



United States
Department of
Agriculture

Forest
Service

Southwestern Region
Regional Office

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Date: FEB 10 2015

Dear Interested Parties,

We made a decision to conduct a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Time Critical Removal Action (cleanup) at the Lead Queen Mine Site (Site) located on the Coronado National Forest, near Patagonia, Arizona, Santa Cruz County. This decision is documented in the enclosed Time Critical Removal Action Approval Memorandum, dated February 10, 2015.

Past mining operations left the Site littered with mine features and waste rock material containing concentrations of lead, aluminum, arsenic, and other heavy metals. The primary goal of the cleanup is to (1) reduce the potential migration of waste rock, sediment, and surface water containing lead, aluminum, arsenic, and other heavy metals; and (2) reduce potential exposure to human populations, animals, or the food chain to lead, aluminum, arsenic, and other heavy metals present in the waste rock, sediment, and surface water. Construction activities associated with the cleanup are planned for spring 2015.

If you need further information regarding this Removal Action Approval Memorandum, please contact Eli Curiel, P.E., On-Scene Coordinator, at (520) 388-8413; or Maria McGaha, P.E., Regional Environmental Engineer, at (505) 842-3837.

Sincerely,

CALVIN N. JOYNER
Regional Forester

for

Enclosure

cc:

Eli Curiel, On-Scene Coordinator
Anne Fischer, Arizona Statewide On-Scene Coordinator
Mark J. Ruggiero, Sierra Vista District Ranger
Mindy Vogel, Coronado Minerals Program Manager
Michele Girard, Forest Hydrologist
Maria McGaha, Regional Environmental Engineer
William Medina, Assistant Regional Environmental Engineer
Kirk Minckler, USDA OGC Denver
Project Mailing List
Administrative Record





TIME CRITICAL REMOVAL ACTION APPROVAL MEMORANDUM

DATE: FEB 10 2015

SUBJECT: Request for a Time Critical Removal Action at the Lead Queen Mine Site (Site),
Coronado National Forest, Santa Cruz County, Arizona

FROM: Eli Curiel, P.E., On-Scene Coordinator (OSC)

TO: Regional Forester

THROUGH: Mark Ruggiero, Sierra Vista District Ranger,
Jim Upchurch, Forest Supervisor, Coronado National Forest
Danny Montoya, Regional Engineering Director, Southwestern Region
Maria McGaha, Regional Environmental Engineer, Southwestern Region

I. PURPOSE

A release or a significant threat of a release that poses a threat to public health or welfare or the environment is occurring on lands under the jurisdiction, custody, or control of the U.S. Department of Agriculture Forest Service (Forest Service), Sierra Vista Ranger District of the Coronado National Forest, Arizona. The purpose of this Memorandum is to request and document approval of the proposed time critical removal action described herein. This time critical removal action at the Lead Queen Mine Site (Site) will reduce the potential for exposure to hazardous substances.

This Time Critical Removal Action Approval Memorandum documents and explains the commencement of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; 42 U.S.C. 9601 *et seq.*) removal action at the Site. The Forest Service's role is to protect the public health and welfare and the environment and to respond to a hazardous substance release on lands under the jurisdiction of the Forest Service, pursuant to the authority found in 42 U.S.C. 9604(a), Executive Order 12580, and 7 C.F.R. 2.60(a)(39). In general, for response actions on National Forest System lands, the Forest Service is the lead agency as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 C.F.R. Part 300. The Forest Service conducts response actions consistent with the NCP.

II. SITE CONDITION AND BACKGROUND

A. Site Description

1. Physical Location

The Site is located approximately 70 miles southeast of Tucson, Arizona, and approximately 6 miles south of Patagonia. Access to the Site is east from Tucson on Interstate 10 about 23 miles to exit 281, and south on State Highway 83 for about 26 miles to State Highway 82 for 13 miles to the town of Patagonia. Take McKeown Avenue east near the Patagonia Post Office and the road turns into Harshaw Road. Travel south on Harshaw Road about 5.2 miles and turn right on Forest Road 4649. Take this road about 0.6 miles and turn right on Forest Road 4684. Take route 4684 about 1.5 miles and park the vehicle. Travel by foot about 0.4 miles over desert terrain to reach the north dump site. Roads are minimally maintained by the Forest Service and may only be accessed by 4-wheel drive vehicles.

The legal description is Township 22 S, Range 16 E, NW $\frac{1}{4}$ in Section 33. The latitude is 31.484815 and longitude is -110.718891.

