ACTION MEMORANDUM

Non-Time Critical Removal Action
Rainy Mine and Mill Site
Project

Mt. Baker-Snoqualmie National Forest
King County, Washington

February 2009

Section 1.01 Table of Contents

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) for the Rainy mine and mill site (Site) located in King County, Washington. The EE/CA provides detailed analyses and the basis for the proposed response action and can be reviewed at the Snoqualmie Ranger District Office on the Mt. Baker-Snoqualmie National Forest located near North Bend, Washington. The project administrative record, including the EE/CA document, is available from the following Mt. Baker-Snoqualmie National Forest website:

http://www.fs.fed.us/r6/mbs/projects/cercla-hazmat-cleanup-projects/index.shtml

The selected Response Action will be executed following non-time-critical removal action processes described by:

- 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 the site features. For a more detailed description, please see the Site Inspection (SI) located at the website shown above.)

1. **Rainy Mine and Mill Site**
   - Latitude/Longitude (East Zone): North 47° 34' 10.0" West 121° 33' 08.8"
   - Township 24 North, Range 10 East, Willamette Meridian, Sections 9 and 16
   - The Site is accessed from North Bend by proceeding northeast on County Road 56 along the Middle Fork of the Snoqualmie River (MFSR) for approximately 12 miles to the Taylor River and Forest Service Road (FR) 5640. Proceed approximately 2 miles north on FR 5640 over the Taylor River bridge. The Site is located on the southwest side of FR 5640 and is marked by an overgrown access road and well established trail.
   - Site Features:
     - Two areas of underground workings--one open adit (West zone) and a partially closed adit/shaft combination and millsite (East zone);
     - Multiple smaller exploration cuts and pits;
     - Two waste rock piles of 25 and 2,000 bank cubic yards (bcy), for the West and East zones, respectively; and
     - Remnants of a few wood-framed structures at the East zone;
   - A perennial stream, Quartz Creek, flows immediately below the workings.
   - Seepage from the East zone waste rock averages 0.3 gallons per minute (GPM) and flows into Quartz Creek.
   - An unnamed drainage of 1 gpm flows past the West end adit portal, across the waste rock and into Quartz Creek.
   - Approximately 2 acres are disturbed

B. Physical Location

1. North Cascades physiographic province of Northwest Washington.
2. Middle Fork Snoqualmie River (MFSR) Valley, King County
3. Rainy mine and mill site is 12 miles northeast of North Bend, Washington;
4. Located on the north bank of Quartz Creek which flows to Taylor Creek then to MFSR
5. The West workings are approximately 900 feet west of the East workings/mill site

C. Site Geology

1. Two mineralized breccia pipes are explored by the East and West Zone workings.
2. Host rock is Snoqualmie Batholith of the Miocene age
3. Primary ore minerals present include, chalcopyrite, brannerite, and molybdenite.
4. Gangue minerals include pyrite, pyrrhotite, arsenopyrite, quartz, and tourmaline.
5. Ore occurs as disseminations in veins and breccia fragments and as massive sulfide lenses up to 12 feet thick.

D. Site History

1. Listing of mine ownership:
   - 1900 -- Initial claim location and development work
   - 1946-- M.F. Gilbreath relocated the original claims and staked additional ground.
   - 1951-54 -- A 50 ton-per-day floatation mill, bunkhouse, and assayer shed were constructed on the property and used to mine and process test shipments of ore..
   - 1952 -- Property leased to the Western States Copper.
   - 1957 --: Anaconda Copper Company explored by drilling 2,128 feet of borings.
   - 1967 -- Inland Copper Ltd. drilled 1,900 feet of borings and estimated a reserve of 5,200,000 tons ore at 0.5 to 0.6% copper..
2. Production
   - 1951-57 -- 2,000 tons
3. The Site is currently inactive

E. Removal Site Evaluation

1. Summary
   - Hazardous substances found at the Site greatly exceed the lowest ecological (Eco) or human health (HH) criteria and/or background values (BG) by the following factors:

Aluminum compounds in surface water (RM-Seep SW2)	36x BG
Arsenic in surface water (RM-Seep SW1)	14x BG
Copper in surface water (RM-Seep SW2)	1680x Eco
Copper in sediment (RM-Seep SS1)	122x Eco
Arsenic in waste rock (RM-WR2-1)	506x BG
Copper in waste rock (RM-WR4)	10x BG

   - Mine waste and sediment at the seeps contain high concentrations of metals and are the primary contaminant sources at the Site. Fine-grained materials (i.e., sediment) that may have been deposited in, or migrated to, Quartz Creek is 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 result from direct contact with the mine waste.
- Removal of the primary contaminant sources (i.e. mine waste and seep sediments) should eliminate surface water quality impairments and metals loading to Quartz Creek and significantly improve water quality. Therefore, the removal action alternatives focused on addressing the mine waste and treatment of the seeps and surface water at the Site was not included in the removal scope.

2. 2003 to 2008 – Forest Service completed site characterization, streamlined risk assessment and EE/CA for the Site. The following summarizes the results of this work:
   - **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 in the consideration of the seeps and contaminated soils.
   - **Surface Water Pathway**
     - The surface water pathway is complete due to elevated concentrations of metals in surface, pore water and seep sediment samples.
     - Four chemicals of interest (COI) exceeded human health screening criteria: arsenic, copper, 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 east seep from WR-1. Iron exceeded human health screening criteria in the west seep from WR-1.
     - Nine COIs exceeded ecological screening criteria: arsenic V, barium, cadmium, copper, iron, mercury, manganese, lead, and zinc. The most notable exceedances were arsenic from the unnamed drainage after flowing over WR-2, and copper in the east seep from WR-1.
     - Five COIs were also detected in the samples collected from Quartz Creek: aluminum, arsenic, copper, iron, and mercury. In general, COI concentrations in the downstream sample were consistent with apparent background levels and significantly lower than in the seep samples.
     - The total combined flow from the seeps and the unnamed drainage is estimated at 1.3 gpm, which represents less than 1 percent of the total flow in Quartz Creek.
     - Rainbow trout, a state priority species, are present in the MFSR. In addition, cutthroat trout, a federal species of concern, have been documented to occur in Quartz Creek and the Taylor River. The benthic invertebrate survey results for riffle habitats suggest that the number and diversity of invertebrates decrease downstream of the Site indicating a decrease in water quality downstream from the Site. However, the results for pool habitats, indicative of sediment quality, do not provide any conclusive evidence of mine-related impacts downstream of the Site.

- **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, soil around the mill foundation, and sediment.
  - The waste piles and mine soils contain elevated concentrations of 14 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 is a non-carcinogenic human health chemical of potential concern (COPC).
    - Arsenic, cadmium and chromium are identified as carcinogenic COPCs
  - Analysis of five waste rock and soil samples indicate a high potential for these materials to generate acid. Paste pH of the five samples was acidic and ranged between 3.1 and 5.0 standard units (su). Paste pH of three-background soil samples were slightly less acidic and ranged between 4.4 and 5.1 su.
  - The Pileated woodpecker, a state candidate species, is the only expected rare, threatened or endangered (RTE) bird species to inhabit the Site. The spotted frog and western toad are RTE species that may be found near the Site, but are unlikely within the disturbed habitat. No RTE plant species were observed or are expected at the Site.
  - Three background and three Site vegetation (vine maple) tissue samples indicate that arsenic and iron concentrations were elevated in the Site vegetation
- **Air Pathway**
  - 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.
- Based upon the human health risk assessment (Streamlined Human Health and Ecological Risk Assessment Rainy Mine and Mill Site, MSE, 2006 [SRA]), unacceptable human health risks are present at the Site. These risks attributed to the presence of seven hazardous substances and/or pollutants or contaminants in waste rock and soil which exceed both the average background soil concentration and the lowest regulatory comparison standard.
  - Non-carcinogenic Hazard Indices exceeded one for adults (0.2-4) and children (3-100). Six human health contaminants of potential concern (COPC) were identified for non-carcinogenic risks: Arsenic, cadmium, chromium, copper, iron and manganese.
  - Carcinogenic risks exceeded EPA risk Criteria (1.E-06 to 1.E-04) for adult and child recreationists. Three COPCs were identified for carcinogenic risks: arsenic, cadmium, and chromium..
  - The most significant exposure pathway is ingestion of and dermal contact with arsenic in mine waste. Ingestion of surface water also poses a slight human health risk.
- Based upon the ecological risk assessment of the SRA, unacceptable ecological risks are present at the Site and are attributed to the presence 13

hazardous substances and/or pollutants or contaminants in waste rock and mine soil which exceed both the average background soil concentration and the lowest regulatory comparison standard.

