Gilt Edge Superfund Site

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY ● REGION 8 ● FEBRUARY 2008

Remedial Investigation Report Available to the Public

Introduction

The U.S. Environmental Protection Agency (EPA) has finalized the Remedial Investigation Report for the Gilt Edge Mine Superfund Site. The report summarizes the findings of environmental investigations performed at the Gilt Edge Mine site, and serves as a basis for future cleanup decisions. To find out how to view or obtain a copy of the report, go to the Contacts section of this fact sheet.

The Gilt Edge Mine is located in the northern Black Hills of South Dakota, less than eight miles from the historic towns of Deadwood and Lead, South Dakota. Acid Rock Drainage (ARD) from the abandoned mine site has the potential to impact the headwaters of the municipal water supplies and coldwater fisheries for communities in the northern Black Hills. **ARD is highly acidic water containing high concentrations of toxic metals.**

The Remedial Investigation Report documents the history of the Gilt Edge Mine site, summarizes the remedial investigations and studies completed, defines the physical characteristics of the site and the nature and extent of the contamination, describes the fate and transport of the contaminants, and summarizes results from the baseline human health and ecological risk assessments.

Background

In 1986, Brohm Mining Company constructed a large-scale, open-pit, cyanide heap-leach gold mine in a small mining district in the Black Hills where gold, copper, and tungsten had been mined intermittently since 1876.

In 1999, Brohm Mining Company became insolvent, leaving 150 million gallons of acidic, heavy-metal-laden water in three open pits, as well as millions of cubic yards of acid generating waste rock requiring cleanup and long-term treatment. At the request of the Governor of South Dakota, EPA listed the Gilt Edge Mine Site on the National Priorities List (NPL) in 2000. The NPL is a list of the nation's most contaminated places, commonly known as Superfund sites. The remedial investigation is an important step in the Superfund process.

EPA has since conducted interim actions at the Gilt Edge Mine site in order to protect human health and the environment in the short term. In 2003, EPA upgraded the water treatment plant and continued to treat contaminated water. That same year, EPA issued an interim Record of Decision in order to begin remediating a portion of the mine site called the Ruby Gulch waste rock dump.

The Remedial Investigation Report addresses the entire Gilt Edge Mine Superfund site, which is comprised of three operable units (OUs). OU1 addresses ARD sources within the primary mine disturbance area,

