

March 2009

Red Devil Mine

Red Devil, Alaska

History

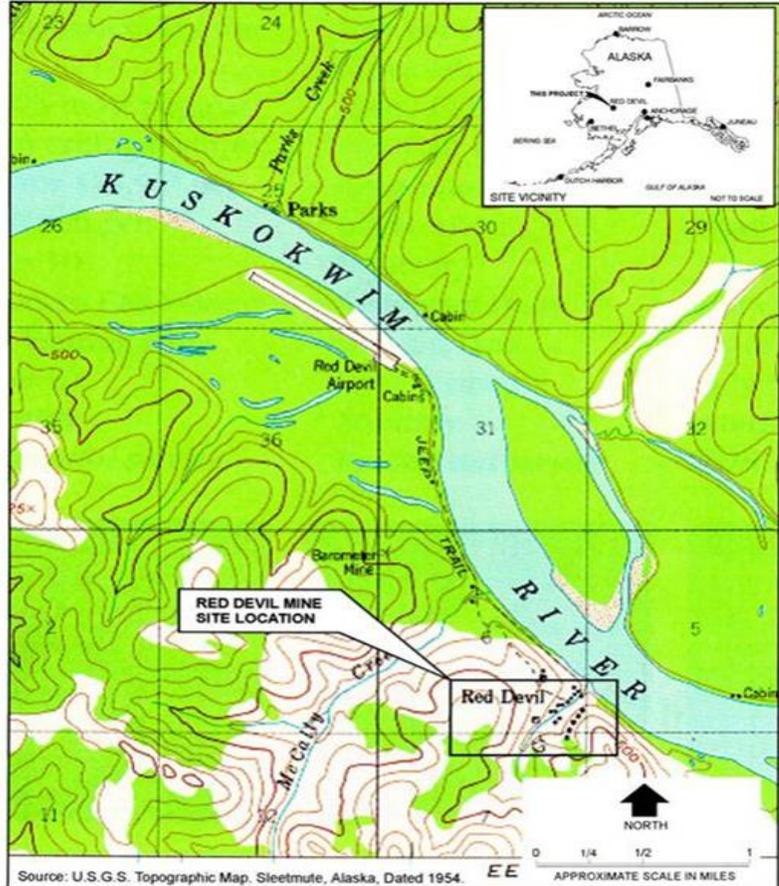
The Red Devil Mine is a historic abandoned mercury mine located on the banks of the Kuskokwim River, 250 miles west of Anchorage and 1.5 miles southeast of Red Devil (pop. 29). The mine is on 10 acres of land managed by the Bureau of Land Management (BLM) and has been selected as a future Native patent by The Kuskokwim Corporation.

Mine features included a housing complex, equipment and chemical storage buildings, a shop pad (laboratory), engine shop, mine portals, power plant, retort building, three settling ponds, and five aboveground petroleum storage tanks.

The Red Devil Mine area has extensive cinnabar deposits which have been mined and retorted (heated) to vaporize and condense the elemental mercury.

Mining at the site began in 1933 and 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, however in 1955, it was rebuilt on the opposite side of Red Devil Creek and operated until 1971.

In 1969, open pit mining began and by 1970, the Red Devil Mine was the largest mercury producer in Alaska and one of the largest in the U.S. The mine shut down in 1971 when the mercury market dropped and has not operated since. The underground mine itself flooded in 1981. During its lifetime, the mine produced approximately 35,000 flasks (76 lbs. per flask) of mercury.



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

State Concerns

BLM conducted a removal in 2001 where they demolished the buildings and buried the debris in three landfills on-site. The State has several concerns which were not addressed in the removal action:

- Tailings and contaminated sediments in the Kuskokwim River and Red Devil Creek exceed Federal screening values for mercury, arsenic and antimony and have not been addressed.