- Aluminum, arsenic, and copper are the most significant Contaminants of Potential Ecological Concern (CPECs) because they pose a potential threat to all four ecological receptor groups (plants, invertebrates, birds, and mammals).
- Six CPECs were identified as posing a risk to aquatic life based on an acceptable risk ratio of $Q \leq 1$ for protected species: aluminum, barium, cadmium, copper, lead, and zinc. The highest risk is from exposure to copper ($Q = 1{,}084$). There is also significant risk from exposure to aluminum ($Q = 33$). Copper also posed a multiple COI risk to aquatic life. Risk ratios from the remaining CPECs were all below than 5. Impacts are to terrestrial plants and animals that live primarily on Site and not to general populations.
- Seven CPECs were identified as posing a risk to aquatic life based on an acceptable risk ratio of $Q \leq 1$ for protected species: silver, arsenic, barium, cadmium, copper, antimony, selenium and zinc. The highest risk is from bioaccumulation of cadmium ($Q = 320$) and copper ($Q = 335$). There is also moderate risk from bioaccumulation of selenium ($Q = 70$) and zinc ($Q = 27$). Copper poses the highest freshwater sediment risk with a risk ratio of $Q = 42$. There is also moderate freshwater sediment risk from silver ($Q = 17$) and arsenic ($Q = 10$).
- Six CPECs were identified as posing a risk to aquatic life based on an acceptable risk ratio of $Q \leq 1$ for protected species: aluminum, barium, cadmium, copper, iron, and zinc. The highest risks are from exposure to aluminum ($Q = 11{,}000$) and copper ($Q = 220$). Aluminum also poses a multiple COI risk to aquatic life. The remaining risk ratios are all below 10.

- 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.

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

1. Surface Water
   - Two hazardous substances and/or pollutants or contaminants (aluminum and arsenic) exceed background and the aquatic life ecological risk-based screening concentrations in Quartz Creek water. Ten contaminants (aluminum, arsenic, barium, cadmium, copper, iron, lead, manganese and zinc) were detected in at least one sample from the waste rock seeps at concentrations that exceeded the lowest regulatory comparison standard and background concentrations in Quartz Creek.
2. Sediment
   - Arsenic and cadmium concentrations in at least one Quartz Creek sediment sample exceed ecological regulatory requirements and background concentrations. Arsenic, cadmium, copper, mercury, and silver concentrations in seep sediment exceed ecological regulatory requirements and background concentrations.
3. Wasterock and mine soil

- Fourteen hazardous substances and/or pollutants or contaminants in waste rock and ore materials exceed both the average background soil concentration and the lowest regulatory comparison standard.
- Aluminum, antimony, arsenic (III, V and total), chromium, copper, iron, lead, mercury, selenium, silver, vanadium and zinc are the primary chemicals of concern.

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.
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)])

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

1. The streamlined risk assessment indicated potential risk to human and ecological receptors from exposure to metals in the mine waste, surface water, and sediment.
   - The maximum detected concentration (MDC) of arsenic (15,800 mg/kg) in the mine waste exceeds the human health risk-based cleanup level of 33 mg/kg by a factor of nearly 500.
   - The MDC of one metal (arsenic) in the mine waste exceeds WDOE's MTCA Method A Industrial Soil cleanup levels.
   - The MDC of 8 metals (aluminum, antimony, arsenic, copper, lead, selenium, silver, and vanadium) in the mine waste exceed WDOE's MTCA Ecological Indicator Soil Concentrations for Protection of Terrestrial Plant and Animals.
   - Metals concentrations in surface water discharging from the seeps and the unnamed drainage also exceed human health and ecological screening criteria. The seeps also contribute metals loading to Quartz Creek.
2. Land uses in areas surrounding the Site include minerals prospecting, timber harvesting, firewood cutting, and recreational activities such as hiking, swimming, camping, fishing, and hunting.
   - 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, cadmium, chromium, copper, iron, and manganese.
   - Children's groups are known to visit the area for educational purposes.
   - 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.