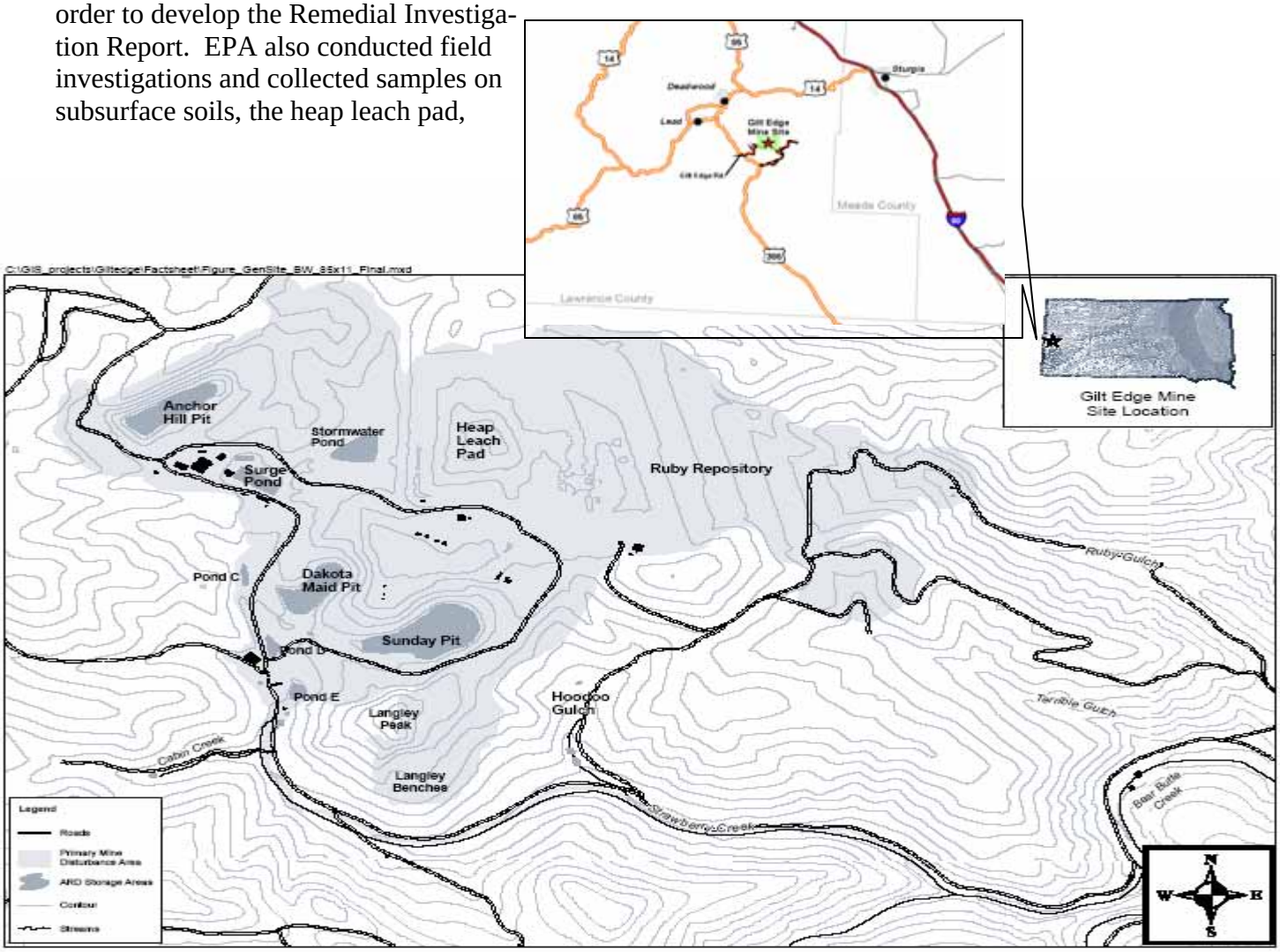
such as acid generating waste rock and fills, spent ore, exposed acid generating bedrock, and sludge. OU2 addresses ARD collection and treatment, groundwater contamination, and contaminant sources, surface water, and sediments in the Lower Strawberry Creek area. OU3 addresses the Ruby Waste Rock Dump, which is one of the largest sources of ARD at the site.

Remedial Investigation Report Details and Findings

Wherever possible, EPA used data from previous field investigations and studies in order to develop the Remedial Investigation Report. EPA also conducted field investigations and collected samples on subsurface soils, the heap leach pad, soil, vegetation, site-wide sludge, surface water, groundwater, and sediment.

Physical Characteristics of the Site

The Remedial Investigation Report describes the physical characteristics of the site, including land use, demographics, climate, geology, groundwater and surface water interaction and water balance. For organizational purposes, Gilt Edge Mine site features are grouped into the following subareas: •Anchor Hill Pit •Dakota Maid Pit •Hoodoo Fill •Langley Benches •Ruby Repository •Lower Strawberry Creek •Sunday Pit •Strawberry Gulch •Stormwater Pond



•Union Hill •Upper South Ruby •Water Treatment Plant, and Groundwater.

The physical characteristics of the site also include a summary of the ARD collection and conveyance infrastructure at the site. EPA maintains this infrastructure in order to control discharge of ARD from the site into area streams. These components are present in numerous remediation subareas, and ARD is routinely pumped to the pit lakes for storage for eventual treatment.

ACID ROCK DRAINAGE

At the Gilt Edge Mine site, a primary environmental problem is Acid Rock Drainage (ARD). ARD occurs when the mineral pyrite is exposed to oxygen. When groundwater or surface water comes into contact with oxidized pyrite, it forms sulfuric acid. This acidic water increases the solubility of toxic metals in soil and rocks, resulting in highly acidic drainage containing high concentrations of toxic metals and metalloids, such as cadmium, copper, zinc, arsenic, and selenium. ARD problems are commonly associated with mining sites because the mining process exposes strongly mineralized rock to water and air.

