Alaska Department of Environmental Conservation
Spill Prevention and Response Division
Contaminated Sites Program

August 2013 Fact Sheet

The Red Devil Mine – An Update

History

The Red Devil Mine is a historic abandoned mercury mine on the banks of the Kuskokwim River, 250 miles west of Anchorage and 1.5 miles southeast of Red Devil (pop. 19). The mine is on 10 acres of land managed by the Bureau of Land Management (BLM) and has been selected as a future Native patent by The Kuskokwim Corporation and Calista Corporation.

The Red Devil Mine area has extensive cinnabar deposits that have been mined and retorted (heated) to vaporize and condense the elemental mercury. Mining at the site began in 1933, and the mine operated continuously until 1946 when the mercury market price dropped. Production began again in 1952 and continued until a fire destroyed the mine and mill equipment in 1954. A new retort was built in 1955 on the opposite side of Red Devil Creek, and it operated until 1971.

Open pit mining began in 1969, and by 1970, the Red Devil Mine was Alaska's largest mercury producer and it was one of the largest in the United States. The mine shut down in 1971 when the mercury market dropped and has not operated since. The underground mine itself flooded in 1981. During the mine's lifetime, it produced roughly 35,000 flasks of mercury (76 pounds per flask).

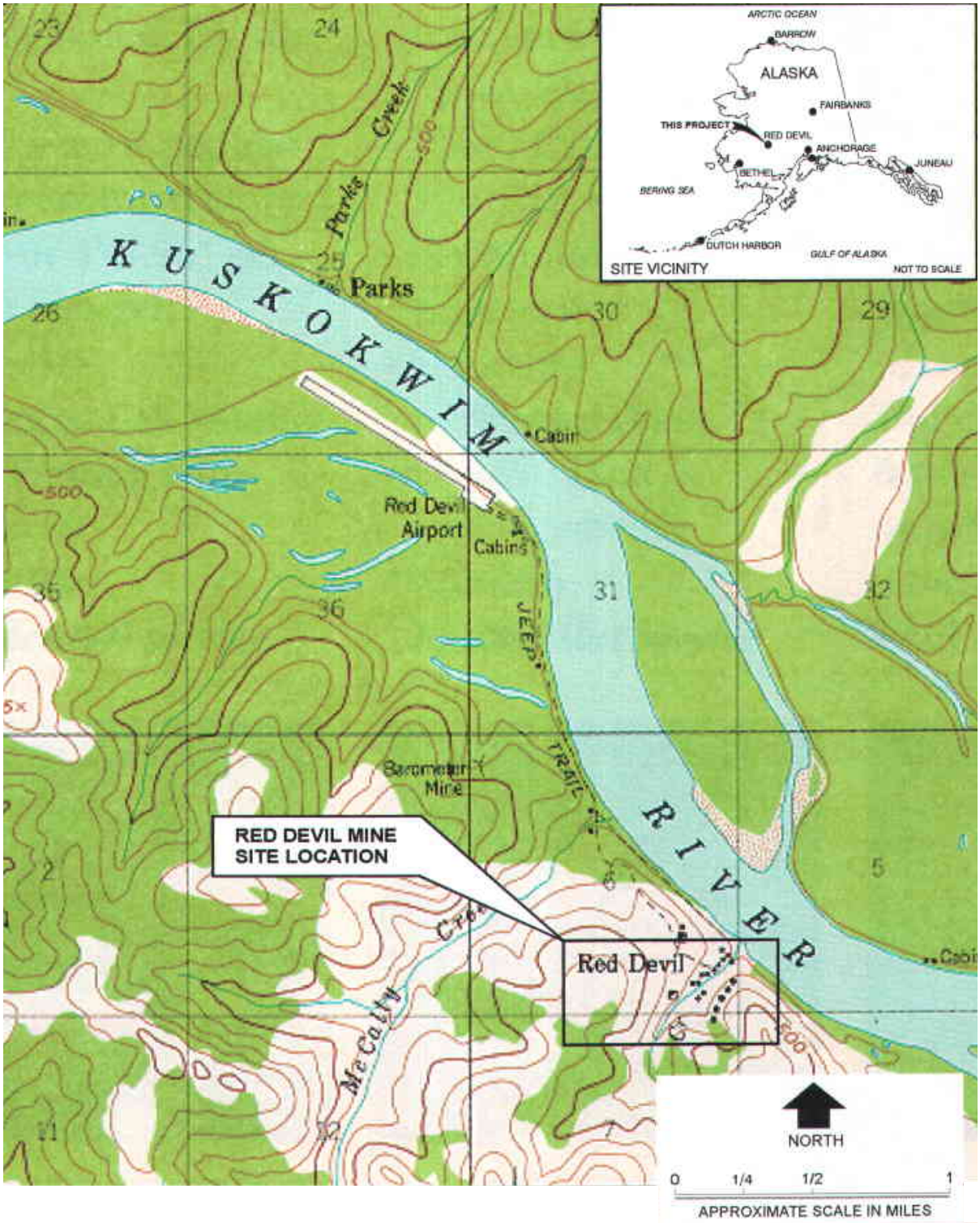
The mine included a housing complex, equipment and chemical storage buildings, a shop pad (laboratory), an engine shop, mine portals, a power plant, a retort building, three settling ponds and five above-ground petroleum storage tanks.

