

# **ACTION MEMORANDUM**

## **Non-Time Critical Removal Action Azurite Mine and Mill Site Project**



Mt. Baker-Snoqualmie National Forest,  
Administered by the Okanogan and Wenatchee National Forests  
Whatcom County, Washington

June 2009

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## I. Purpose

The purpose of this Action Memorandum is to document my decision to proceed with the non-time-critical removal action described in the Engineering Evaluation/Cost Analysis (EE/CA, 2008) for the Azurite mine and mill site (Site) located in Whatcom County, Washington. Incorporated in the EE/CA are Site data presented in a Site Inspection (SI) prepared by Cascade Earth Sciences in 2005. The EE/CA provides detailed analyses and the basis for the proposed response action. Both documents can be reviewed at the Methow Valley Ranger District Office on the Okanogan and Wenatchee National Forests located in Winthrop, Washington. The project administrative record, including the EE/CA and SI documents, is available from the following Okanogan and Wenatchee National Forests website:

<http://www.fs.fed.us/r6/oka/projects/geology.shtml>

This non-time-critical removal action is guided by the following authorities and technical guidance:

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; 42USC 9604)
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40CFR Part 300)
- US Environmental Protection Agency's (EPA) *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*; OSWER 9360.0-31, August 1993.

## II. Site Conditions and Background

### A. Site Description

The following highlights Site features and characteristics. For a more detailed description, please see the Site Inspection (SI) located at the website shown above.

#### 1. Azurite Mine and Mill Site

- Latitude/Longitude: North 48° 40' 57" West 120° 46' 51"
- Township 37 North, Range 17 East, Willamette Meridian, Sections 29 and 30
- The Site is accessed from Mazama by proceeding northwest on Lost River Road (County Road 9140), then the Harts Pass and Chancellor Roads (Forest Service 5400 and 5400-700) to the Azurite mine road (FS Trail 475). The mine is approximately 10 miles by foot or ATV along this narrow-gauge mine route.
- Site Features:
  - Five open or caved mine adits/raises, including the production adit (for a total of 9,000 feet of horizontal underground workings);
  - Two acidic waste rock piles totaling approximately 25,200 bank cubic yards (bcy);
  - Mill foundation and misc. debris;
  - Approximately 55,000 bcy of acidic-to-neutral pH mill tailings;
  - Circa 1935 standing mine office building and remnants of other structures.
- An adjacent perennial stream, Mill Creek, is undercutting and eroding the Wenatchee adit waste rock.
- Small seeps are present near the toe the Wenatchee adit waste rock and the tailings piles.
- An estimated 10-20 gallons per minute (gpm) of ground water is intercepted by the Tinson adit and discharges to the surface at the adit portal. This flow disappears into the ground on the slope below the adit.

- A total of approximately 5 acres are disturbed.

#### **B. Physical Location**

1. North Cascades physiographic province of Northwest Washington.
2. Upper Skagit drainage, Whatcom County
3. Azurite mine and mill site is 18.5 air miles west-northwest of Mazama, Washington;
4. Located on the north and south valley walls of Mill Creek which flows into Canyon Creek then into Ruby Creek and ultimately into the Skagit River

#### **C. Site Geology**

1. Precious and base metals occur in fissure veins in shears zones oriented N10°W and S50°W and dipping 45-60° to the west and northwest respectively.
2. The primary veins vary from a fraction of a foot to 12 feet wide, can be traced on the surface for up to 3,000 feet and are composed of quartz with calcite and various sulfide minerals (iron, zinc, copper and arsenic)
3. Host rock is Cretaceous argillite, quartzite and conglomerate with local intrusive stocks of diorite and granodiorite
4. Primary ore minerals are gold-bearing chalcopyrite, pyrrhotite and pyrite.
5. Gangue minerals include quartz, calcite, non-auriferous pyrite and pyrrhotite and arsenopyrite.
6. Ore occurs as disseminations in vein quartz and locally, as massive lenses.