Nature and Extent of the Contamination

Another primary component of the remedial investigation is to characterize the nature and extent of contamination at the site. There are two main contaminated media at the site: contaminant source materials and contaminated water, including surface water, ARD, and groundwater. The key findings presented in detail in the Remedial Investigation Report are as follows:

Contaminant Sources

There are seven categories of contaminant source materials: waste rock fills, spent ore, exposed rock surfaces, underground mine workings, tailings, soil stockpiles, and sludge. These contaminant sources are widespread within the primary mine disturbance area, and most of the source materials have the potential to generate ARD.

Groundwater

Groundwater is strongly impacted by ARD contamination in the primary mine disturbance area. While groundwater is a significant route for contaminant migration, it has not impacted private wells and has not been identified outside of the site boundary.

Acid Rock Drainage (ARD)

The remedial investigation focused on ARD within the water collection, conveyance, and treatment system and includes all mine pits, waste rock fill areas, amended tailings facilities, processing facilities, and underground workings. The vast majority of ARD is captured and treated, and the effluent is discharged to Strawberry Creek. However, a portion of ARD generated on site has a high sulfate content and cannot be treated efficiently in the current water treatment plant, so EPA is evaluating plant upgrades. In addition, collection systems on site operate well, but are not capable of intercepting all of the ARD, and traces of ARD-related contamination are present in surface water outside of the collection system.

Surface Water

Strawberry Creek

Numerous remedial actions have been completed by EPA and the South Dakota Department of Environment and Natural Resources (SD DENR) to improve the surface water quality at Strawberry Creek. However, lower Strawberry Creek continues to be impacted by ARD generated within the primary mine disturbance area and relic mine tailings. Stream sediments in lower

Strawberry Creek are contaminated, and ARD affected groundwater may be discharging to surface water there due to extensive groundwater-surface water interactions.

Bear Butte Creek
Bear Butte Creek is located downstream from the three site drainages, Strawberry Creek, Terrible Gulch, and Ruby Gulch. Surface water quality in Bear Butte Creek downstream of its confluence with Strawberry Creek is being monitored for adverse impacts from the mine site.

Fate and Transport of the Contaminants

The Remedial Investigation Report also discusses the factors involved in the fate and transport of contaminants, meaning the physical, chemical, and biological processes that impact the movement of contaminants and how these contaminants might be altered while being transported. The Remedial Investigation Report looks at factors such as site conditions, potential routes of migration, contaminant release mechanisms, and fate and persistence of contaminants in the environment. Some of the key findings in this section of the Remedial Investigation Report include:

- Exposed Rocks at the site generate ARD from snow melt and rainfall;
- Contaminants are mobilized in groundwater at at the site primarily because that groundwater is impacted by ARD;
- The groundwater and groundwater-surface water interactions are the most significant migration routes for contaminants at the site;
- In the event that existing ARD collection systems failed, contaminant migration in surface water would be significant;
- Cyanide concentrations at the site have been reduced to trace levels, but spent ore remains a potential source of nitrates into the environment;
- Water treatment plant sludge could contaminate surface and groundwater under certain conditions.