The BLM removed all the buildings in 2001 and the tanks in 2004. Most mining occurred underground in an extensive series of stopes – step-like excavations – and tunnels, but surface strip-mining and exploration were also conducted.

Contamination

The Red Devil Mine is considered abandoned, and there are no former viable owners. Therefore, the BLM, as the land manager, is conducting the cleanup,

Mine tailings shown eroding into Red Devil Creek in August 2011.



Located in a small valley with fairly steep slopes, the Red Devil Mine was bisected by Red Devil Creek, which flows a half mile to the Kuskokwim River.

and the Alaska Department of Environmental Conservation (DEC) and U.S. Environmental Protection Agency (EPA) are making sure that the cleanup is done in accordance with state and federal regulations.

The EPA first inspected the site in late 1971 and collected water and sediment samples. Between 1979 and 2008, the EPA, DEC, BLM and U.S. Geological Survey conducted subsequent sampling investigations at the mine and surrounding areas.

Mine tailings had been used as fill across the site. The investigations showed elevated concentrations of metals in the tailings around the two different retort areas, in the sediment and surface water of Red Devil Creek, and in the groundwater on both sides of the creek. Petroleum-contaminated

An overview of the Red Devil Mine site (top) shows what the site looked like before the Bureau of Land Management demolished the buildings in 2001 and 2002. BLM contractors removed some chemicals, batteries and waste, but most of the debris, including some hazardous waste, was buried on site. Another aerial photo (bottom) shows what the site looked like in June 2004.

soil was found at several locations along the fuel pipeline and tanks.

From 2000 to 2004, the BLM demolished the buildings and fuel tanks and buried the debris on-site. Due to those BLM actions – operating heavy equipment on-site and moving tailings around – it was unknown if previous sample results were still representative of site conditions.

In January 2008, the EPA and DEC requested that the BLM conduct a comprehensive site characterization, called a Remedial Investigation, to determine the extent of the metals contamination in the soil, sediment, surface water and groundwater, and a Risk Assessment to calculate health risks to humans, plants and animals.

From 2010 to 2012, the BLM conducted several field sampling events where its contractors collected soil and groundwater samples across the site, sediment and surface water samples from Red Devil Creek, and sediment samples from the Kuskokwim River to determine levels of contaminants at the site. A Risk Assessment to evaluate risk to future on-site residents, current and future recreational and subsistence users, future mine workers, and ecological receptors was also conducted using site sampling results and land-use information.

Based on the results of the Remedial Investigation, the following conclusions have been made:

- A large volume of soil and tailings in the Main Processing Area exceed screening

Summary of 2010-2012 Highest Soil and Tailings Sample Results
(In milligrams per kilogram or mg/kg)

Contaminant	West Side Shops	West Side Older Retort	Surface Mined Areas	East Side Tailings and Settling Ponds	East Side Newer Retort	Human Health Screening Level[1]	Ecological Screening Level[2]
Antimony	23,300	28,900	508	16,800	15,100	3.6/41	0.27
Arsenic	4,940	9,490	8,510	9,880	7,730	3.9/4.5	43
Mercury	939	2,070	174	1,527	1,067	1.4/18	11

[1]State screening levels are from 18 AAC 75.341, Table B1 – Migration to groundwater/direct contact or outdoor inhalation.

[2]Antimony and arsenic values are from EPA's Ecological Soil Screening Levels. The mercury value is from Oregon's cleanup regulations.

