Colorado Department of Public Health and Environment

UPDATE FACT SHEET

CENTRAL CITY/CLEAR CREEK SUPERFUND SITE

September 2008

Earthmoving operations are planned for OU4 of the Central City/Clear Creek Superfund Site this fall, including regrading and capping of waste-rock piles.

INTRODUCTION

The Central City/Clear Creek Superfund site is located in Clear Creek and Gilpin counties, approximately 30 miles west of Denver. A 400-square-mile watershed, the Central City/Clear Creek Superfund Study Area extends from the Continental Divide east to about Golden. The Colorado Department of Public Health and Environment and the U.S. Environmental Protection Agency (EPA) have assessed potential impacts to human health and the environment from mine waste piles and tunnel discharges. With mine waste scattered throughout the watershed, cleanup goals focus on improving water quality.

The environmental issues addressed by these projects include metals contamination in the surface waters of Clear Creek, particularly the North Fork, and the management of mine tailings, waste rock and tunnel drainage to prevent further contamination of the creek.

Contaminants of concern (COCs) for aquatic life include zinc, copper, cadmium and manganese. These metals are found in surface water and primarily affect trout and aquatic insects, and adjacent habitat.

The contaminants of concern for humans are arsenic and lead. Health risks to humans could result from long-term drinking of ground water with high concentrations of these metals, ingestion of tailings and waste rock, and inhalation of airborne dust.

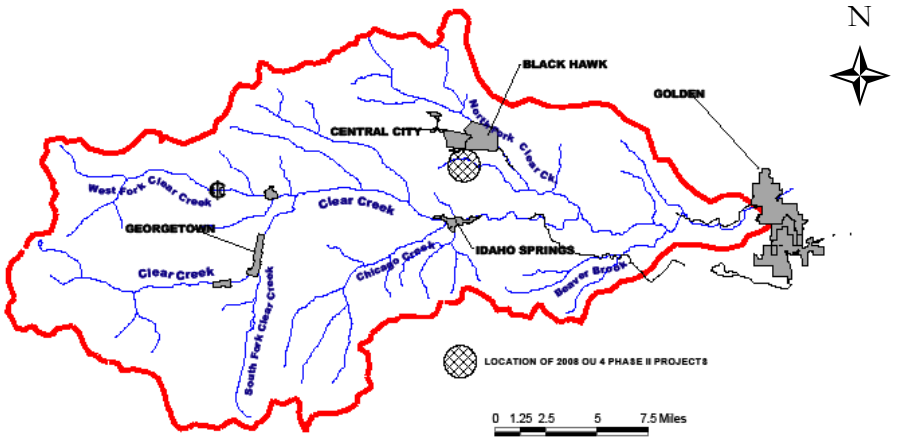
HISTORY

Gold was discovered near Idaho Springs in January 1859, and in the Black Hawk/Central City area the following May. For the next 20 years, the Black Hawk/Central City area was the leading mining center in Colorado with the construction of mills to process the gold and silver found through placer and hard-rock mining. The decline of mining in the area began with the silver crash in the 1890s and the rise of mining in Leadville. However, mining continued to be an important industry in Clear Creek and Gilpin counties from the turn of the century until approximately 1950. Since 1950, mining in the area has been limited, with only a handful of mines operating.

The site was placed on the list of Superfund sites in September 1983. Since that time, the Colorado Department of Public Health and Environment, EPA and the local community have worked to clean up heavy metal contamination resulting from hard rock mining in the area. The Department and EPA have developed clean-up plans to deal with the worst sources of contamination within the Clear Creek watershed.

In 1992, limited stakes gaming began in Central City and Black Hawk. Introduction of gambling has led to some land use changes. While these changes have the potential to increase the direct human exposure to mine wastes, many mine waste clean-up projects were implemented as property developed.

CENTRAL CITY/CLEAR CREEK SUPERFUND STUDY AREA



Work on Phase II of the sediment-control projects for Operable Unit 4 of the Central City/Clear Creek Superfund site got under way in late August and is expected to last through November.