The regional climate in the desert is semi-arid; however, the mountainous region of southern Arizona is characterized as cool and wet due primarily to the higher elevations. Summers are hot and dry; normally moderated in late June through September by intense thunderstorms and heavy runoff. The site is situated at an elevation of approximately 4849 feet above sea level.

2. Site Characteristics

The 5-acre Site is within a lead-silver base metal vein deposit in the Patagonia Mountains of the Harshaw Mining District, Santa Cruz County. The Harshaw Mining District is within the Harshaw Creek Watershed. The topography is a rough terrain with elevations up to 6,350 feet and declines to 4,500 feet in a radius of 2.5 miles. South of Red Mountain and east of the Patagonia Mountains the elevations rise to about 5,000 feet.

The Lead Queen Mine is developed to a depth of 166 feet by about 1,200 feet of work, including shaft drifts, crosscuts, and stopes on two levels. The ore is almost all sulfides, though much of it is yellowish with carbonate and chlorides of lead. Past mining operations left the Site littered with mine features, and waste rock material. These mine features present a physical safety hazard to the public and potential threat to human health and the environment. The shafts located approximately 100 feet higher than the lower adits are also conduits and sources for collecting and conveying surface water and tunnel water. During high precipitation events, saturated water makes its way into the faults and tunneling system and eventually out of the lower adit. The iron rich water then is conveyed into a tributary of the Harshaw Creek Watershed, and eventually into Harshaw Creek, Sonoita Creek and Patagonia Lake.

Essentially, the tunnel water discharge has had decades of reaction time with pyrite-rich rock material and some probable bacterial action that has *naturally* put dissolved iron in the ecosystem.

Mining History

The Lead Queen Mine is one of five mine features in the Buffalo Group and was formerly known as the Jefferson Group and is situated within the Harshaw Mining District. The Lead Queen Mine is the most extensively developed property of this group.

The Lead Queen Mine was owned at times, or in part, by the Jefferson Mining Co. It was discovered in 1897 and ceased operations in March 1902. In 1910 the property was again developed by the T.E. Munn Mining Co. of San Antonio Texas and includes shafts, drifts, crosscuts and stopes.

Other mines near the Lead Queen belong to the Wieland Group and include Basin No. 1 Prospect, Great Silver Mine, Dewey Prospect and Red Rock Prospect. The rough topography is mainly andesite which is intruded by rhyolite. Locally some older silicate limestone and altered shale are also present.

3. Removal Site Evaluation

In September 2014, Forest Service staff conducted an initial inspection of the Site and discovered an orange-reddish precipitate and a milky white aluminum precipitate in the streambed in an upper tributary of Harshaw Creek near the area of the Lead Queen Mine. Severe monsoon thunderstorms and back to back hurricanes created significant rainfall and subsequent saturation which flooded the local mine workings, releasing mine water into the streambed of the tributary.

The Forest Service, in cooperation with the USGS, performed an investigation which included sampling and analysis of the waste rock, sediment, and surface water at the Site. A total of 50 waste rock, sediment, and surface water samples were collected and analyzed (*Regional Lead Queen Mine Area Data Table, USGS 2014*). Results of the waste rock analysis confirmed lead concentrations up to 35,300 mg/kg; up to 3,296 mg/kg zinc; up to 6,617 mg/kg copper; up to 29,400 mg/kg aluminum; and up to 1,025 mg/kg arsenic. These heavy metals are classified as hazardous substances as defined by CERCLA Section 101(14).

The sediment lead and arsenic concentrations also exceed more than three times the background concentrations. Background sediment lead concentration is 22 mg/kg, and arsenic is 15 mg/kg. Sediment concentrations for lead are up to 356 mg/kg (16 times background), and arsenic is up to 599 mg/kg, thus several orders of magnitude above background concentrations.

The surface water lead and arsenic concentrations exceed more three times the background concentrations. Background surface water lead concentration is 2.9×10^{-5} mg/L, and arsenic is 3.5×10^{-4} mg/L. Surface water concentrations for lead are up to 3.7×10^{-3} mg/L and arsenic is up to 4.57 mg/L. These values are several orders of magnitude above background concentrations.

Background surface water iron concentration is 0.002 mg/L and background sediment iron concentration is 6500 mg/kg. The highest concentration of iron found in surface water is 1600 mg/L, and 295,000 mg/kg in the sediment. These iron concentrations are several orders of magnitude above background iron concentrations. The result of these iron-rich concentrations is a red-orange sludge (ochre) spread throughout the drainage bottoms.

4. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant, or Contaminant

Uncontained and uncontrolled waste rock and surface water at the Site are documented to contain elevated concentrations of lead, aluminum and arsenic. Waste rock material and surface water contaminated with lead and arsenic from the Site pose a continual threat of a release to the surrounding environment, specifically Harshaw Creek.

Lead, aluminum, and arsenic substantially above background levels are found down gradient of the Site. These substances are listed as hazardous substances as defined by section 101(14) of CERCLA.

Ingestion of lead causes poisoning and is a suspected carcinogen of the lungs, brain and kidneys. Lead ingestion in children can cause irreversible brain damage, slow growth and hearing problems. Children can assimilate lead in their bodies faster than adults, and thus may be particularly susceptible to lead exposure. Lead exposure in pregnant women can cause premature birth, low birth weight or a spontaneous abortion. It can affect a male's reproductive system. (<http://www.atsdr.cdc.gov/tfacts13.pdf>). Lead concentrations at the Site in the soil are up to 35,300 mg/kg. Arizona Non-Residential Soil Remediation Level for protection of human health is 800 mg/kg.

Breathing high levels of arsenic can result in a sore throat or irritated lungs. Ingesting high levels of arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting or breathing low levels of arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with arsenic may cause redness and swelling. Several studies have shown that arsenic exposure can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The arsenic levels in soil are up to 1,025 mg/kg. Arizona Non-Residential Soil Remediation Level for protection of human health is 10 mg/kg.

Aluminum (Al) is the third most common mineral and the most common metal in the Earth's crust. However, in acidic environments, it can be a major limiting factor to many plants and aquatic organisms. The greatest concern for occurs in areas that are affected by wet and dry acid deposition. Acid mine drainage can be a major source of Al. In solution, the metal can combine with several different agents to affect toxicity. In general, Al hydroxides and monomeric Al are the most toxic forms. Dissolved organic carbons, F, PO (3)3- and SO (4)2- ameliorate toxicity by reducing bioavailability. Elevated metal levels in water and soil can cause serious problems for some plants. Algae tend to be both acid- and Al tolerant and, although some species may

disappear with reduced pH, overall algae productivity and biomass are seldom affected if pH is above 3.0. Aluminum and acid toxicity tend to be additive to some algae when pH is less than 4.5. Very low Al levels may benefit some plants, although the metal is not recognized as an essential nutrient. Hyper accumulator species of plants may concentrate Al to levels that are toxic to herbivores. Toxicity in aquatic invertebrates is also acid dependent. Taxa such as Ephemeroptera, Plecoptera, and Cladocera are sensitive and may perish when Al is less than 1 mg.L-1 whereas dipterans, mollusks, and isopods seem to be tolerant. In Al-sensitive species, elevated levels affect ion regulation and respiratory efficiency. Toxicity tends to be greatest near a species' threshold of pH sensitivity. At lower pHs, Al may have a slight ameliorative effect by interfering with H+ transport across membranes. Aquatic invertebrates can accumulate very high levels of Al, but most of this appears to be through adsorption rather than assimilation.

Other hazardous substances or pollutants and contaminants not discovered to date or not specifically identified herein may exist at the Site. These substances may also pose a threat to human health and the environment.

5. National Priorities List (NPL) Status

The Site is not listed on the NPL.

6. Maps, pictures and other graphic representations

Maps and pictures of the Site are attached in the Appendix.

B. Other Actions to Date

From 2010 to 2014, USGS collected samples of sediment, water, and soil from drainages and mine waste rock sources in the Upper Harshaw Watershed as part of a watershed investigation of mines within the Patagonia Mountains, Arizona. The samples were investigated for lead, aluminum, arsenic, and other heavy metal concentrations. Results of the investigation shall be presented in a Preliminary Assessment/Site Inspection (PA/SI) report due to be completed spring 2015. The PA/SI report includes the Lead Queen Mine and other mine sites in the Upper Harshaw Watershed.

The Forest Service plans to prepare an Engineering Evaluation/Cost Analysis (EE/CA) for the Upper Harshaw Watershed.

C. State and Local Authorities Roles

1. State and Local Actions to Date

Arizona Department of Environmental Quality (ADEQ) issued the Forest Service two Notice of Violations, which state: (1) "Addition of a pollutant to navigable waters from a point source without a permit", and (2) "Discharge of storm water associated with an industrial activity without a permit".