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- Site investigations indicate that mercury, arsenic, and antimony contaminated soil and tailings remain at the site above the DEC cleanup levels. Soil borings next to the former retort building, covered in 2002 by a monofill, revealed free phase (liquid) mercury not addressed in removal actions. Additional borings in that area also show very high levels of mercury, arsenic, and antimony not covered by the monofill. Potential future migration of the free mercury has not been studied or addressed.
- A complete site characterization, to fully describe the nature and extent of contamination, has not occurred at the original (pre-1959) retort facility.
- Tailings with elevated levels of antimony, arsenic, and mercury were used throughout the site as fill. Tailings were placed in the monofill from unidentified areas around the site without sampling the soil left in place or assessing the remaining risk posed by residual contamination. Additional tailings piles are spread throughout the site, including Red Devil Creek, but their locations have not been documented or characterized.
- The heavily contaminated settling ponds have not been characterized or addressed but continue to leach contamination to the groundwater.
- There are potential ecological impacts to aquatic and terrestrial receptors from the contamination that have not been evaluated.
- A sufficient human health Risk Assessment has not been conducted.
- Contaminated groundwater continues to flow into Red Devil Creek and on to the Kuskokwim River. Additional monitoring wells are needed to determine the extent of the groundwater contamination.
- Institutional Controls sufficient to ensure the integrity of the monofills and a Five-Year Review schedule have not been agreed upon by the agencies.

Contamination

The U.S. Environmental Protection Agency (EPA) first inspected the site in late 1971 and collected water and sediment samples. Very high mercury concentrations of up to 9,000 micrograms per liter (ug/L) were found in the settling pond.

Between 1979 and 2008, EPA, ADEC, BLM, and the U.S. Geological Survey conducted subsequent sampling investigations at the mine and surrounding areas. The sum of these investigations showed elevated concentrations of metals and petroleum in the soils around the retort building, as high as 73,300 milligrams per kilogram (mg/kg) of mercury, compared to DEC's cleanup standard of 1.4 mg/kg. Tests also noted antimony at 6100 mg/kg (DEC's standard is 3.6), and 7190 mg/kg of arsenic (DEC's standard is 3.9). This correlated to approximately 250 cubic yards of RCRA-regulated (arsenic or mercury) hazardous waste. Tests also showed evidence of fuel spills, with diesel-range organics at 13,600 mg/kg, above the approved alternative cleanup level of 1,190 mg/kg.

Mine tailings with elevated levels of antimony, arsenic, and mercury were used throughout the site as fill. These tailings act as a continuing source for groundwater contamination. Groundwater monitoring wells were installed in both sides of Red Devil Creek: the highest measured concentration from groundwater monitoring wells was 515 ug/L arsenic (compared to the state standard of 10), 1250 ug/L antimony (state standard is 6), and 49 ug/L mercury (state standard is 2).

Sediment samples from Red Devil Creek contained the highest concentrations of antimony 6680 mg/kg (screening level is 3), arsenic 5150 mg/kg (screening level is 6), and mercury 250 mg/kg (screening level is 0.18). Other contamination included asbestos present in the housing complex buildings, elevated levels of diesel-range organics and benzene in the soils at the Fuel Storage Area, and elevated lead (13,500 mg/kg) in the soils at the Battery Storage Area.

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BLM Building Removal Actions

In July, 1998, BLM submitted a "Draft Limited Waste Removal Work Plan," for limited waste removal at the Red Devil Mine site. That September, DEC requested a revised plan, asking for additional sampling and documentation. BLM conducted waste identification and removal in the summer of 1999. Approximately 100 batteries, mercury contaminated retort slag, mineral processing chemicals, and liquid wastes (petroleum products and solvents) were removed.

In 2002, BLM submitted a plan to DEC to place building debris and other solid waste into two buried landfills on the site. One of the "monofills" would contain all of the hazardous waste from the site. The monofills did not comply with State Solid Waste guidelines for buried landfills and were partially placed on top of the most highly contaminated areas without addressing the contamination first. Due to these and other technical reasons, DEC did not concur with this action, however BLM conducted the work over DEC objections. Work that summer included building demolition, debris removal and on-site disposal of various materials. Two monofills were created which did not comply with State Solid Waste guidelines.

- Monofill #1 (4400 cubic yards [cy]) holds building debris, concrete, wood, scrap metal, crushed drums, 3 vehicles, 23 drained non-PCB transformers, and Category 1 and II asbestos-containing materials.
- Monofill #2 (930 cy) contains the retort bricks and retort slag (hazardous waste treated with arsenic and mercury encapsulant to prevent leaching); retort building debris and general building debris. A 60-mil geomembrane liner was placed on top of the retort building concrete pad and some surrounding contaminated soils. The retort bricks, slag, and debris were placed on top of the liner, covered with tailings and then

another liner. Tailings were placed on top of the liner as a cap. Appropriate quality control sampling of the encapsulation was not conducted, thus it is unknown if it was effective.

