U.S. ENVIRONMENTAL PROTECTION AGENCY
POLLUTION/SITUATION REPORT
Bonanza Mine and Mill - Removal Polrep

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**Region X**

**Subject:** **POLREP #5**
**Bonanza Mine and Mill**

**Sutherlin, OR**
**Latitude: 43.3899870 Longitude: -123.1845630**

**To:** Brooks Stanfield, EPA Region 10

**From:** Dan Heister, On-Scene Coordinator
**Date:** 10/21/2014
**Reporting Period:** 9/28/14 – 10/11/14

## 1. Introduction

### 1.1 Background

| | | | |
|---|---|---|---|
| **Site Number:** | 10NE | **Contract Number:** | START 14-06-0006 |
| **D.O. Number:** | ERRS 0013/030309.0013 | **Action Memo Date:** | 6/4/2014 |
| **Response Authority:** | CERCLA | **Response Type:** | Time-Critical |
| **Response Lead:** | EPA | **Incident Category:** | Removal Action |
| **NPL Status:** | Non NPL | **Operable Unit:** | |
| **Mobilization Date:** | 8/4/2014 | **Start Date:** | 8/4/2014 |
| **Demob Date:** | 11/22/2014 | **Completion Date:** | 11/22/2014 |
| **CERCLIS ID:** | ORN001001174 | **RCRIS ID:** | |
| **ERNS No.:** | | **State Notification:** | 6/4/14 |
| **FPN#:** | | **Reimbursable Account #:** | |

#### 1.1.1 Incident Category
Abandoned historical mercury mine and mill.

#### 1.1.2 Site Description

##### 1.1.2.1 Location
The Bonanza Mine and Mill Site is located near the small community of Nonpareil, 6 miles east of Sutherlin, Douglas County, Oregon. The Site is located in the SW ¼ of Section 16 of Township 25 South, Range 4 West, Willamette Meridian (latitude N43° 23'46", longitude W123°10'54").

Except for one former building used as a residence, other mine and mill buildings are no longer present, leaving only the mill concrete foundations, calcine, and waste rock. The mine had 12 adits and more than three miles of subterranean tunnels and shafts. The mine adits have since been abandoned, and no open adits have been located during the 2014 removal action.

Five residences are located close to the mine, including two residences within 200 feet of the former mill. Besides roads and driveways leading to the residences, the land is undeveloped. The nearest off-Site residences are located about a half mile away, to the northeast, along Banks Creek Road.

The Bonanza Mine has an operation history extending from the mid-1860s through 1960. The main mercury-containing mineral is cinnabar, although metacinnabar and native mercury were also reported in the mine workings. Total recorded mercury production was 39,540 flasks (or 3,005,040 pounds).

##### 1.1.2.2 Description of Threat
The data from numerous environmental investigations shows that environmental media are contaminated by elevated concentrations of mercury, arsenic, and other metals, and the source of metals is from historical mercury mining, processing, and disposal operations. Elevated metals concentrations are present in calcine, waste rock, and soil at the former mill site, the surrounding hillside, and valley floor.

#### 1.1.3 Preliminary Removal Assessment/Removal Site Inspection Results
Data regarding the nature and extent of the contaminants of concern found at the Site are summarized below.

1999 – Preliminary Assessment

Ecology and Environment, Inc. (E&E) completed a Preliminary Assessment (PA) of Red Rock Road (Road)

for EPA in May 1999. The PA evaluated the potential for exposure to public health and the environment from potential metals contamination associated with the Road. The Road is a former railroad grade approximately 17 miles long that was constructed of calcine from the Bonanza Mine. The amount of material used in construction of the Road is estimated at 316,000 cubic yards ($yd^3$). As a result of the PA, further investigation was recommended.

2000 - Site Inspection

E&E completed a Site Inspection (SI) of Red Rock Road and surrounding watersheds for EPA in May 2000. As part of this SI, nine surface soil samples were collected from potential source areas at the Bonanza Mine Site, including the former mill, calcine, waste rock, and an abandoned adit. Mercury concentrations in these areas ranged from 74 to 12,000 milligram per kilogram (mg/kg), arsenic concentrations ranged from 71.3 to 246 mg/kg, and lead concentrations ranged from 6.5 to 1,240 mg/kg. The total on-Site volume of calcine was estimated at 2,080 $yd^3$ and waste rock was estimated at 400 $yd^3$.