#### **D. Site History**

1. Summary of mine ownership and operation:
  - 1915 – Charles and Hazard Ballard and C.R. McClean staked 31 claims at the Site.
  - 1918 – Azurite Copper Co. was formed by the claimants, and the Discovery Adit was driven.
  - 1918 – The first gold was produced by cyanidation of ore processed in an arrastre.
  - 1918 thru 1925 – Azurite Copper Co. was reorganized to Azurite Gold Co., a larger scale development was started and the Tinson Adit was driven “several hundred feet.”
  - 1931 – A 30 ton per day (tpd) Mace smelter was installed, the Tinson Adit was advanced farther, and the access road was constructed to replace the trail. Eight tons of high grade ore were shipped to the Tacoma smelter.
  - 1931 – The Tinson Adit was driven to 1,110 ft, and the Wenatchee Adit was collared.
  - 1933 – Fifteen tons of copper matte were shipped to the Tacoma Smelter.
  - 1934 – ASARCO leased the Site.
  - 1935 – ASARCO expanded underground development.
  - 1936 – A 100 tpd mill with comminution, gravity concentration, cyanide leach vats, and tramway connection to the Wenatchee Adit was commissioned.
  - 1937 thru 1938 – Continuous production.
  - 1939, Feb. – Production terminated.
  - 1939 thru 1940 – Intense exploration proceeded without success.
  - 1942 – ASARCO removed all equipment.
2. Production
  - 1918-39-- 72,443 tons (~\$1 million)

3. The Site is currently abandoned

## E. Removal Site Evaluation

### 1. Summary

- Hazardous substances found at the Site that substantially exceed the lowest ecological (Eco) or human health (HH) criteria and/or background values (BG) by the following factors (SI, pp. iv-v):

Arsenic in surface water (Adit discharge/Seeps)	29x BG
Copper in surface water (Adit discharge/Seeps)	26x Eco
Arsenic in Tailings	30x BG
Copper in Tailings	30x BG
Lead in Tailings	12x BG
Arsenic in waste rock (Wenatchee Adit)	9x BG
Copper in waste rock (Wenatchee Adit)	6x BG
Zinc in waste rock (Wenatchee Adit)	5x BG
Arsenic in sediment (Mill Creek)	5x BG
Copper in sediment (Mill Creek)	3x BG
Arsenic in surface water (Mill Creek)	3x BG

- Mine waste (tailings and waste rock) and surface water contain high concentrations of metals<sup>1</sup> and are the primary contaminant sources at the Site.
  - Fine-grained materials derived from the mine waste (i.e., sediment) that may have been deposited in, or migrated to, Mill Creek are considered a secondary contaminant source.
  - Surface and groundwater flowing through the mine waste are also considered secondary contaminant sources because impairments to surface water quality at the Site may result from direct contact with the mine waste.
  - Removal of the primary contaminant sources (i.e. mine waste) should reduce or eliminate surface water quality impairments and metals loading to Mill Creek and may significantly improve water quality. Therefore, the removal action alternatives focused on addressing the mine waste.
2. Pathways and Environmental Hazard Assessment—developed from the Site characterization, streamlined risk assessments and EE/CA
- **Groundwater Pathway**
    - No water wells are located within a 4-mile radius of the Site.
    - Groundwater pathway is considered incomplete.
    - Groundwater will be addressed indirectly by consolidation and capping of the contaminated tailings and waste rock as well as impacted soils.
  - **Surface Water Pathway**
    - The surface water pathway is complete due to elevated concentrations of metals in surface water and stream sediment.
    - Four chemicals of interest (COI) exceeded human health screening criteria: total arsenic, arsenic V, iron and manganese. Arsenic exceeded human health screening criteria in all surface water samples, and iron and manganese exceeded human health screening criteria in the Wenatchee waste rock seep.
    - Six COIs exceeded ecological screening criteria: barium, cadmium, copper, lead, manganese and zinc in the Wenatchee waste rock seep.

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<sup>1</sup> For the purposes of this report the term “metals” includes arsenic and antimony which lack one or more characteristics of true metals.

