CASE STUDY

Shiny Rock Mine
Marion County, Oregon

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Prepared by
The Interstate Technology & Regulatory Council
Mining Waste Team

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1. SITE INFORMATION

1.1 Contacts

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1.2 Name, Location, and Description

Shiny Rock Mine is located 15 miles east of Elkhorn, eastern Marion County, Oregon. The Shiny Rock Mining Corporation (SRMC) owns 15 acres of land in an area referred to as "Jawbone Flats." The property is located 15 miles east of the community of Elkhorn in eastern Marion County. Portions of the property have been used for processing ores from mines located in the surrounding areas and other mining-related activities. The site is located in the Willamette National Forest within one of the largest stands of old-growth timber near Opal Creek in Oregon. Adjacent land is used for hiking and, historically, has been used for mining and logging.

Shiny Rock began mining operations in 1972 and operated a small mill at the Jawbone Flats site. Ores were processed in the mill through a flotation procedure that used a compound called "Aerofloat 25," which contains cresol, and, during one season, small amounts of cyanide to produce lead, silver, and zinc concentrates. Mill tailings and filtrate from dryers were discharged to a settling/evaporation pond on site, resulting in accumulation of metal-contaminated sediments. Investigations during 1992 documented soil contaminated with lead and cadmium around the mill (located in a former mining camp) and the nearby settling pond. Lead levels were as high as 17,000 mg/kg.

The topography of the site and surrounding area is characterized by dendritic drainages that form steep, narrow valleys. Elevation is 1,600–4,400 feet above mean sea level. Slopes are as steep as 35º. The eastern portion of the property is drained by Battle Ax Creek and, to a lesser degree, Opal Creek. These creeks meet near the south-central portion of the property and form the Little North Santiam River.

The groundwater table has not been encountered at the site; however, it is expected that fractured bedrock forms the regional aquifer in the area. Local bedrock structures and fractures probably control groundwater flow. It appears, based on observations at excavations on site, that precipitation infiltrates through the thin to moderately thick alluvial and colluvial materials that underlie the site to the bedrock contact and then flows laterally to discharge points along surface water channels.

2. REMEDIAL ACTION AND TECHNOLOGIES

The mining-related remedial action objective for this site is to remove mine tailing residues and tailings in the settling pond containing metals exceeding Numerical Soil Cleanup Levels (Oregon Administrative Record [OAR] 340-122-045) for lead and cadmium. The cleanup levels are presented in Table 3-1 and discussed in more detail in ODEQ (1992). The selected remedial action for the metal-contaminated soil is stabilization with cement, compression into concrete blocks, and disposal based on the results of the toxicity characteristic leaching procedure (TCLP) analyses. If TCLP levels for metals are nondetectable, the blocks will be tested further and may be disposed of as demolition debris or used as building materials, depending on additional test results. If TCLP levels are detectable at levels below what would be considered hazardous waste, the blocks may be disposed of at a solid waste landfill. If TCLP levels exceed concentrations indicated for a hazardous waste, the blocks must be disposed of at a hazardous waste landfill.

In 1992, approximately 680 cubic yards of metal-contaminated soil was excavated, stabilized with cement, and disposed of in Finley Buttes Regional Landfill in Boardman, Oregon.

3. PERFORMANCE

Mitigation of ecological risk is the performance metric for the concentration values listed in Table 3-1.

Table 3-1. Cleanup concentrations

Contaminant	TCLP	Total
Cadmium	2.0 ppm	200 ppm
Lead	0.5 ppm	40 ppm

The selected remedial action will be protective by reducing lead and cadmium concentrations at the site so that TCLP concentrations will be less than 2 ppm lead and 0.5 ppm cadmium, and total metals concentrations will be less than 200 ppm lead and less than 40 ppm cadmium. The action is considered permanent because it reduces the toxicity of the material by stabilizing the metals in a solid cement matrix. The technology has been demonstrated to be effective in successfully treating similar wastes (Versar, Inc. 1992). This technology is readily implementable and is cost-effective based on a comparison of the total cost to the reduction in toxicity.