3. Sensitive Oregon tailed frog or western toad populations are at risk because their small home ranges may include Site seep areas containing sediment and water containing high concentrations of aluminum, arsenic, copper, and iron.
4. Some impact to benthic invertebrate populations in Quartz Creek is indicated (CES 2005).

B. Actual or potential contamination of drinking water supplies or sensitive ecosystems:

1. The seeps emanating from waste rock pile WR-1 and the unnamed drainage that flows across waste rock pile WR-2 both discharge to Quartz Creek.
2. 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 Quartz Creek for cooking and as a drinking source.
   - Four COIs in the seeps and unnamed drainage exceeded human health screening criteria: arsenic, copper, iron, and manganese.
   - The MDC of arsenic (57.7 μg/L) in the unnamed drainage exceeds WDOE and EPA human health screening criteria (0.018 μg/L) by a factor of more than 3,000.
3. Quartz Creek is habitat to the cutthroat trout, a federal species of concern.
   - Ten COIs in the seeps and unnamed drainage exceeded ecological screening criteria: aluminum, arsenic, barium, beryllium, cadmium, copper, iron, lead, selenium, and zinc. The MDC of copper (2,020 μg/L) in the seep exceeds WDOE (1.86 μg/L) and EPA (1.0 μg/L) ecological screening criteria by factors of more than 1,000 and 2,000, respectively.

C. High levels of hazardous substances, pollutants, or contaminants in soils, at or near the surface that may migrate:

1. The two waste rock piles on site contain a total of approximately 2,000 bcy.
   - The waste rock contains high concentrations of several metals.
   - Both waste rock piles are unvegetated and subject to erosion. Waste fines eroding from the piles will migrate to Quartz Creek.
   - The toe of waste rock pile WR-1 appears to be in the Quartz Creek floodplain.

D. Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released:

1. The waste rock piles are subject to erosion during rain events and snowmelt.
2. The Site is estimated to receive more than 100 inches of rain and 400 inches of snow per year.

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 one open shaft and one open adit.