- Except for total arsenic, COI concentrations in the downstream Mill Creek water samples were consistent with apparent background (upstream) levels and significantly lower than in the seep samples.
- The total combined flow from the seeps and the Tinson adit drainage is estimated at <25 gallons per minute (gpm), which represents less than 1 percent of Mill Creek's late-summer flow.
- Six COIs exceeded ecological screening criteria and background in Mill Creek sediment: arsenic, cadmium, chromium, copper, nickel and zinc.
- Lead is identified as a human health chemical of potential concern (COPC) in surface water. Arsenic is identified as a human health COPC in sediment.
- Fish are absent in Mill Creek above a permanent fish barrier located 2.4 miles below the Site (CES Technical Memorandum, 10/30/2007). Bull trout, a federal threatened species, are known to be present in Canyon Creek and may also use lower Mill Creek. The benthic invertebrate survey results suggest little if any mine-related impact to aquatic invertebrates in Mill Creek.
- **Soil Pathway**
  - The soil ingestion pathway is complete and significant for both human and ecological receptors because of elevated metals concentrations in the waste rock, tailings and mill-area soils.
  - The waste and mine soils contain elevated concentrations of 13 hazardous substances and/or pollutants or contaminants that exceed both the average background soil concentration and the lowest regulatory comparison standard (both human and ecological).
    - Arsenic, copper, lead and mercury concentrations exceed background concentrations by 5 to 100 times.
    - Arsenic is identified as a human health chemical of potential concern (COPC) in waste rock, tailings and mill-area soils.
  - Analysis of six waste rock and six tailings samples indicate a high potential for these materials to generate acid. Paste pH of all waste rock samples was acidic, averaging 4.6 standard units (su). Paste pH of all tailings samples was acidic, averaging 4.0 standard units (su). Paste pH of five background soil samples averaged 4.9 su.
  - Two background and four Site vegetation (grasses) tissue samples indicate that aluminum, arsenic, cadmium, cobalt, copper, iron, lead magnesium, nickel, potassium, and zinc concentrations were elevated in the Site vegetation compared to background.
- **Air Pathway**
  - There are no residences within four miles of the Site.
  - The most likely air pathway is due to inhalation of particulate matter.
  - This pathway is considered complete because arsenic impacted soil and waste material is concentrated at the surface where human and ecological receptors could be exposed to particulate matter.
  - Addressing and/or eliminating the soil exposure pathway will likely render the air exposure pathway incomplete.
- **Risks to Humans** Based upon the human health risk assessment (Streamlined Human Health and Ecological Risk Assessment Azurite Mine and Mill Site, MFG, 2008 [SRA]), unacceptable human health risks are present at the Site. These risks are attributed to the presence of arsenic in waste rock, tailings and mill-area soils which exceeds both the average

- Hazard Indices for non-carcinogenic COPCs (arsenic and lead) did not exceed one for the modeled recreational users. Thus, no unacceptable risk is associated with these elements at the Site.
- Carcinogenic risks exceeded MTCA risk criteria (1.E-06) but not the EPA risk range (1.E-06 to 1.E-04) for the modeled recreational users. Arsenic was the single COPC identified for carcinogenic risks.
- The most significant exposure pathway is ingestion of and dermal contact with arsenic in mine waste.
- **Risks to Environment** Based upon the ecological risk assessment of the SRA, unacceptable ecological risks are present at the Site and are attributed to the presence 21 hazardous substances and/or pollutants or contaminants in waste rock, tailings and mill-area soil, which exceed both the average background soil concentration and other initial screening criteria.
  - Fifteen metals in waste rock, tailings, mill-area soils, surface, seep and pore water, or sediment have potential to cause harmful effects to terrestrial and aquatic plants or animals based on an acceptable Hazard Quotient (HQ) of  $HQ \leq 1$  for protected species.
  - Three COPCs in surface water were identified as posing a risk to protected species based on an acceptable  $HQ \leq 1$ : barium, copper and lead.
  - Four COPCs in seep water were identified as posing a risk to protected species based on an acceptable  $HQ \leq 1$ : aluminum, cadmium, copper and zinc.
  - One COPC in pore water was identified as posing a risk to protected species based on an acceptable  $HQ \leq 1$ : barium.
  - Thirteen metals had  $HQ > 10$  in one or more exposure pathways.
  - Although a number of rare, threatened or endangered (RTE) plant or animal species may occur in the Site vicinity, none were observed. Potential occurring RTE species of note are spotted owl, pileated woodpecker, willow flycatcher, Canada lynx, tailed frog, western toad, and spotted frog.
  - Ecological risks appear to be limited to individual receptors and there does not appear to be significant population-level risks. However, individuals at risk could include federally protected species, if they are present and maintain small home ranges within contaminated habitat.
  - Catastrophic failure of the Wenatchee adit waste rock pile could result in large negative effects on aquatic systems below the Site.