Summary of 2010-2012 Highest Groundwater Sampling Results
(In parts per billion or micrograms per liter – ug/L)

Contaminant	West Side Shops	East Side Tailings	Settling Ponds	Human Health Screening Level[1]
Antimony	101	13,100	5,860	6
Arsenic	32.8	6,650	1,760	10
Mercury	56	6	1.6	2

[1]Screening levels are from 18 AAC 75.345, Table C – Groundwater cleanup standards.

Summary of 2010-2012 Highest Sediment and Surface Water Concentrations

(Sediment is in milligrams per kilogram, mg/kg, and surface water is in parts per billion or micrograms per liter, ug/L)

Contaminant	RDC: Upstream of Mine	RDC: Below and In Tailings	RDC: Mouth of Creek	Kuskokwim River: Red Devil Delta	Kuskokwim River: Dolly Sluice Delta	Screening Levels[1,2]
Sediment						
Antimony	<1.2	6,360	1,900	1,280	1,420	3
Arsenic	65	130,000	1,890	1,790	1,280	6
Mercury	0.55	63	79	56	29,000	0.17
Water						
Antimony	1.5	167	184			14
Arsenic	1.1	1,030	78			150
Mercury	0.0064	0.31	0.24			0.05

[1]Screening levels for sediment are based on the National Oceanic and Atmospheric Administration Screening Quick Reference Table for Inorganics in Solids – protective of ecological receptors (mortality).

[2]Screening levels for water are based on Alaska Water Quality Standards – antimony and mercury: protective of human health and aquatic organisms; arsenic: protective of aquatic organisms only.

levels[1] for arsenic, antimony and mercury; a preliminary determination of the vertical and lateral extent has been made.

- Some tailings contain concentrations of leachable arsenic which make them qualify as hazardous substances.
- Sediment and surface water in Red Devil Creek exceed screening criteria for arsenic, antimony and mercury. Contaminant concentrations are elevated at the mouth of the creek where it flows into the Kuskokwim River.
- Juvenile fish in Red Devil Creek contained higher concentrations of mercury than fish from other creeks flowing into the Kuskokwim.
- Sediment in the Kuskokwim River exceeds screening criteria for arsenic, antimony, and mercury.
- Groundwater at the site flows to Red Devil Creek and to the Kuskokwim River. It exceeds screening criteria for arsenic, antimony and mercury.
- Soil in some areas of the Surface-Mined Area above the pre-1955 retort exceeded screening levels for arsenic, antimony and mercury.
- Cancer and non-cancer risk levels to future on-site residents, current and future recreational and subsistence users, future mine workers, and several ecological receptors all exceeded state and federal standards.

BLM Building Removal Actions

In 1999, the BLM removed from the site roughly 100 batteries, mercury-contaminated retort slag, mineral processing chemicals and liquid wastes (petroleum products and solvents).

In 2002, the BLM submitted a plan to DEC to place building debris and other solid waste into

[1] Screening levels or criteria are risk-based levels that are used initially at a site before site-specific data is available; the levels are very conservative because there are so many unknowns about the site. Once that data is collected (such as in a risk assessment), the responsible party will propose cleanup levels that use the site-specific information. DEC reviews and approves the cleanup levels – the levels that must be achieved to protect human health and the environment.

two buried landfills on the site. One of the "monofills" – a landfill that has debris from one location – would contain all of the hazardous waste from the site, and the other would contain building debris, asbestos, scrap metals, crushed drums and drained PCB transformers. The monofills did not comply with Alaska Solid Waste guidelines for buried landfills and were partially placed on top of the most highly contaminated areas without addressing that contamination first. Due to these and other technical reasons, DEC did not concur with this action. The BLM, however, conducted the work over DEC's objections. A third monofill was created in 2004, in accordance with a DEC-approved work plan, to dispose of the metal from the above-ground fuel tanks and ore hopper.

Petroleum Removal Actions

In 2005, the BLM began removing petroleum-contaminated soil from the area of the five above-ground storage tanks and the fueling pipeline, in accordance with a DEC-approved work plan. Very little characterization work had been performed prior to the start of the removal action. Contractors discovered a larger volume of contaminated soil than anticipated, and not all the contamination could

Mine tailings are shown adjacent to the settling pond in an August 2009 photo.

be excavated in 2005. Additional contaminated soil was excavated in 2006, however, due to funding and timing constraints, not all the contamination could be removed. The remaining soil was sampled in 2010 and sample results showed that the cleanup levels were met. Roughly 2,000 cubic yards of contaminated soil were stockpiled on-site awaiting treatment.