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION

Media	**Sample Location**	**Flowrate/ Volume** (cfs, gpm, or cy)	**Contaminant**	**Highest Concentration**	**Lowest Criteria** Eco – Ecological HH – Human Health	**Background Concentration**
Surface Water	RM-Seep SW1	0.31 gpm	Aluminum Arsenic Arsenic V Barium Copper Iron Zinc	1,260 µg/L 14.1 µg/L 14.1 C ug/L 8 B µg/L 687 µg/L 580 µg/L 20 B µg/L	87 µg/L – Eco 0.018 µg/L – HH 3.1 µg/L – Eco 4 µg/L – Eco 1.2 µg/L – Eco 300 µg/L – Eco 13.34 µg/L – Eco	80 B µg/L 1.1 B µg/L 0.91 C µg/L < 3 µg/L <0.5 µg/L <10 µg/L <10 µg/L
	RM-Seep SW2	0.24 gpm	Aluminum Arsenic Barium Cadmium Copper Zinc	2,890 µg/L 1.9 B µg/L 14 µg/L 0.7 µg/L 2,020 µg/L 60 B µg/L	87 µg/L – Eco 0.018 µg/L – HH 4 µg/L – Eco 0.04 µg/L – Eco 1.2 µg/L – Eco 13.34 µg/L – Eco	80 B µg/L 1.1 B µg/L <3 µg/L <0.1 µg/L <0.5µg/L <10 µg/L
	RM-AWR-SW-3	1.0 gpm	Arsenic V Arsenic Copper	52.3 C µg/L 57.7 µg/L 2.1 B µg/L	3.1 µg/L – Eco 0.018 µg/L – HH 1.2 µg/L – Eco	0.91 C µg/L 1.1 B µg/L <0.5µg/L
Pore Water	QC-PW-4	NA	Copper	1.9 B µg/L	0.8 µg/L – Eco	<0.5 µg/L
	RM-Seep-PW1	NA	Aluminum Barium Cadmium Copper Iron Zinc	1,320 µg/L 17 µg/L 0.5 µg/L 409 µg/L 9,360 µg/L 70 µg/L	87 µg/L – Eco 4 µg/L – Eco 0.03 µg/L – Eco 0.8 µg/L – Eco 1,000 µg/L – Eco 9.2 µg/L – Eco	50 B µg/L <3 µg/L <0.1 µg/L <0.5 µg/L <10 µg/L <10 µg/L
	RM-Seep-PW2	NA	Arsenic, V Cadmium	28.42 C µg/L 0.2 B µg/L	3.1 µg/L – Eco 0.03 µg/L – Eco	0.91 C µg/L <0.1 µg/L
Sediment	QC-SS-3	NA	Arsenic Copper	22.6 mg/kg 145 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	9.5 mg/kg 18 mg/kg
	QC-SS-4	NA	Arsenic	15.3 mg/kg	5.9 mg/kg – Eco	9.5 mg/kg
	RM-Seep SS-1	NA	Arsenic Cadmium Copper Silver	179 mg/kg 1.27 mg/kg 4,410 mg/kg 4.79 mg/kg	5.9 mg/kg – Eco 0.6 mg/kg – Eco 35.7 mg/kg – Eco 1.8 mg/kg – Eco	9.5 mg/kg 0.39 mg/kg 18 mg/kg 0.04B mg/kg
	RM-Seep SS-2	NA	Arsenic Copper Silver	205 mg/kg 2,620 mg/kg 33.9 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco 1.8 mg/kg – Eco	9.5 mg/kg 18 mg/kg 0.04 B mg/kg
Site Soils	RM-S1 RM-S2 RM-S3	NM	Arsenic Copper Lead Selenium Silver	299 mg/kg 1,660 mg/kg 79.6 mg/kg 10.2 mg/kg 41.1 mg/kg	1.6 mg/kg – HH 50 mg/kg – Eco 40.5 mg/kg – Eco 0.21 mg/kg – Eco 2 mg/kg – Eco	31.2 mg/kg 200 mg/kg 31.4 mg/kg 0.37 mg/kg 0.4 B mg/kg
Wasterock (East Zone, near	RM-WR1-1 RM-WR1-2 RM-WR1-3	2,000 cy	Arsenic V Arsenic Chromium	221.7 C mg/kg 222 mg/kg 12 B mg/kg	10 mg/kg – Eco 1.6 mg/kg – HH 0.4 mg/kg – Eco	30.8 mg/kg 31.2 mg/kg 5.3 mg/kg

Mill and Shaft)	RM-WR1-4 RM-WR1-5		Copper Selenium Silver Vanadium	1,970 mg/kg 11.1 mg/kg 41.3 mg/kg 67 mg/kg	50 mg/kg – Eco 0.21 mg/kg – Eco 2 mg/kg – Eco 2 mg/kg – Eco	200 mg/kg 0.37 mg/kg 0.4 B mg/kg 26.4 mg/kg
Wasterock (West Zone, near Adit)	RM-WR2-1	25 cy	Arsenic III Arsenic V Arsenic Copper Selenium Silver Zinc	28.08 mg/kg 15,772 C mg/kg 15,800 mg/kg 1,310 mg/kg 4.4 mg/kg 15 mg/kg <100 mg/kg	7 mg/kg – Eco 10 mg/kg – Eco 1.6 mg/kg – HH 50 mg/kg – Eco 0.21 kg – Eco 2 mg/kg – Eco 8.5 mg/kg - Eco	0.411 mg/kg 30.8 mg/kg 31.2 mg/kg 200 mg/kg 0.37 mg/kg 0.4 B mg/kg 63.7 mg/kg

IV. Endangerment Determination

Actual or threatened releases of hazardous substances and/or pollutants or contaminants (aluminum, arsenic, copper, mercury, selenium, silver, 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, copper, mercury, selenium, silver, and zinc will continue to migrate into the environment without a response action.