**F. Release or Threatened Release into the Environment of a Hazardous Substance.**

1. Waste rock, tailings and mill-area soil

- Fifteen hazardous substances and/or pollutants or contaminants in waste rock, tailings and mill-area soils exceed both the average background soil concentration and the lowest regulatory comparison standard (SI, Table 5).
  - Arsenic, copper, lead and mercury concentrations exceed background concentrations by 5 to 100 times.
  - Arsenic is identified as a human health chemical of potential concern (COPC) in waste rock, tailings and mill-area soils.
- Catastrophic failure of the Wenatchee adit waste rock pile could result in the release of many tons of waste containing fifteen hazardous substances and/or

2. Surface Water
  - A hazardous substance (arsenic) exceeds background, human health and aquatic life ecological risk-based screening concentrations in water of Mill Creek, the waste rock and tailings seeps and the Tinson adit.
  - Seven contaminants (arsenic, cadmium, copper, lead, manganese, selenium and zinc) exceed aquatic life ecological risk-based screening concentrations in the Wenatchee waste rock seep and Tinson adit discharge.
3. Sediment
  - Six contaminants (arsenic, cadmium, chromium, copper, nickel and zinc) exceed background and/or aquatic life ecological risk-based screening concentrations in Mill and Canyon Creek sediments.
4. Pore water
  - Barium in Mill Creek pore water exceeds the lowest ecological risk-based screening criteria.

**G. National Priority List Status**

1. The project site has not been proposed for the National Priority List (NPL), and a Hazard Ranking System (HRS) rating has not been calculated.

**H. Other Actions to Date**

1. None

**I. State and Local Authorities' Role**

1. State and Local Actions to Date
  - Site is not listed on the Washington Department of Ecology's Hazardous Sites List (February 2009)
2. Potential for Continued State/Local Response
  - None for this Site

**III. Threats to Public Health or Welfare and the Environment, and Statutory and Regulatory Authorities (NCP [40CFR 300.415(b)(2)])**

See the following table for a summary of analytical results

**A. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants:**

1. The streamlined risk assessment indicated potential risk to human and ecological receptors from exposure to metals in the mine waste, surface water, sediment and pore water.
  - A recreational exposure pathway for humans leads to risks, primarily from arsenic by drinking water from the waste rock and tailings seeps, the Tinson adit or Mill Creek and from arsenic, copper, and zinc by incidental ingestion of contaminated soils.
  - The 95<sup>th</sup> Upper Confidence Limit (UCL) of arsenic (1094 mg/kg) in the mine waste rock, tailings and mill-area soils exceeds the human health carcinogenic preliminary remediation goal (PRG) of 47.7 mg/kg by a factor of nearly 23.
  - HQs for aluminum, total arsenic, arsenic V, chromium, copper, iron, lead, mercury and zinc in waste rock, tailings and mill-area soils exceed 10 for three or more ecological receptor groups (plants, invertebrates, birds, mammals).

- HQs for cadmium and copper in seep water exceed 10 for three or more ecological receptor groups.
  - Catastrophic failure of the Wenatchee adit waste rock pile could result in the release of many tons of waste containing fifteen hazardous substances and/or pollutants or contaminants into Mill and Canyon Creeks causing physical and chemical impacts.
2. Land uses in areas surrounding the Site include recreational activities, such as hiking, swimming, camping, fishing, and hunting, as well as mineral prospecting activities like gold panning.
    - Since abandoned mines, especially those sites containing old structures, equipment, and mineral specimens attract these forest users, it is likely they would come into contact or potentially be exposed to high concentrations of arsenic, copper, lead and mercury.
    - The area is open to recreational use and the public is not restricted from entering the area or coming into contact with contaminated soils, rock and water at the Site.
- B. Actual or potential contamination of drinking water supplies or sensitive ecosystems:**
1. There are no public water supplies at the Site and no drinking water wells within a 4-mile radius; however, recreationists may occasionally use water from Mill Creek for cooking and as a drinking water source.
    - Four COIs in surface water exceeded human health screening criteria: total arsenic, arsenic V, iron and manganese. Arsenic exceeded human health screening criteria in all surface water samples, and iron and manganese exceeded human health screening criteria in the Wenatchee waste rock seep.
  2. Canyon Creek, and potentially, lower Mill Creek below the Site, provide habitat for bull trout, a federal threatened species.
    - Catastrophic failure of the Wenatchee adit waste rock pile could result in the release of many tons of waste containing fifteen hazardous substances and/or pollutants or contaminants into Mill and Canyon Creeks causing physical and chemical impacts.
- C. High levels of hazardous substances, pollutants, or contaminants in soils, at or near the surface that may migrate:**
1. The two waste rock and tailings piles on site contain a total of approximately 80,222 bcy.
    - The mine waste contains high concentrations of several metals, including arsenic, copper, lead and zinc.
    - Mine waste piles are unvegetated and subject to erosion. Waste fines eroding from the piles will migrate to Mill Creek.
    - The toe of the Wenatchee adit waste rock pile is being undercut by Mill Creek.
    - Catastrophic failure of the Wenatchee adit waste rock pile could result in the release of many tons of waste containing fifteen hazardous substances and/or pollutants or contaminants into Mill and Canyon Creeks causing physical and chemical impacts.
- D. Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released:**
1. The mine waste piles are subject to erosion during rain events and snowmelt. Spring/summer runoff or convective thunderstorms may result in flooding along Mill Ck which could cause further undercutting of toe of Wenatchee adit dump increasing potential for failure.