2000 – Removal Assessment

In September 2000, Hart Crowser, Inc. (HC) performed a Removal Assessment (RA) at the former mill site for ODEQ to gather additional data to delineate the extent of metals contamination at the Site. As part of this RA, 31 surface and near-surface soil samples were collected from the former mill site and surrounding hillside. Mercury concentrations ranged from 67.7 to 12,000 mg/kg, arsenic concentrations ranged from 20.3 to 314 mg/kg, and lead concentrations were generally below 70 mg/kg. Calcine, waste rock, and roadway soils also had elevated mercury and arsenic concentrations ranging up to 179 mg/kg and 246 mg/kg, respectively.

One sample each of the former mill soil and calcine were analyzed for mercury speciation. Methyl mercury was detected at 0.03765 mg/kg in soil and 0.00246 mg/kg in calcine. Sequential extraction on soil and calcine indicated that most of the mercury was sulfide-bound, primarily in the form of cinnabar or metacinnabar. Volatile mercury was detected at 2,100 and 2,360 microgram per cubic meter ($\mu g/m^3$).

Water samples were collected from the on-Site well and water storage tank. Arsenic was detected at 0.0536 milligram per liter (mg/L) in a sample collected from the on-Site well and this concentration exceeds the Federal Maximum Contaminant Level (MCL) of 0.005 mg/L for drinking water. Reportedly, well water is used only for agricultural purposes and not for drinking water. Based on the findings of the removal assessment, the first of two removal actions described in Section 2.1.2 (Response Actions to Date) was performed by ODEQ in 2000 in certain areas to achieve prompt human health risk reduction. Water samples have been collected from the spring water storage tank and have consistently had no detections of mercury and arsenic using standard drinking water analytical methods.

2003 – Site Visit

HC returned to the Site on behalf of ODEQ in 2003 to assess whether ecological receptors and/or exposure pathways were present or potentially present at or in the Bonanza Mine Site and along Foster Creek. Impacts to the Site and surrounding properties attributable to contaminated environmental media were not observed during the Site visit. Physical impacts from historical mining operations included the waste rock pile, mine access roads, and mine excavation. Based on the results of the Oregon Natural Heritage Information Center data search and information from the Oregon Department of Fish and Wildlife, HC concluded that there is a possibility that rare, threatened, and endangered species may be present at or near the Site.

2005 – Post-Removal Assessment Report

HC compiled and assessed available information for the Bonanza Mine in 2005 to assist in preparation of a forthcoming Remedial Investigation (RI) Work Plan. This report also developed a preliminary conceptual site model (CSM) for both human and ecological receptors at the Site and identified tasks to be performed during the RI to address data gaps. Volatile mercury was measured in soil from the former mill and calcine. No other environmental media samples were collected as part of this activity. The RI Work Plan has not yet been prepared.

2013 – Soil Assessment

In December 2013, ODEQ screened 118 soil samples using a field portable X-Ray fluorescence spectrometer (FPXRF) to gather additional data to identify those areas where soil concentrations are below a site-specific background concentration for arsenic and a residential risk-based concentration for mercury. Nine discrete soil samples were also collected and sent off-Site for laboratory analysis. The results of this assessment indicated that arsenic and mercury contamination is more widespread in the northern portion of the property than previously anticipated. The results also showed that arsenic and mercury contamination extends into the southern portion of the Site near two existing residences.

## 2. Current Activities

### 2.1 Operations Section

#### 2.1.1 Narrative

#### 2.1.2 Response Actions to Date

**2.1.2.a** The following removal actions have been undertaken by the Oregon Department of Environmental Quality (ODEQ) in the past:

2000 – Removal Action

Based on the findings of the 2000 HC RA, HC performed a removal action at the former mill site for ODEQ from 14 through 29 September 2000. The objective of this action was to provide prompt risk reduction by excavating soil exceeding 230 mg/kg mercury in the mill area, and for arsenic and lead the cleanup goals were 50 mg/kg and 400 mg/kg, respectively. Eight $yd^3$ of soil were excavated from the mill furnace area, and this material was transported off-Site for disposal as hazardous waste. Approximately 240 $yd^3$ of mercury-contaminated soil was excavated from the mill area and placed in a lined and covered temporary storage cell near the base of the waste rock pile. This material was removed from the Site in April 2004 and transported off-Site for disposal. Larger debris such as concrete, firebrick, and a metal furnace were placed in a subsurface vault located at the former mill site. Disturbed areas were restored, as closely as possible, to the original site conditions.