V. Proposed Actions and Estimated Costs

A. Proposed Actions

1. Proposed Action Description—<u>Excavation and On-site Disposal; ridge repository with engineered cover (See EE/CA for full description and conceptual drawings)</u>
   - Under this option, waste rock piles WR-1 and WR-2, contaminated soil around the mill foundation (S1 & S3), and contaminated sediment at the two seeps would be excavated and removed to a constructed repository.
     - Clearing 2,000 feet of the 15-foot-wide existing access road.
       - Constructing a 100-ft temporary bridge or acceptable alternative for access to the Site.
       - Compacting and placing ~300 loose cubic yards (lcy) of coarse road base.
       - Installing temporary erosion control Best Management Practices (BMPs).
     - Excavating waste rock, contaminated soil, and sediment with arsenic concentrations above the risk-based cleanup levels (soil = 33 mg/kg, sediment = 132 mg/kg).
       - Approximately 2,000 bank cubic yards (bcy) from waste rock pile WR-1 at the mill site.
       - Approximately 25 bcy from waste rock pile WR-2 near Adit 1.
       - Approximately 25 bcy of contaminated soil from around the mill foundation (including the concrete foundation).
       - Approximately 100 bcy of sediment from the two seeps areas.
     - Using heavy equipment to demolish the concrete mill foundation.
     - Backfilling the open shaft with ~150 bcy of waste rock from WR-1.
     - Loading the remaining waste rock, contaminated soil, sediment and concrete (~2,000 bcy total) in dump trucks and transporting to an on-site repository.

  - Using a Niton XRF to assist in delineating the extent of excavation and to field check removal efforts. Collecting a minimum of one composite confirmation sample from each area for verification of contaminant removal.
  - Grading the areas (~0.4 acre) from which waste rock and soil has been excavated to blend with the surrounding topography and promote drainage; Applying 6 to 12 inches of growth media (~130 lcy), applying fertilizer, seeding with a Forest Service approved seed mix, hydromulching, and planting tree seedlings in the mill site.
  - Reclaiming 2,000 feet of access road by ripping compacted surfaces, grading to blend with the natural hillside to the extent possible, seeding ~1 acre with a Forest Service approved seed mix and hydromulching.
  - Removing the temporary bridge, if installed to access the Site
- The repository would be constructed on a ridge about one mile northeast of the East-zone workings. This location is well above the Quartz Creek floodplain, has a slight depression, and is relatively close to the Site. The area can easily accommodate the estimated volume of mine waste with capacity to accommodate swell (~2,400 lcy total).
  - Clearing and grubbing the repository site (~0.3 ac) and stockpiling the woody debris. Excavating 2.3 feet of topsoil (~1,130 bcy) from the repository footprint and stockpiling for use in the repository cap and to cover the excavated waste areas and other disturbed areas.
  - Excavating a diversion channel along the uphill edge of the repository to intercept surface water run on. The earthen, V-shaped channel will be constructed with a slope of 1 to 2 percent, 1 to 2 feet deep, and 2H:1V side slopes. For cost estimation purposes, the assumed channel length is 200 feet. Riprap protection (~2 lcy) would be installed at the channel outlet to prevent erosion. Presumably, the riprap would be obtained from material screened on site.
  - Excavating a concave pit for the mine waste. Soil that is excavated will be stockpiled during construction and used for the cap.
  - Placing and compacting the waste rock, concrete, and contaminated soil and sediment in the repository in 8-inch-thick lifts to the approximate configuration shown in Figure 3 of the EE/CA. The proposed design is conceptual and the actual engineered designs may differ considerably based on site-specific conditions and constraints. However, the general design configurations and site preparation tasks described in the following bullets will likely be very similar independent of location.
  - Shaping the repository to blend with the surrounding topography; The foundation slope should not exceed 10 percent. The repository side slopes should not exceed a 3:1 horizontal to vertical (3H:1V) ratio and the top surface should be graded to minimize erosion, promote drainage, and prevent ponding on the repository surface.
  - Installing an engineered repository cover consisting of a geosynthetic membrane sandwiched between a 12-inch-thick fine bedding layer and a 6-inch-thick drainage layer, overlain by 2 feet of well-graded soil
    - Generating ~820 lcy of fine bedding material on site by screening the mine waste and contaminated soil; Placing and compacting the screened fines over the waste material in one 12-inch lift.