In October 2014, the state and local organizations conducted site inspections of the Lead Queen Mine.

2. Potential for Continued State/Local Response

Forest Service is coordinating with ADEQ to address the findings in the NOV's.

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

Conditions at the Site represent a release, and potential threat of a release, of a CERCLA hazardous substance threatening the public health or welfare, or the environment, based on the factors set forth in the NCP at 40 C.F.R. §300.415(b)(2). These factors include:

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

The Chemicals of Concern (COC) include, but are not limited to, lead, zinc, arsenic, copper, cadmium, iron, mercury, and aluminum. Conditions within the watershed area have created an elevated risk of downstream contamination on National Forest System (NFS) and private lands below the Site. Occupied homes, outbuildings, and the Nature Conservancy's Patagonia-Sonoita Creek Preserve are located in close proximity to Sonoita Creek, downstream of the area.

The Patagonia Mountains have high levels of biodiversity and are home to a variety of species protected under the Endangered Species Act including, jaguar, ocelot, lesser long-nosed bat, Mexican spotted owl, western yellow-billed cuckoo, Sonora tiger salamander, and the northern Mexican gartersnake. In addition, the area also contains designated Critical Habitat for jaguar and Mexican spotted owl, and proposed critical habitat for the northern Mexican gartersnake and the western yellow-billed cuckoo.

The area is best-known and most popular places for birding in the U.S. Bird enthusiasts who come from all over the world to catch a glimpse of more than 300 species of birds, including many Neotropical species that migrate, nest, and live in this unique habitat.

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

There is a potential risk of waste rock, soil, and sediment containing elevated concentrations of lead, zinc, arsenic, copper, cadmium, mercury, iron, and aluminum and other hazardous substances to erode from the abandoned mine Site into stream channels within the watershed area.

3. Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release.

Hazardous substances are located within and around the waste rock piles at the Site. These hazardous substances may pose a threat of release to the environment down gradient into Sonoita Creek.

4. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

A substantial increase in soil erosion, sediment delivery to streamcourses, and peak flows from both 2014 summer monsoon thunderstorms and frontal storms have occurred. Hyperconcentrated flows of non-cohesive materials (i.e., debris flows) are likely in upper portions of the watershed. Increased sediment loads in stream channels will also increase the scouring capability of flood flows when these sediments are transported in flood water.

The elevated concentrations of iron found in the drainages is primarily attributed to iron that has built up for decades in a tunnel system going at least several hundred feet back and underneath a nearby ridgetop. The monsoon storms in September 2014 suddenly flushed the iron-rich material into the environment.

5. Threat of fire or explosion

The mining district is susceptible to wildland fire on an annual basis which would increase runoff and erosion potentials.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this Removal Action Time Critical Approval Memorandum, may present an imminent and substantial endangerment to public health, welfare, or the environment due to exposure of hazardous substances. If the Site is not remediated before the next monsoon season, the soil, sediment and waste rock containing hazardous substances will erode and wash down the canyon. If the work is delayed, road access to the area will be limited and/or eliminated as the roads will be deteriorated and destroyed by the rapid monsoon runoff.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

Data collected during the preliminary assessment and 2014 site inspection were evaluated and document lead, zinc, arsenic, copper, cadmium, mercury, iron, and aluminum as the primary Chemicals of Concern (COC). The site inspection documents that the risk to human health has increased from an undisturbed environment due to past mining activities. The most likely routes of exposure are inhalation, ingestion, and dermal contact of hazardous substances in the soil, sediment, and water.

The following removal action objectives have been identified for the Site:

- Reduce potential migration of waste rock, sediment, and surface water containing lead, zinc, arsenic, copper, cadmium, mercury, iron, and aluminum;

- Reduce potential exposure to human populations, animals, or the food chain to lead, zinc, arsenic, copper, cadmium, mercury, iron, and aluminum present in waste rock, sediment, and surface water.

A. Proposed Action

1. Proposed action description

The proposed action for the Site is to remove soil, ochre sediment, and waste rock containing excessive amounts of lead, zinc, arsenic, copper, cadmium, mercury, iron, and aluminum and other heavy metal and dispose onsite at a consolidation cell. In addition, the proposed action includes closure of other mine features such as adits and shafts.