Confirmation soil samples were collected after the removal action. A few samples exceeded the mercury cleanup goal (up to 6,400 mg/kg); however, these sample areas are beneath two to six feet of clean material. Characterization samples collected from the surrounding hillside, calcine, waste rock pile, roads, driveways, and cell base had mercury concentrations ranging from 1.53 to 220 mg/kg. Four samples with greater than 230 mg/kg mercury were from the mine adit (306 mg/kg), the temporary repository (500 mg/kg), an area south of the former mill (930 mg/kg), and a small area where free mercury was observed (5,100 mg/kg).

2014 – Removal Action

NRC Environmental, with technical support and documentation from APEX, performed a second removal action at the Site for ODEQ in February 2014. The objective of this action was to achieve prompt human health risk reduction by removing and capping soil in certain inhabited areas of the Site that were impacted by elevated concentrations of mercury and arsenic. At the time this removal action was performed, the contaminants of concern were mercury and arsenic, and the cleanup goals were 23 mg/kg and 17 mg/kg, respectively.

Prior to implementation of the removal action, FPXRF screening was performed at 118 points scattered across the Site. Arsenic ranged from non-detect to 471 parts per million (ppm), and mercury concentrations ranged from non-detect to 1,200 ppm. Using this information, six areas were identified that had arsenic or mercury concentrations above the cleanup goals. During conduct of the removal action (12 through 21 February 2014) and follow-up site visit (12 March 2014), 39 additional data points were collected from across the Site with the purpose of better understanding the metals distribution across the Site. Arsenic concentrations in these points ranged from non-detect to 81 ppm, and mercury concentrations ranged from non-detect to 459 ppm. The results indicated that the mine-waste contamination from the mill site area is more widespread than previously anticipated, including contamination encountered near two existing home sites.

The largest areas of contaminated soil encompass about 16 acres, including the original mill site and calcine pile. ODEQ determined that these areas could not be excavated at this time due to resource constraints. Temporary fencing and gates were installed to restrict access to certain areas and the existing blackberry vegetation restricting access to Area 4 was left undisturbed. Approximately 60 $yd^3$ of contaminated soil and firebrick were excavated from the smaller areas, and this material was placed in a temporary cell near the base of the waste rock pile where it remains. Disturbed areas were restored, as closely as possible, to the original site conditions.

**2.1.2.b.** The following removal actions have been undertaken by EPA as part of this ongoing removal action for the current reporting period:

***Excavation and Reconstruction***
ERRS continued to excavate drainage channels in Area 1 and Area 2 along with the anchor trench around the toe of the repository.

ERRS placed 40 bags of powdered bentonite at Residence 6 to fill void space between large cobbles that were previously identified as pathways for mercury vapors. The void space was backfilled using clay excavated from the anchor trench in Area 1. A layer of 6 inch sub-base was then placed throughout Residence 6 to level the area on October 11.

On October 8, ERRS placed topsoil around the trees at Residence 1. Soil from the anchor trench in Area 1 was used to level the south section, and shale rock from Residence 2 was used to level the north section. An additional layer of 2.5 inch minus rock imported from Umpqua Quarry was then placed throughout Residence 1.

During previous reporting periods, approximately 5,200 $yd^3$ of mine-waste contaminated material was excavated at the mill site. During the current reporting period, the mill site was backfilled with 4,600 $yd^3$ of soil excavated from Residence 2 and smaller quantities of jaw rock and excavated soil in Area 1 and Area 2. The mill site was then covered with a thin layer of topsoil and seeded.

***Erosion Control Measures***
ERRS placed weed-free seed and straw along the eastern section of Area 1 to promote revegetation of the hillside. The drainage ditches in Area 1, Area 2, and Area 4 were lined with gabion rock for erosion control.