In 2010, in accordance with a DEC-approved work plan, the petroleum-contaminated soil was moved to a cleared area and landspread on the ground surface to encourage naturally occurring microbes to break down the petroleum. Soil samples were collected to establish a baseline concentration and the soil was seeded to reduce possible erosion. The BLM is required to conduct annual sampling, and if the contaminant concentrations have not reduced significantly within the next several years, the BLM may be required to conduct additional actions, such as tilling, to accelerate the petroleum breakdown.

Current Status

The DEC has been working with the EPA to oversee the BLM's Remedial Investigation work. Both the Remedial Investigation and Risk Assessment Report are scheduled to be finalized in the early fall of 2013. The BLM submitted a draft Feasibility Study to the DEC and EPA in April 2013. The Feasibility Study will propose cleanup levels and evaluate different cleanup options. The DEC and EPA will be working with the BLM to ensure appropriate cleanup alternatives are evaluated. DEC and the EPA will also be working with the BLM on a potential early action to reduce the migration of contaminated sediment and surface water of Red Devil Creek from flowing into the Kuskokwim River.

National Priorities List Inclusion

The EPA has a list of the most contaminated sites in the United States called the National Priorities List (NPL), or Superfund List. In 2008, DEC asked the EPA to evaluate the Red Devil Mine site to see if it would qualify for the NPL, and it did qualify. In 2009, at the request of then-Gov. Sarah Palin, DEC Commissioner Larry Hartig sent a letter to the EPA stating that the State of Alaska did not object to placing the Red Devil Mine on the NPL (July 17, 2009, letter). The BLM and Department of Interior objected to listing it, as outlined in their Sept. 1, 2009, letter (Sept. 1, 2009, letter). The Department of Interior, BLM and EPA met and BLM requested a separate agreement with EPA and DEC (Sept. 8, 2009, letter).

The EPA replied with "five essential elements" that would need to be part of a separate agreement with BLM if the site was not listed (Oct. 1, 2009, letter); those elements included public participation, meaningful participation by Tribes, EPA concurrence of documents and remedy selection, an enforceable schedule for milestones with stipulated penalties, and a formal dispute resolution process.

The BLM offered a different approach with a Memorandum of Understanding (Oct. 2, 2009, letter). On Nov. 6, 2009, DEC sent a letter to the EPA supporting the EPA's request of the "five essential elements" and stating that the NPL listing process should begin in March 2010 if an agreement hadn't been reached (Nov. 6, 2009, letter). The BLM and EPA continued to disagree regarding the basic principles of an agreement (Oct. 26, 2009, letter), (Jan. 11, 2010, letter), (Feb. 23, 2010, letter), (April 13, 2010, letter), (May 14, 2010, letter), (May 24, 2010, letter), (Aug. 23, 2010, letter), (Oct. 27, 2010, letter), (Nov. 22, 2010, letter). In August 2011, staff from the federal Office of Management and Budget conducted a site visit and met with the BLM, EPA and DEC.

In August 2011, the Kuskokwim Corporation asked the EPA to put the Red Devil Mine on the NPL (Aug. 22, 2011, letter), and the EPA responded (Oct. 19, 2011, letter). On Oct. 9, 2012, the Georgetown Tribal Council asked EPA to put the Red Devil Mine on the NPL (Oct. 9, 2012, letter); as of Aug. 7, 2013, DEC has not seen EPA's response to that letter.

In August 2012, at the direction of Gov. Sean Parnell, Alaska Attorney General Michael Geraghty re-

quested that the EPA place the Red Devil Mine site on the NPL (Aug. 3, 2012, letter). Attorney General Geraghty reiterated the State of Alaska's support of the EPA's original "five essential elements" and requested that if an agreement wasn't reached by a midway deadline, that the site be placed on the NPL in April 2013 (Sept. 12, 2012, letter). The EPA responded to the State of Alaska by confirming its commitment to obtaining an agreement and committed to forwarding a draft agreement shortly (Oct. 12, 2012, letter).

After no additional contact from the EPA, in January 2013, Attorney General Geraghty again asked that the site be listed as there had been no notice of any forward progress on an agreement (Jan. 23, 2013, letter); as of Aug. 7, 2013, the EPA hadn't responded to that letter.

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