- Installing ~2,450 sy of geosynthetic membrane (geosynthetic clay liner [GCL] or high-density polyethylene [HDPE] liner) over the bedding layer and testing per the manufacturer's specifications
- Carefully placing a 6-inch-thick drainage layer (~410 lcy) over the GCL in one loose lift
- Placing a single layer of filter fabric (~2,450 sy) over the drainage layer to prevent piping of fines from the cover soil into the coarse material
- Placing a 24-inch-thick, well-graded, clean soil cover (~1,640 lcy) over the filter fabric in one lightly compacted 12-inch lift and one loose 12-inch lift; Adding soil amendments and seeding the cover with a Forest Service approved seed mix and hydromulching (~0.5 ac).
- Placing woody debris generated during the removal action over the final cover surface to prevent erosion and provide natural habitat.

2. Contribution to Remedial Performance
   - Monitoring ofr surface water, pore water and sediment in seeps and Quartz Creek will determine whether additional removal or remedial actions are necessary.
3. Description of Alternative Technologies
   - The Forest Service considered a wide array of cleanup technologies for the Site. Refer to Table 12 – *Removal Action Technology Screening Summary* located in the table section of the EE/CA.
   - Three feasible alternatives were then developed and evaluated:
     - Alternative 1 - No Action
     - Alternative 2 – Excavation and Off-Site Disposal of Contaminated Wasterock/Soils/Sediment
     - Alternative 3 – Excavation and On-Site Disposal of Contaminated Wasterock/Soils/Sediment
       - Optional Locations: Mill site or Ridge
       - Optional Covers: Earthen Clay or Engineered
4. Alternative 3 was selected with a ridge repository location and an engineered cover as the proposed alternative because it provides similar environmental protection, effectiveness and feasibility as Alternative 2 (Excavation with off-site disposal), complies with relevant state and federal laws and regulations and is more cost effective (See Section 6, EE/CA).
5. Engineering Evaluation/Cost Analysis
   - MSE, consultants to the Mt. Baker-Snoqualmie National Forest, prepared the EE/CA. The EE/CA is 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 1/12/2009
     - No comments, comment letters or comment emails were received for this project.
1. Applicable or Relevant and Appropriate Requirements (ARARs)
   - ARARs are listed in Appendix B of the EE/CA. These include both Federal and State ARARs

- Chemical-specific ARARs establish acceptable amounts or concentrations of chemicals that may be found in or discharged to the ambient environment.
- Location-specific requirements may determine hazardous substance concentrations or cleanup activities when they occur in specific locations or physical positions.
- Action-specific requirements do not determine the cleanup alternative but instead define the techniques used to perform the chosen cleanup methods.

2. Project Schedule
   - The removal action is proposed for the summer of 2009.

B. Estimated Costs

1. Estimated removal action cost for the project is;
   - Removal Action - $508,150
   - Forest Service oversight - $50,000
2. A detailed cost breakdown is shown in Appendix C 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 Quartz Creek during snowmelt and heavy rainstorms. Seepage from the waste rock piles containing hazardous substances will continue to enter Quartz Creek. These waters and sediments can further degrade the aquatic environment and surface water quality.

VII. Outstanding Policy Issues

None

VIII. Enforcement

No viable responsible parties have been identified for this Site.

IX. Recommendation

A. Removal Action Justification

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 ample justification for further action.

This decision document represents the selected removal action for the Rainy Site, in King 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.

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: Rodney Mack (for) Date: 2/13/09
Rob Iwamoto
Forest Supervisor
Mt. Baker-Snoqualmie National Forest

Approved: Sam Carlson Date: 4/3/09
Sam Carlson
Director of Engineering
Pacific Northwest Region