***Vehicle and Equipment Decontamination and Screening***
On October 2, the 336 CAT excavator was decontaminated and screened with the Lumex mercury vapor analyzer in accordance with the protocol developed during the previous reporting period. Both cab filter and the engine filter were replaced. This was the last piece of heavy equipment that required decontamination. Later that day, the ERRS mercury vacuum was decontaminated and screened with the Lumex. In general, the vacuum was less than 100 $ng/m^3$ with the exception of a few components that were consistently greater than 5,000 $ng/m^3$; these components were discarded in the repository and will be replaced upon demobilization from the Site.

***Homesite Placement and Utilities***
ERRS continued to install water line and phone conduit to Residence 4 and Residence 5. CenturyLink placed communication cable from the southwest corner of Area 4 to near Residence 4. The mini-excavator began to install a utility trench leading up the road near Area 2 toward Residence 1.

On September 29, OSC Liverman contacted START to request a survey of the property boundary to assist with the positioning of the replacement manufactured homes and identify potential borrow sources of clean fill. START arranged for a surveyor to identify all corners of the property and flag approximate 100 foot intervals along the northern and southern boundaries. The survey was scheduled for October 11 – 14 during the following reporting period.

On October 8, ODEQ was informed of EPA's decision to place the manufactured homes at Residence 1 and Residence 6. The decision was based on an analysis of Site circumstances, including but not limited to the location of the former mill, the volume of mine-waste contaminated material excavated from and replaced with clean backfill at both locations (and elsewhere on Site), ambient construction-related screening data using field instruments such as the Lumex mercury vapor analyzer, and homeowner preference. OSC Heister discussed this decision in greater detail on the following day when ODEQ Bryn Thoms and two representatives from the Oregon Health Authority visited the Site.

***Screening, Sampling and Laboratory Results***
As mentioned during previous PolReps, the distribution and concentration of mercury vapors on Site appears to be affected by multiple variables including temperature, humidity, wind speed, wind direction, Site activities, and proximity to the repository, among other factors. The hillside surrounding the excavated areas, along with the footprints of Residences 1, 2 and 6 were also considered potential sources of mercury vapors. In early October, START and OSC Heister decided to assess the influence of the repository by performing Lumex mercury vapor screening both before and after the repository was completely covered with a 6 inch layer of clean compacted topsoil.

The results in draft Table 4 were collected when the repository was only partially (25%) covered with compacted topsoil. All concentrations were less than the ATSDR standard for the normal occupancy recommendation in residential settings (1,000 ng/$m^3$), although the concentrations at some of the locations were within 20% of the standard.

Draft Table 4: Repository only partially covered on 10/4.

| Location | Date | Time | Mercury Vapor (ng/m3) |
|---|---|---|---|
| Residence 1A | 4-Oct-14 | Morning | 620 |
| | 4-Oct-14 | Noon | 112 |
| | 4-Oct-14 | Afternoon | 28 |
| Residence 1B | 4-Oct-14 | Morning | 91 |
| | 4-Oct-14 | Noon | 54 |
| | 4-Oct-14 | Afternoon | 13 |
| Residence 1C | 4-Oct-14 | Morning | 11 |
| | 4-Oct-14 | Noon | 23 |
| | 4-Oct-14 | Afternoon | 31 |
| Residence 2A | 4-Oct-14 | Morning | 267 |
| | 4-Oct-14 | Noon | 210 |
| | 4-Oct-14 | Afternoon | 164 |
| Residence 2B | 4-Oct-14 | Morning | 277 |
| | 4-Oct-14 | Noon | 241 |
| | 4-Oct-14 | Afternoon | 338 |
| Residence 6A | 4-Oct-14 | Morning | 54 |
| | 4-Oct-14 | Noon | 208 |
| | 4-Oct-14 | Afternoon | 27 |
| Residence 6B | 4-Oct-14 | Morning | 41 |
| | 4-Oct-14 | Noon | 122 |
| | 4-Oct-14 | Afternoon | 72 |
| Mill Site | 4-Oct-14 | Morning | 673 |
| | 4-Oct-14 | Noon | 106 |
| | 4-Oct-14 | Afternoon | 838 |

The results in draft Table 5 were collected after the repository was completed covered with 6 inches of compacted topsoil. All concentrations were well below the ATSDR standard for the normal occupancy recommendation in residential settings (1,000 ng/$m^3$), notably the mill site which had elevated concentrations greater than 24,000 ng/$m^3$ during previous reporting periods. Based on the results from this limited screening event, it appears that the repository was likely a significant source of mercury vapors during the 2014 removal action.