Risk Assessments

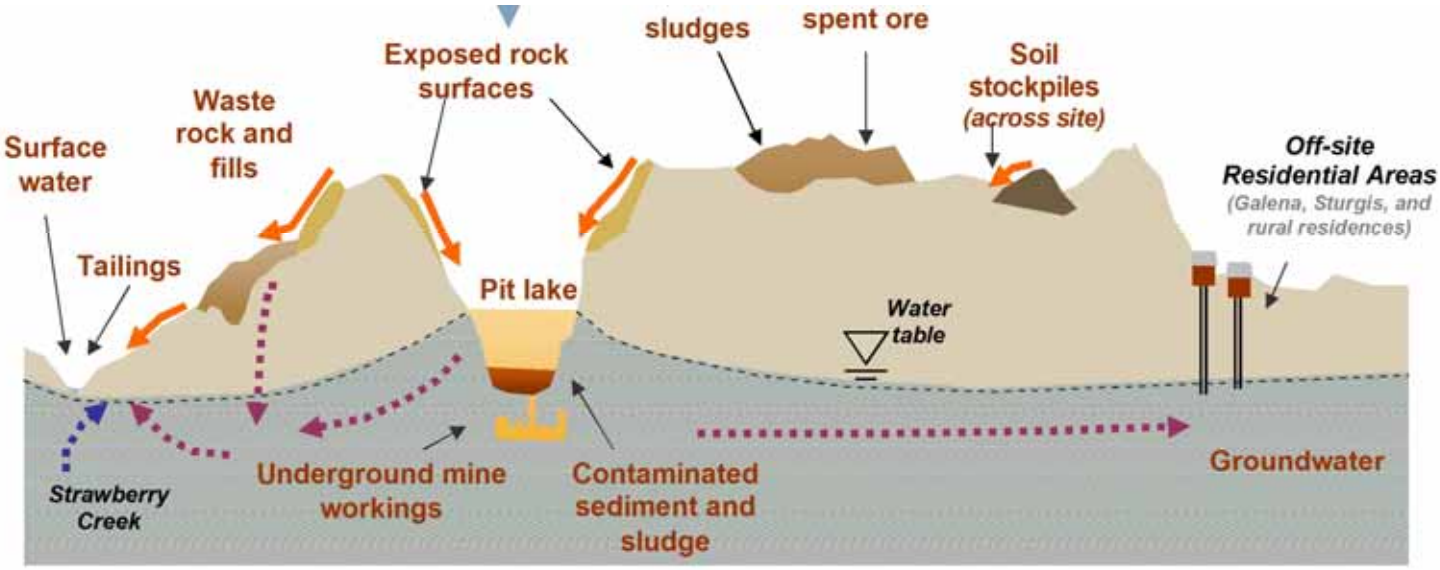
The Remedial Investigation Report also describes the results from the Baseline Human Health Risk Assessment and the Ecological Risk Assessment which EPA finalized in 2006 and 2003, respectively.

The Baseline Human Health Risk Assessment uses contaminants of potential concern (COPCs) to conduct an exposure assessment for soil, surface water, groundwater, sediment, and fish tissue. The COPCs include arsenic, manganese, thallium, aluminum, cadmium, copper, iron, manganese, lead, antimony, chromium, and zinc. The assessment considers ATV riders, hikers, commercial workers, construction workers and off-site children, fishermen, and residents as "potential human receptors", or groups of people most likely to be exposed to contaminants on site.

The assessment then determines potential remediation goals for surface water, sediment, and groundwater, and remedial action levels for soils. These goals and action levels are determined for each COPC at the site based on its potential to cause averse health effects to potential site users.

The Ecological Risk Assessment calculates risks to such things as fish, plants, and wildlife. The Remedial Investigation Report discusses the assessment in detail. The conclusions drawn include that conditions at Strawberry Creek have improved dramatically but sediment there continues to pose a risk to organisms living there. Risks are high for fish and organisms living in Strawberry Creek, Hoodoo Gulch, and Ruby Gulch. Risks from surface soil contamination are of concern to terrestplants and wildlife in the riparian area of Strawberry and Bear Butte creeks and in the mine source srea. Risks from surface water and soil are high in the riparian

SITE CONCEPTUAL MODEL



Potential Exposure Pathways and Receptors

Sed SW

Off-Site Recreational Fisherman

- Ingestion of and/or dermal contact with sediments and surface water
- Ingestion of fish

GW Sed

Off-Site Resident

- Groundwater ingestion
- Ingestion of and/or dermal contact with sediments and surface water

GW Soil Food

On-Site Resident

- Groundwater ingestion
- Ingestion of and/or dermal contact with surface soil
- Ingestion of terrestrial food items

Soil

On-Site Const. Worker

- Inhalation/ingestion of and/or dermal contact with surface and subsurface soil

GW

On-Site Commercial Worker

- Inhalation/ingestion of and/or dermal contact with surface soil
- Groundwater ingestion