2. The Site is estimated to receive about 40 inches of precipitation per year, of which, perhaps 2/3rds falls as snow.

**E. Other situations or factors that may pose threats to public health or the environment:**

1. Physical hazards at the site pose a significant risk to the public and include five underground mine openings and high, unstable waste rock faces.

**SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION – AZURITE MINE AND MILL SITE**

Media	EE/CA Sampling Location (SI Sampling Location)	Contaminant	Highest Conc. (#1)	Lowest Failed Criteria (#2) <sup>2</sup>	Mean “Apparent” Background Concentration <sup>1</sup>
Surface Water	SW-2 (MC-SW-04)	Arsenic, TR (3/3 samples)	1.5 ug/L TR	0.018 ug/L – HH, WA	0.85 ug/L
	SW-3 (MC-SW-06)	Arsenic, TR (3/3 samples)	2.4 B ug/L TR	0.018 ug/L – HH, WA	0.851 ug/L
Aduit/Waste Seeps	TTDIS (AM-AS-01)	Arsenic, TR (1/1 samples)	26.4 ug/L TR	0.018 ug/L – HH, WA	0.85 ug/L
	TTDIS (AM-AS-01)	Cadmium, TR (1/1 samples)	0.19	0.105 ug/L – Aq. Life, EPA	0.06 ug/L
	Seep-2 (AM-SP-01)	Arsenic, TR (1/1 samples)	5.3 ug/L	0.018 ug/L – HH, WA	0.85 ug/L
		Cadmium, TR (1/1 samples) Copper, TR (1/1 samples)	0.2 ug/L 6.8 ug/L	0.105 ug/L – Aq. Life, EPA 3.1 ug/L – Aq. Life, EPA	0.06 ug/L 0.43 ug/L
Seep-1 (AM-SP-02)	Arsenic, TR (1/1 samples) Copper, TR (1/1 samples)	12.6 ug/L 1180 ug/L	0.018 ug/L – HH, WA 3.1– Aq. Life, EPA	0.85 ug/L 0.43 ug/L	
Soil	Tailings Pile	Arsenic	1520 mg/kg	0.011 mg/kg – Method B Prot. SW	88.6 mg/kg
		Cadmium	6.9 mg/kg	0.01 mg/kg – Method B Prot. SW	3.0 mg/kg
Chromium		38.7 mg/kg	19 mg/kg – Method A	66.6 mg/kg	
Copper		251 mg/kg	0.71 mg/kg – Method B Prot. SW	148 mg/kg	
Lead		305 mg/kg	50 mg/kg – Method B Plant Receptor	45.4 mg/kg	
Mercury		0.2 mg/kg	0.05 mg/kg – Method B Prot. SW	0.1 mg/kg	
Zinc		109 mg/kg	24 mg/kg – Method B Prot. SW	241 mg/kg	
Waste Rock Pile	Arsenic	478 mg/kg	0.011 mg/kg – Method B Prot. SW	88.6 mg/kg	
	Cadmium	14.7 mg/kg	0.01 mg/kg – Method B Prot. SW	3.0 mg/kg	
	Chromium	76.8 mg/kg	19 mg/kg – Method A	66.6 mg/kg	
	Copper	531 mg/kg	0.71 mg/kg – Method B Prot. SW	148 mg/kg	
	Lead	194 mg/kg	50 mg/kg – Method B Plant Receptor	45.4 mg/kg	
	Mercury	0.7 mg/kg	0.05 mg/kg – Method B Prot. SW	0.1 mg/kg	
	Nickel Zinc	42.9 mg/kg 1310 mg/kg	12 mg/kg – Method B Prot. SW 24 mg/kg – Method B Prot. SW	31.4 mg/kg 241 mg/kg	
Sediment	SW-2 (MC-SW-04)	Arsenic, Total(3/3 samples)	77 mg/kg	9.8 mg/kg – TEC, McDonald	29 mg/kg
		Cadmium, Total (1/3 samples)	4.9 mg/kg	0.99 mg/kg – TEC, McDonald	3.3 mg/kg
		Chromium, Total (1/3 samples)	68.4 mg/kg	43.4 mg/kg – TEC, McDonald	47 mg/kg
		Copper, Total (3/3 samples)	254 mg/kg	31.6 mg/kg – TEC, McDonald	176 mg/kg
		Zinc, Total (3/3 samples)	257 mg/kg	121 mg/kg – TEC, McDonald	142 mg/kg
	SW-3 (MC-SW-06)	Arsenic, Total (3/3 samples)	110mg/kg	9.8 mg/kg – TEC, McDonald.	29 mg/kg
		Cadmium, Total (1/3 samples)	4.5 mg/kg	0.99 mg/kg – TEC, McDonald	3.3 mg/kg
		Chromium, Total (3/3 samples)	85.1mg/kg	43.4 mg/kg – TEC, McDonald	47 mg/kg
		Copper, Total (1/3 samples)	279 mg/kg	31.6 mg/kg – TEC, McDonald	176 mg/kg
		Nickel, Total (3/3 samples) Zinc, Total (3/3 samples)	50 mg/kg 234 mg/kg	22.7 mg/kg – TEC, McDonald 121 mg/kg TEC, McDonald	29 mg/kg 142 mg/kg

