0.243 |

**Critical Values for Background Threshold Values (BTVs)**

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.915 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.218 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data Not Normal at 5% Significance Level |

**Data appear Approximate Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 299.5 | 90% Percentile (z) | 253.2 |
| 95% UPL (t) | 273.7 | 95% Percentile (z) | 268.6 |
| 95% USL | 308.4 | 99% Percentile (z) | 297.6 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.152 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.25 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.189 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 19.59 | k star (bias corrected MLE) | 16.82 |
| Theta hat (MLE) | 10.15 | Theta star (bias corrected MLE) | 11.81 |
| nu hat (MLE) | 822.7 | nu star (bias corrected) | 706.5 |
| MLE Mean (bias corrected) | 198.7 | MLE Sd (bias corrected) | 48.45 |

**Background Statistics Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 287.2 | 90% Percentile | 262.8 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 289.5 | 95% Percentile | 284.5 |

| | | | |
|---|---|---|---|
| 95% WH Approx. Gamma UTL with 95% Coverage | 324.3 | 99% Percentile | 328.4 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 328.8 | | |
| 95% WH USL | 337.9 | 95% HW USL | 343.2 |

**Lognormal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.856 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.265 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.188 | Data Not Lognormal at 5% Significance Level | |

**Data Not Lognormal at 5% Significance Level**

**Background Statistics assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 344.8 | 90% Percentile (z) | 264.5 |
| 95% UPL (t) | 297.5 | 95% Percentile (z) | 289 |
| 95% USL | 362.8 | 99% Percentile (z) | 341.1 |

**Nonparametric Distribution Free Background Statistics**

**Data appear Approximate Normal at 5% Significance Level**

**Nonparametric Upper Limits for Background Threshold Values**

| | | | |
|---|---|---|---|
| Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 274 |
| Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 274 | 95% BCA Bootstrap UTL with 95% Coverage | 274 |
| 95% UPL | 270.8 | 90% Percentile | 236 |
| 90% Chebyshev UPL | 329.2 | 95% Percentile | 242 |
| 95% Chebyshev UPL | 388.3 | 99% Percentile | 267.6 |
| 95% USL | 274 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

**Zinc**

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 21 | Number of Distinct Observations | 19 |
| Minimum | 84 | First Quartile | 103 |
| Second Largest | 213 | Median | 111 |
| Maximum | 236 | Third Quartile | 135 |
| Mean | 125.4 | SD | 39.68 |
| Coefficient of Variation | 0.316 | Skewness | 1.724 |
| Mean of logged Data | 4.793 | SD of logged Data | 0.272 |

**Critical Values for Background Threshold Values (BTVs)**

| | | | |
|---|---|---|---|
| Tolerance Factor K (For UTL) | 2.371 | d2max (for USL) | 2.58 |

**Normal GOF Test**

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.793 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.27 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.188 | Data Not Normal at 5% Significance Level | |

**Data Not Normal at 5% Significance Level**

**Background Statistics Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 219.5 | 90% Percentile (z) | 176.2 |
| 95% UPL (t) | 195.4 | 95% Percentile (z) | 190.6 |
| 95% USL | 227.8 | 99% Percentile (z) | 217.7 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 1.249 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.743 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.252 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.189 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 13.05 | k star (bias corrected MLE) | 11.22 |
| Theta hat (MLE) | 9.609 | Theta star (bias corrected MLE) | 11.18 |
| nu hat (MLE) | 548 | nu star (bias corrected) | 471.1 |
| MLE Mean (bias corrected) | 125.4 | MLE Sd (bias corrected) | 37.44 |

**Background Statistics Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Wilson Hilferty (WH) Approx. Gamma UPL | 194.7 | 90% Percentile | 175.1 |
| 95% Hawkins Wixley (HW) Approx. Gamma UPL | 194.7 | 95% Percentile | 192.6 |
| 95% WH Approx. Gamma UTL with 95% Coverage | 225 | 99% Percentile | 228.5 |
| 95% HW Approx. Gamma UTL with 95% Coverage | 226.1 | | |
| 95% WH USL | 236.2 | 95% HW USL | 237.8 |

**Lognormal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.881 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.908 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.236 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.188 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

**Background Statistics assuming Lognormal Distribution**

| | | | |
|---|---|---|---|
| 95% UTL with 95% Coverage | 229.9 | 90% Percentile (z) | 170.9 |
| 95% UPL (t) | 195 | 95% Percentile (z) | 188.7 |
| 95% USL | 243.4 | 99% Percentile (z) | 227.1 |

**Nonparametric Distribution Free Background Statistics**

**Data do not follow a Discernible Distribution (0.05)**

**Nonparametric Upper Limits for Background Threshold Values**

| | | | |
|---|---|---|---|
| Order of Statistic, r | 21 | 95% UTL with 95% Coverage | 236 |
| Approx, f used to compute achieved CC | 1.105 | Approximate Actual Confidence Coefficient achieved by UTL | 0.659 |
| | | Approximate Sample Size needed to achieve specified CC | 59 |
| 95% Percentile Bootstrap UTL with 95% Coverage | 236 | 95% BCA Bootstrap UTL with 95% Coverage | 236 |
| 95% UPL | 233.7 | 90% Percentile | 172 |
| 90% Chebyshev UPL | 247.2 | 95% Percentile | 213 |
| 95% Chebyshev UPL | 302.4 | 99% Percentile | 231.4 |
| 95% USL | 236 | | |

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 703 | and consists of observations collected from clean unimpacted locations. | | | | | | | | | | | |
| 704 | The use of USL tends to provide a balance between false positives and false negatives provided the data | | | | | | | | | | | |
| 705 | represents a background data set and when many onsite observations need to be compared with the BTV. | | | | | | | | | | | |
| 706 | | | | | | | | | | | | |