The following summarizes the proposed action:

1. Excavate and remove soil, ochre sediment, and waste rock and dispose on-site at a consolidation cell;
2. Construct and install gabion wall structures to eliminate/reduce the potential for aluminum precipitate and ochre sediment to migrate further downstream;
3. Closure of adits and shafts at the Site;
4. Access Road Improvement: Partial reconstruction of NFSR 4684; construction of approximately 0.5 miles of temporary access road from NFSR 4684 to the Site.

2. Contribution to Remedial Performance

The proposed action in this Time Critical Removal Action is consistent with long-term remedy action planned for the Upper Harshaw Watershed.

3. Applicable or Relevant and Appropriate Requirements (ARARs)

This Time Critical Removal Action will be in compliance with State and Federal environmental regulations to the extent practicable given the exigencies of the situation.

4. Project Schedule

This Time Critical Removal Action is expected to be fully implemented by April 2015.

B. Estimated Costs

The Forest Service will hire an environmental firm to perform the proposed action. The estimated cost of this removal action is \$ 175,000, including project oversight.

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

Any delay in this removal action will result in further exposure to hazardous substances from the Site to human and ecological receptors.

VII. OUTSTANDING POLICY ISSUES

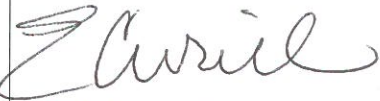


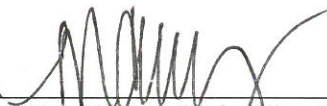


No outstanding policy issues with the Site have been identified at this time.

VIII. ENFORCEMENT

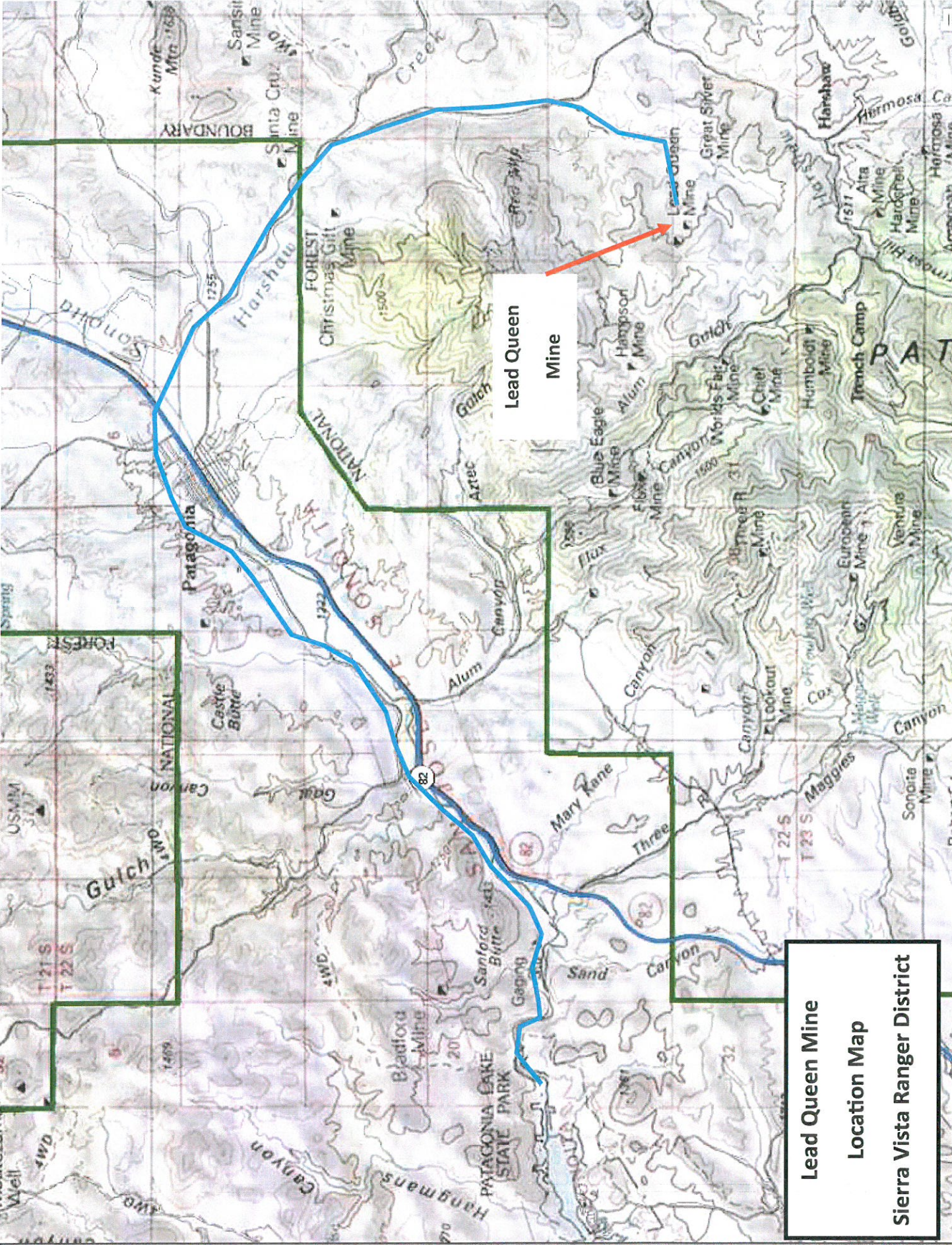
Pursuant to CERCLA authorities, no viable Potentially Responsible Parties have been identified at this time.