Notes:

µg/L = microgram per liter

mg/kg = milligrams per kilogram

HH, WA = Washington human health (WAC 173-201A)

Aq. Life, EPA = Freshwater Chronic Aquatic Life Criteria (Clean Water Act –Section 304 EPA 877-R-02-097)

Method B Prot. SW = Method B Protection of Surface Water (WAC 173-340-740)

Method A = Table 740-1 Method A Soil Cleanup Levels for Unrestricted land Uses (WAC 173-340-740)

Method B Plant Receptor = Table 749-3 Ecological Indicator Soil Concentrations (mg/kg) for Protection of Terrestrial Plants and Animals (WAC 73-340-7493)

TEC, McDonald

<sup>1</sup>MTCA (WAC 173-340-709[4]) Requires 10 samples for determination of background concentrations in soils. However, due to the limited number of samples actually collected, mean concentrations listed are in terms of an “apparent” background.

<sup>2</sup> Aquatic life criteria for copper is based on alkalinity; the biotic ligand model for copper was highly dependent on dissolved organic compounds (DOC) and resulted in concentrations ranging from 2.7 to 11.1 µg/L for *Daphnia Magna* and from 14.1 to 56.2 µg/L for Rainbow trout (Appendix J).

#### IV. Endangerment Determination

Actual or threatened releases of hazardous substances and/or pollutants or contaminants (aluminum, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel and zinc) from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may present a continuing endangerment to the environment. Aluminum, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel and zinc will continue to migrate into the environment without a response action.

#### V. Proposed Actions and Estimated Costs

##### A. Proposed Actions

1. Description of Alternative Technologies
  - The Forest Service considered a wide array of cleanup technologies for the Site. Refer to EE/CA Section 5.0 and Table 6.1.
  - Four feasible action alternatives were then developed and evaluated:
    - Alternative 1 - No Action
    - Alternative 2a – On-Site Closure In-Place
    - Alternative 2b – On-Site Consolidation and Closure in Place
    - Alternative 3a – Removal to Constructed Off-Site Repository
    - Alternative 3b – Landfill Disposal Off-Site
2. Alternative 2b was selected because it provides the best combination of overall protection of human health and the environment, implementability, and cost effectiveness of any of the alternatives. Alternative 2b would (a) remove contaminated Wenatchee adit waste rock from the 100-year flood plan and eliminate the potential for catastrophic failure of that material into Mill Creek; (b) eliminate exposure of contaminated waste rock, tailings and soils to human and ecological receptors on the surface; and (c) potentially eliminate seepage from waste rock and tailings deposits. (See Section 6, EE/CA).
3. Proposed Action Description—On-Site Closure after Consolidation (See EE/CA for full description and conceptual drawings): The proposed action will excavate and consolidate Wenatchee adit waste rock and contaminated mill-area soil with the existing tailings. The lower slope of the tailings pile will be reinforced and the entire repository capped.
  - Upgrade the existing access roads to accommodate necessary construction equipment and facilitate long-term inspection and maintenance;
    - Replace Slate Creek bridge
    - Upgrade South Fork Slate Creek bridge
    - Heavy maintenance of mine road to Cady Pass, reconstruct some switchbacks. Existing road width is generally adequate.
    - Reconstruct mine road from Cady Pass to mine (remove slough and widen to 9 ft minimum)
      - End haul cut material
      - Reconstruct some switchbacks
    - Install road drainage and additional cross or relief culverts as needed
    - Few hemlock, Douglas fir or grand/silver fir trees will be cut; none >21” dbh expected
    - Warning signs will be placed on the road as appropriate
    - This decision does not affect the existing closure of the mine access road (FS Trail 475) to public motorized vehicles.
    - Elevations: 4,000-6,000 ft above mean sea level (amsl)
  - Construct a retaining wall (gabion or equivalent) at base of tailings pile for mine waste consolidation efforts;