Draft Table 5: Repository covered with 6 inches of soil by 10/7.

| Location | Date | Time | Mercury Vapor (ng/m3) |
|---|---|---|---|
| Residence 1A | 7-Oct-14 | Afternoon | 13 |
| | 8-Oct-14 | Morning | 339 |
| | 8-Oct-14 | Mid-Morning | 23 |
| | 8-Oct-14 | Noon | 15 |
| | 8-Oct-14 | Afternoon | 10 |
| | 9-Oct-14 | Morning | 30 |
| Residence 1B | 7-Oct-14 | Afternoon | 3 |
| | 8-Oct-14 | Morning | 432 |
| | 8-Oct-14 | Mid-Morning | 18 |
| | 8-Oct-14 | Noon | 60 |
| | 8-Oct-14 | Afternoon | 20 |
| | 9-Oct-14 | Morning | 98 |
| Residence 1C | 7-Oct-14 | Afternoon | 8 |
| | 8-Oct-14 | Morning | 160 |
| | 8-Oct-14 | Mid-Morning | 25 |
| | 8-Oct-14 | Noon | 13 |
| | 8-Oct-14 | Afternoon | 11 |
| | 9-Oct-14 | Morning | 88 |
| Residence 6A | 7-Oct-14 | Afternoon | 5 |
| | 8-Oct-14 | Morning | 81 |
| | 8-Oct-14 | Mid-Morning | 41 |
| | 8-Oct-14 | Noon | 28 |
| | 8-Oct-14 | Afternoon | 20 |
| | 9-Oct-14 | Morning | 112 |
| Residence 6B | 7-Oct-14 | Afternoon | 60 |
| | 8-Oct-14 | Morning | 83 |
| | 8-Oct-14 | Mid-Morning | 46 |
| | 8-Oct-14 | Noon | 10 |
| | 8-Oct-14 | Afternoon | 27 |
| | 9-Oct-14 | Morning | 189 |
| Mill Site | 7-Oct-14 | Afternoon | 120 |
| | 8-Oct-14 | Morning | 247 |
| | 8-Oct-14 | Mid-Morning | NA |
| | 8-Oct-14 | Noon | NA |
| | 8-Oct-14 | Afternoon | NA |
| | 9-Oct-14 | Morning | 167 |

***Repository***
During the current reporting period, ERRS continued to perform compaction of the repository using a vibratory compactor, bulldozers and haul trucks. The repository was expanded toward the south to overlay pre-existing calcine piles and to accommodate the greater volume of mine-waste contaminated material. The compaction of the mine-waste contaminated material at the repository was completed on September 29. ERRS began to place unscreened topsoil on the repository on October 3. The topsoil was compacted to a depth of approximately 6 inches using the bulldozer and by October 7 the entire repository had been covered with topsoil. On October 10, ERRS removed windrows, sharp sticks and rocks from the compacted topsoil and smoothed the edges of the repository using the mini-excavator in preparation for deploying the liners during the following reporting period.

Twelve rolls of 40-millimeter (mil) low-density polyethylene (LDPE) were delivered on October 7 and staged in Area 1; each roll is 16,300 $ft^2$. This liner will be in direct contact with the compacted topsoil. A second liner composed of 200-mil geotextile composite will be delivered during the next reporting period. Ultimately, the geotextile composite will be placed above the LDPE liner and underneath a soil cap to create a pathway for infiltrated groundwater.

***Best Management Practices***
Continued to monitor and measure Site conditions and maintain Site BMPs. Continued to deploy the DataRam particulate monitors around the top of the repository, the staging area, and Residence 3. Dust suppression efforts were effective, especially as the daily temperatures decreased and relative humidity increased.

***Off-Site Support Activities***
During the reporting period, OSC Heister devoted considerable time to searching for two replacement trailers throughout the Willamette Valley while OSC Liverman prepared a draft action memorandum amendment and maintenance, monitoring, and repair (MM&R) plan. OSC Liverman also coordinated with ODEQ and Douglas County staffs along with SHPO, USFWS, and tribal staffs regarding final project documents.