Soil

On-Site ATV Rider

- Inhalation/ingestion of and/or dermal contact with surface soil

Soil Sed SW

On-Site Hiker

- Inhalation/ingestion of and/or dermal contact w/ surface soil
- Ingestion of and/or dermal contact w/ sediment and surface water

Soil Sed

Wildlife (Aquatic/ Terrestrial)

- Ingestion of vegetation, soil, and surface water
- Dermal contact with surface water, sediment, and soil

area along Strawberry Creek, Ruby Gulch and downstream Bear Butte Creek.

Site Conceptual Model

The Remedial Investigation Report also presents the site conceptual model for the Gilt Edge Mine Site. *(see Site Conceptual Model on page 5)* The site conceptual model illustrates the current understanding of the contaminant sources, migration routes, exposure pathways, and potential receptors at the Gilt Edge Mine site. The model draws on information gathered in the remedial investigation, particularly from the fate and transport and risk assessment information. A short summary of the information that the site conceptual model draws upon is as follows:

Source Materials
The primary environmental source of contamination at the site is the sulfide-containing rock materials that generate ARD, which contaminate both surface water and groundwater. These materials also contain elevated levels of metals that could pose risks to humans, plants and animals. ARD is generated by numerous source materials, including waste rock fill materials, HLP spent ore, exposed rock surfaces, amended tailings, sludge, and underground mine workings.

Migration Routes
ARD and other contaminants can migrate via surface water, groundwater, and air at the Gilt Edge Mine Site.

Surface Water
Due to earlier EPA response action, major surface water discharges from the site are being controlled or prevented through interim environmental controls that collect ARD and convey it into the site water treatment plant circuit. While current environmental controls make ARD releases to surface water unlikely, there is a high potential for migrating surface water to become contaminated should these controls fail.

Groundwater
ARD has infiltrated groundwater in the alluvial and bedrock aquifers. ARD is moving from the pit lakes into groundwater and underground mine workings influence contaminant migration into groundwater and lead to surface water discharges in some locations.

Air
Air is a possible, but unlikely, migration route for contaminants at the site because the size of most source materials are too large to become airborne.

Exposure Pathways
Exposure pathways are ways in which someone or something can become exposed to contaminants at the site. At the Gilt Edge Mine site, the primary exposure pathways are direct contact with contaminated surface water, sediments, or soil.

Potential Receptors
Potential receptors are people, wildlife, or other things that might be exposed to contaminants at the site. EPA considers fishermen, offsite residents, construction workers, commercial workers, benthic aquatic organisms, vegetation, soil organisms and terrestrial wildlife as most likely to be exposed to contaminants at the site. Fish are particularly susceptible to being exposed to contaminants at the site.

EPA considered all possible future uses of the site, including low-density residential use and recreational uses such as snowmobiling, cross-country skiing, ATV use, hiking, hunting, and fishing within the Strawberry Creek drainage. EPA also considered future user groups, including onsite residents, commercial workers, construction workers, and recreational workers.

It should be noted that the future use of the Gilt Edge Mine Site is still undecided. During the next phase of the Superfund cleanup process, the development of the Feasibility Study, EPA will determine which future uses are both plausible and will best meet the goals of the cleanup.

Next Steps

Based on information gathered in the Remedial Investigation Report, EPA is currently conducting a Feasibility Study to identify and evaluate the appropriate remedial alternatives for the Gilt Edge Mine Site. The public will be notified of its completion and provided a reasonable time for review.

EPA will then issue a Proposed Plan for cleanup. The Proposed Plan will analyze the alternatives discussed in the Feasibility Study and will describe the alternative preferred by EPA. The public will be notified of the availability of the Proposed Plan and associated public comment period.

Finally, a Record of Decision will be issued detailing which cleanup alternative presented in the Proposed Plan has been selected. The Record of Decision will include a written response to public comments received.

Contacts

For more information, please feel free to contact the following representatives:

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Or visit our Website at:

http://www.epa.gov/region8/superfund/sd/giltedge/index.html

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