- Excavate contaminated soil near the old mill area and place on the tailings pile;
  - Reconstruct the access road between the Wenatchee adit waste rock pile and tailing pile, with temporary Mill Creek crossing;
  - Collect and remove any trash or mining debris not left for site interpretation and dispose of in an approved landfill;
  - Excavate the Wenatchee adit waste rock pile that currently abuts Mill Creek and consolidate the waste rock within a portion of the tailings pile, above the retaining wall; sideslopes will be contoured to no steeper than 2 (H, horizontal):1 (V, vertical);
  - Regrade the Wenatchee adit area and access road, reconstruct creek margin, and remove temporary Mill Creek crossing;
  - Add soil amendments (fine-grained limestone), if necessary, and revegetate the disturbed area previously occupied by the mine waste pile, mill remnants, and access road;
  - Regrade the tailings not covered by waste rock in-place to a side slope no steeper than 2H :1V
  - Cap the tailings pile and consolidation area with a minimum 12-inch-thick soil cover from “local” borrow area;
    - Cover material appears to be available on site at the base of the avalanche chute just beyond (up drainage from) the mill site.
  - Place a minimum 12-inch-thick rock cover from local talus slopes and non-woven geotextile over the soil cover (an engineered cover may be substituted in part for the above described cover layers);
  - Install up gradient run-on/runoff control ditches for the closed piles;
  - Install metal safety gratings at the open mine adits and shafts;
  - Access to openings above the Wenatchee adit would be accessed by foot and/or helicopter;
  - Install passive treatment of mine drainages/seeps utilizing ViroMine™ technology or similar, if necessary (the existing seeps may be eliminated by the construction work)-- to be determined through Site monitoring; and
  - Perform short-term and long-term operations and monitoring (O&M) activities.
    - Inspection/monitoring/maintenance of constructed facilities – 30 or more years;
    - Environmental sampling – 10 or more years.
4. Contribution to Remedial Performance
- Monitoring of surface water and any seeps in and adjacent to Mill Creek will determine whether additional removal or remedial actions are necessary.
5. Engineering Evaluation/Cost Analysis
- MFG, consultants under the ASARCO Administrative Order on Consent, prepared the EE/CA. The EE/CA and its appendices are incorporated in this Action Memorandum by reference.
  - The Forest Service released the EE/CA for a thirty-day public comment period to solicit comments and concerns.
    - The 30-day comment period ended 1/9/2009
    - Three comment letters were received by the Forest Service. These included eleven individual substantive comments. The letters, individual comments and written responses are part of the Administrative Record for this Site (See Response to Comments) and are available at the following website:

- Two responders concurred with the selection of recommended alternative but voiced concerns about the potential impacts of the action, especially the access road, on the surrounding roadless area's potential as designated wilderness. *The response notes that while long term vehicle access is needed to the Site for monitoring and maintenance, the mine access road (FS Trail 475) will remain closed to public motorized access. Construction techniques such as back hauling excavated road material and other best management practices will be used to minimize environmental impacts of the removal. Also, the consolidation, covering, and revegetation of the anomalously-colored mine waste rock and tailings by the removal action should reduce the aesthetic impact of the Site overall.*
  - One responder preferred the No-Action alternative stating that the potential human health hazard was not real or sufficient to justify the clean-up cost. *The response noted that unacceptable human health risks are present at the Site in the form of arsenic in waste rock, tails and mill-area soil. Carcinogenic risks from arsenic through ingestion and dermal exceed Washington State Model Toxics Control Act (MTCA) risk criteria (1.E-06) for a typical recreational Site user*
  - For the detailed comments and responses please see Response to Comments at the Forest Service website noted above.
6. Applicable or Relevant and Appropriate Requirements (ARARs)
- Potential ARARs are listed in Appendix F of the EE/CA. These include both Federal and State ARARs.
  - Detailed ARARs discussion and analysis is presented in EE/CA Sections 3.0 and 6.0.
  - Potential chemical-specific ARARs establish acceptable amounts or concentrations of chemicals that may be found in or discharged to the ambient environment.
    - Surface water criteria are expected to be met in the long term;
    - Soil clean-up level will be protective of human and most ecological receptors. Local plants, invertebrates, and small animals that exist primarily on any remaining contaminated soil areas may be exposed to some risk;
    - Contaminated Mill Creek sediments will not be removed, thus avoiding collateral impacts to the aquatic environment;
    - Ground water is indirectly addressed through removal, consolidation, and isolation of contaminated waste rock, tailings, and mill-area soils.
  - Potential location-specific requirements may determine hazardous substance concentrations or cleanup activities when they occur in specific locations or physical positions.
    - The Removal will comply with key location-specific ARARs, including the National Forest Management Act, Endangered Species Act, and National Historic Preservation Act
  - Potential action-specific requirements do not determine the cleanup alternative but instead define the techniques used to perform the chosen cleanup methods.
    - The repository design is expected to comply with key action-specific ARARs such as the Clean Water Act and waste management regulations.

7. Project Schedule
  - Removal funds are expected to come from ASARCO bankruptcy settlement and the removal schedule is dependent upon the finalization of the bankruptcy proceeding or, until that time, continued funding through the ASARCO Environmental Trust or other sources.
    - Summer 2009--Access road work
    - Summer 2010--Access road work, Initial removal preparation
    - Summer 2011—Removal construction activities
    - 2012 and beyond—Monitoring/maintenance/operations

**B. Estimated Costs**

1. Estimated present net value (NPV) for the removal action project cost is \$5,705,000;
  - Removal Action - \$4,643,000
  - Monitoring (NPV, 30 years) - \$1,062,000
2. Estimated cost breakdown is shown in Appendix I of the EE/CA.

**VI. Expected Change in the Situation Should Action be Delayed or not Taken**

Sediment containing high concentrations of aluminum, arsenic, copper, mercury, selenium, silver, and zinc will continue to be eroded and deposited into Mill Creek during snowmelt, heavy rainstorms and high stream flow. Seepage from the waste rock and tailings piles and the Tinson adit containing hazardous substances will continue unmitigated. These waters and sediments can further degrade the aquatic environment and surface water quality of Mill Creek. Catastrophic failure of the Wenatchee adit waste rock pile could result in the release of many tons of waste containing fifteen hazardous substances and/or pollutants or contaminants into Mill and Canyon Creeks causing physical and chemical impacts

**VII. Outstanding Policy Issues**

None

**VIII. Enforcement**

With the exception of the funding from the ASARCO Trust and the ASARCO bankruptcy mentioned above, the Forest Service has not identified other viable responsible parties.

**IX. Recommendation**

**A. Removal Action Justification**

1. The NCP states that an appropriate removal action may be conducted at a site when a threat to human health or welfare or the environment is identified. The removal action is undertaken to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of a release at a site. Section 300.415(b)(2) of the NCP outlines eight factors to be considered when determining the appropriateness of a removal action. Five of these factors are applicable to the Site (See Section III above) and provide the justification for further action.
2. This decision document represents the selected removal action for the Azurite Site, in Whatcom County, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the Site.

**B. Recommendation**

Conditions at the site meet the NCP section 300.415(b)(2) criteria for a removal action, as discussed above, and I recommend your approval of the proposed removal action.

Recommended: /s/ Norman F. Day, for  
Rebecca Lockett Heath  
Forest Supervisor  
Okanogan and Wenatchee National Forests

Date: 6/15/2009

Approved:  
Sam Carlson  
Director of Engineering  
Pacific Northwest Region



Date: 7/4/09

By my signature, I approve that portion of the recommended Removal Action not reserved to the Secretary of Agriculture by his Memorandum of May 28, 2009. The portion of the Removal Action reserved to the Secretary is road construction and reconstruction within the Inventoried Wilderness Area. Upon the Secretary's action allowing road construction and reconstruction inside the Inventoried Roadless Area, my signature approves the remainder of the Removal Action activities.