4. COSTS

Stabilization and off-site disposal costs are shown in the Table 4-1.

Table 4-1. Stabilization and off-site disposal costs

Capitol costs	
Analyses	$5,000–$9,500
Stabilization	$105,000
Trucking	$21,000–$60,000
Disposal	$9,600–$167,000
Total	$140,600–$381,500
Operation and maintenance	$0
Present worth cost	$140,600–$381,500

5. REGULATORY CHALLENGES

This action is consistent with all relevant Oregon regulations (OAR 340-122-080(3)(b)(B)). The metal-contaminated soils are subject to the Resource Conservation and Recovery Act (RCRA) mining waste exemption (40 CFR 261.4(b)(7)). Consequently, even though they fail the TCLP test for lead and would otherwise be considered a RCRA characteristic waste, they are only a solid waste. Oregon law (OAR 340-101-004) provides a more stringent mining waste exclusion. The Oregon exemption excludes from the state definition of hazardous waste the residues from the extraction and beneficiation of ores and minerals (federal law also excludes residues from processing ores). Also, under Oregon definitions (OAR 340-100-010(2)(c)), beneficiation is limited to "the upgrading of ores and minerals by purely physical processes (e.g., crushing, screening, settling, flotation, dewatering and drying) with the addition of other chemical products only to the extent that they are a non-hazardous aid to the physical process."

Although the metal-contaminated soil is not considered a hazardous waste and consequently RCRA regulations would not be considered applicable, RCRA regulations may still be considered relevant. Appropriate sections of relevant regulations will be achieved by the proposed remedial action.

In addition, RCRA provides standards specific to closure of waste piles in 40 CFR 265.258 which specify that, upon closure, all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste be removed. The recommended remedy will comply with these standards by ensuring that soil beneath the waste pile does not contain metals at concentrations exceeding the cleanup standards.

Oregon DEQ also had concerns about the potential long-term stability of the blocks. Consequently, several tests may be required depending on the end use of the blocks (if they are used rather than disposed of in a landfill). The tests that the Oregon DEQ identified include tests designed to mimic weathering conditions to which the blocks could be exposed in some uses, i.e., durability tests that involve cycling the stabilized material through freeze/thaw and wet/dry conditions and examining the impacts. In addition, regardless of end use, Oregon DEQ has required that a representative subset of the blocks be subjected to the TCLP. This test involves crushing the stabilized material to a 9.5 mm particle size, placing it in an acidic solution, and analyzing metals that are leached out. If lead or cadmium are detected in this leachate, the blocks will be disposed of in a landfill rather than used.

Finally, Oregon DEQ also considered the fact that the concentrations of total lead and cadmium in 10 samples collected from the mixed, stockpiled soil were close to or below the industrial soil cleanup levels specified in OAR 340-122-046. The total concentrations of lead ranged 1740–2200 ppm. The concentrations of cadmium ranged 49–64 ppm. The industrial soil cleanup levels for lead and cadmium are 2000 ppm and 1000 ppm, respectively. TCLP concentrations of these untreated samples ranged 1.2–12.4 ppm for lead and 0.06–0.25 ppm for cadmium. OAR 340-122-046 specifies leachate concentrations of 2 ppm for lead and 0.5 ppm for cadmium. The addition of cement is expected to reduce the leachate levels to nondetect for these metals. Note that the cadmium concentrations are also below the Oregon DEQ cleanup level, 100 ppm, determined to be protective for residential scenarios and at these levels should present minimal risk during a fire.

6. STAKEHOLDER CHALLENGES

The Friends of Opal Creek (a local activist group) supported the proposed remedial action. The group was very pleased with the plans and the pace of the activities at the site. There was concern regarding the proposed remedial action to stabilize and potentially use the metal-contaminated soil. In particular, it was pointed out that the metals may be disseminated in the environment through weathering while they are part of a structure and that if the structure caught on fire, cadmium could volatilize and result in a hazardous atmosphere.

7. OTHER CHALLENGES AND LESSONS LEARNED

No information available.

8. REFERENCES

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