IX. RECOMMENDATION

The decision implements the Time Critical Removal Action described herein. Conditions at the Site meet the NCP section 300.415(b) (2) criteria for a Time Critical Removal Action. Implementation of this action is approved by the United States Department of Agriculture, Forest Service.

Recommended By: 	Date: 1/12/15	Concur: 	Date: 1/20/15
ELI CURIEL, P.E. On-Scene Coordinator		MARK RUGGIERO Sierra Vista District Ranger	
Concur: 	Date: 1/27/15	Concur: 	Date: 2/6/15
JIM UPCHURCH Forest Supervisor		MARIA A. MCGAHA, P.E. Regional CERCLA Coordinator	
Concur: 	Date: 2/6/15	Approved By: 	Date: 10 FEB 2015
<i>for</i> DANNY R. MONTOYA Regional Engineer		CALVIN N. JOYNER Regional Forester	

- Cc:
- Eli Curiel, On-Scene Coordinator
 - Anne Fischer, Arizona Statewide On-Scene Coordinator
 - Mark J. Ruggiero, Sierra Vista District Ranger
 - Mindy Vogel, Coronado Minerals Program Manager
 - Michele Girard, Forest Hydrologist
 - Maria McGaha, Regional Environmental Engineer
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Lead Queen Mine

**Lead Queen Mine
Location Map
Sierra Vista Ranger District**



PHOTOGRAPH LOG
Lead Queen Mine SITE
January 9, 2015

Activity: Preliminary Site Sampling

Site Location: Patagonia Mountains

1 **Date:** 10/25/14 **Direction of View:**



Description: Collection of Aluminum Precipitate Sediment

2 **Date:** 10/26/14 **Direction of View:**



Description: Lead Queen mine adit opening

3 **Date:** 10/25/14 **Direction of View:**

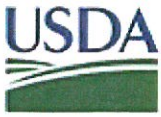


Description: Aluminum Precipitate

4 **Date:** 10/26/14 **Direction of View:**



Description: Waste Dump Pile



PHOTOGRAPH LOG
Lead Queen Mine SITE
January 9, 2015

Activity: Preliminary Site Sampling

Site Location: Patagonia Mountains

5

Date: 10/25/14

Direction of View:

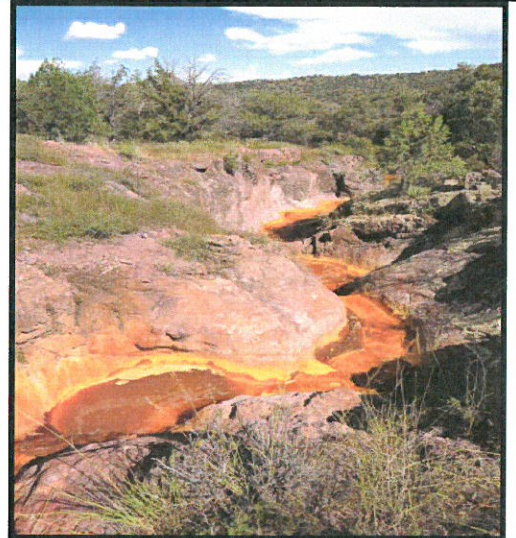


Description: Sludge in Drainage

6

Date: 10/26/14

Direction of View:



Description: Sludge in Drainage

7

Date: 10/25/14

Direction of View:



Description: Reddish-Orange Sludge

8

Date: 10/26/14

Direction of View:



Description: Aluminum Precipitate