**2.1.3 Enforcement Activities, Identity of Potentially Responsible Parties (PRPs)**
EPA has initiated a PRP search for this Site, and EPA will continue to collect and analyze additional information about mining companies involved with operations at the Site and/or owners of the Site.

**2.1.4 Progress Metrics** (as of 10/11/14)

| Waste Stream | Medium | Quantity | Manifest # | Treatment | Disposal |
|---|---|---|---|---|---|
| Commingled mercury waste | Soil and other debris removed using hand tools | (2) 55-gallon drums | - | Macro-encapsulation | RCRA Subtitle C Facility (TBD) |
| Commingled mercury waste | Soil and other debris removed using Hg recovery vacuum | (1) 5-gallon pail | - | Retirement (sulfide treatment) | TBD |

## 2.2 Planning Section

### 2.2.1 Anticipated Activities

#### 2.2.1.1 Planned Response Activities

#### 2.2.1.2 Next Steps
The following removal activities are expected to occur during the next reporting period (10/12/14 – 10/25/14): obtain weed-free straw; add 1 inch rock at Residence 1; continue to develop Residence 6; continue to excavated utility trenches; survey the property boundary; receive results from the second liner test and recalculate acceptable soil cap thickness for the repository; perform additional screening with the Lumex mercury vapor analyzer; receive 200-mil geotextile liner; deploy both liners on the repository; backfill the anchor trenches and begin covering the liners with soil; identify on-Site borrow sources for soil cap; demolish and reconstruct pumphouse; coordinate the inspection and purchase of the replacement manufactured homes; coordinate with utility providers regarding homesite locations; continue to monitor and measure Site conditions; continue to monitor and maintain Site BMPs; continue to communicate Site activities with representative from the state, the property owner, and the general public.

#### 2.2.2.1 Issues
A Douglas County Sheriff's Deputy informed EPA that hunting season began on October 4.

During the previous reporting period, EPA met with Mr. Don Smith, the property landowner, to discuss the possibility of siting the replacement manufactured homes near the EPA command post. During the current reporting period, OSC Heister informed Mr. Smith that the homes would be placed at Residence 1 and Residence 6. Mr. Smith expressed his satisfaction with this decision.

## 2.3 Logistics Section

### 2.3 Logistics Section
The ERRS response manager proposed a reduced soil cap on the repository of 12 inches (the original design included a 24 inch cap). On October 7, a START engineer was consulted on the proposal, and he requested the results of two liner tests to reassess the cap thickness. Although the data from one of the

tests was received on October 9, the results from the second test were not received by the end of the current reporting period.

**2.5.1 Safety Officer**
Operation of the vibratory compactor near the anchor trench should be performed with caution to reduce potential collapse of the sidewall. Poison oak has been identified throughout the Site, and both ERRS and START members have had limited exposures to the irritating effects of the plant.

**2.4 Finance Section**

No information available at this time.

**2.5 Other Command Staff**

**2.5.1 Safety Officer**
Daily safety meetings are held. During each meeting, key personnel review the day's planned activities and any pertinent safety-related issues are highlighted. Personnel are also encouraged to present any particular concern or issues and any recommendation for improvement of project work and/or safety.

During the reporting period, site personnel were in Level D PPE based on the results of ongoing air monitoring and/or sampling.

**2.5.2 Liaison Officer**
Outreach activities are being addressed by key project personnel on an as needed basis.

**2.5.3 Information Officer**
See 2.5.2. Additionally, a Community Involvement Coordinator (CIC) has been assigned to the project and is available to also assist with outreach activities on an as needed basis.

**3. Participating Entities**

**3.1 Unified Command**
While UC is not established, ODEQ is integrated into the project organization, as appropriate.

**3.2 Cooperating Agencies**
N/A

**4. Personnel On Site**

EPA – 1
START – 1
ERRS – 13
ODEQ Western Region – 1 representative performed a Site visit on 10/9.
OHA – 2 representatives performed a Site visit on 10/9.

**5. Definition of Terms**

N/A

**6. Additional sources of information**

**6.1 Internet location of additional information/report**
**www.epaosc.org/BonanzaMineandMill**

**6.2 Reporting Schedule**
POLREPs will be prepared about every two weeks to coincide with OSC rotation schedule.

**7. Situational Reference Materials**

No information available at this time.