- A third monofill was created in 2003 to dispose of the aboveground tanks and ore hopper.

Petroleum Removal Actions

In 2005, BLM began removing petroleum-contaminated soil from the area of the five aboveground storage tanks and the fueling pipeline, in accordance with a DEC-approved workplan. The workplan stated that excavation would occur in 2005 and disposal/treatment in 2006. 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 of the contamination could be excavated in 2005. Additional contaminated soil was excavated in 2006, however due to funding and timing constraints not all of the contamination could be removed and more remains in-situ at Tank 4. Approximately 3000 cubic yards of contaminated soil has been excavated and stored in a lined and covered cell. In 2007 and 2008, BLM stated that they did not have funding to continue the removal, or dispose of or treat, the soil. Some funds have been obligated for 2009. DEC has requested that a treatment plan be submitted by June 1, 2009.

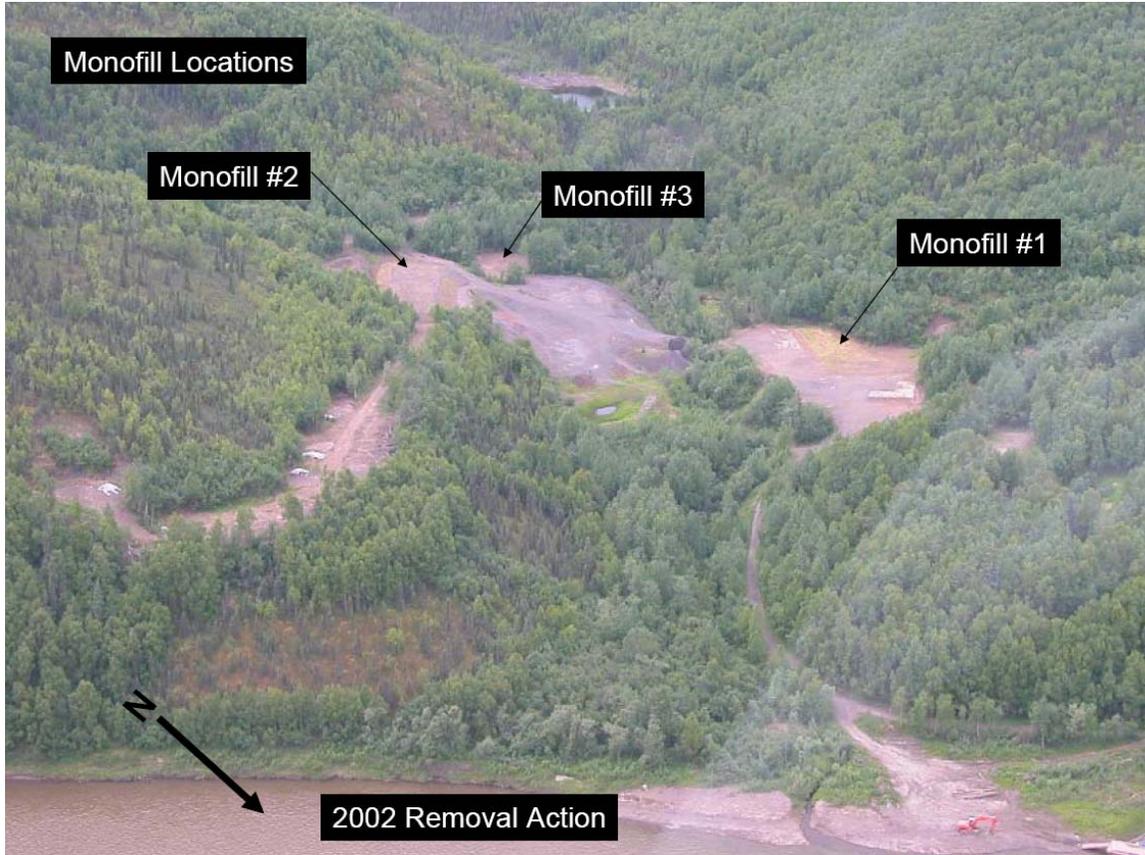
Contacts

For more information about this site, contact:

Anne Marie Palmieri, Project Manager
AnneMarie.Palmieri@alaska.gov
 (907) 766-3184

Jennifer Roberts, Section Manager
Jennifer.Roberts@alaska.gov
 (907) 269-7553

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Settling pond and adjacent tailings, September 2008.