BUSY CONSTRUCTION SEASON PLANNED

Approximately $1.25 million of Phase II sediment-control construction is planned this fall. The Colorado Department of Public Health and Environment, which will oversee the work, received three bids earlier this summer. The project was awarded to local contactor McCollum's Excavating, LLC. Work began on Aug. 27 and is expected to last through November. Here's a summary of the work to be performed:

Nevada Gulch:

Keystone Waste Rock Pile: Crews will grade and consolidate waste rock on site, perform grading near Nevada Gulch, construct run-on control ditches to divert water around the pile, and install a culvert.

American Flag Waste Rock Pile: Crews will construct two rock check dams to slow storm water running through the site. They also will replace an existing culvert and conduct minor regrading.

Near Nevadaville: Workers will reconstruct part of the Nevada Gulch drainage and will repair an existing ditch.

Church Placer Repository: A new access road to the future consolidation area will be built on the property. Three detention ponds and associated inlet and outlet structures will be added, and the Aduddell and Druid waste rock piles will be regraded. The entire Church Placer site will see limited grading to remove erosion cuts and rills. Other work includes placement of a rock cover over parts of the property, construction of run-on control ditches and debris removal.

Pittsburg Mine Tailings Pile & Adjacent Channel:

Russell Gulch Channel: Workers will remove eroded tailings from the channel and place them on stable areas on the Pittsburg and Mattie May mine waste piles. They will reconstruct the channel, installing four rock drop structures to slow water flow and reduce sediment transport. Crews also will revegetate along the channel.

Mine Waste and Tailings Pile: The pile will be regraded, and a rock cover will be placed over the tailings. Workers also will build run-on ditches and an energy-dissipation basin.

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The Pittsburg Mine Tailings Pile will be addressed this fall.

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Baltimore, Alva Adams and Mattie May waste rock piles: The Baltimore, Alva Adams and Mattie May waste rock piles all are located near the Pittsburg Mine Tailings Pile. Crews will re-grade and place rock cover on the piles and will install a run-on control ditch at the Baltimore pile. To protect the piles from erosion, riprap will be placed along the toe of each pile adjacent to Russell Gulch. Tailings and sediment will be consolidated at the Mattie May, and the regraded pile will be capped with a rock cover. Parts of the historic mine road that accesses these sites will be rebuilt where it is affected by erosion and/or construction.

South Willis Gulch: Plans call for the construction of five rock mini-dams to reduce the energy of water flowing in South Willis Gulch, reducing erosion potential as well as the movement of metal-laden sediment.

The future Church Placer repository will be used to consolidate waste rock and tailings that cannot be capped in place.

AGENCIES TO COORDINATE OVERLAPPING PROJECTS

The Colorado Department of Transportation (CDOT), Colorado Department of Public Health and Environment (CDPHE), Environmental Protection Agency (EPA) and the Silver Dollar Metropolitan District (SDMD) have joined with other agencies to mitigate mining impacts under Superfund, restore fish and wildlife habitat, and improve transportation safety along the State Highway (SH) 119 corridor between U.S. 6 and Black Hawk.

The North Clear Creek Mitigation Advisory Committee (NCCMAC) allows the different entities to share information and coordinate concurrent projects to improve efficiency, prevent duplication and save money.

Cleanup of mine drainage from the National Tunnel near Black Hawk is being coordinated with CDOT's Main Street South, a project to widen SH 119 from two to four lanes for the stretch one mile south of Black Hawk.

A CDOT project now under construction is a curve straightening of SH 119, one mile north of US 6. It began this summer and will continue into the fall. To enhance the environment of North Clear Creek Canyon, some of the plants removed as part of this project were transplanted to areas around the Black Hawk/Central City Sanitation District Wastewater Treatment Plant. The rock generated by this project will be used by CDPHE this fall for rock cover at the Church Placer Repository and the Pittsburg Waste Pile.

One of the NCCMAC group's goals is to facilitate improvements to North Clear Creek downstream of Black Hawk so the creek may someday support brown trout.

Participating agencies include the Colorado Division of Wildlife, Federal Highway Administration, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Colorado School of Mines, University of Colorado, City of Black Hawk, Black Hawk/Central City Sanitation District and Gilpin County.

For NCCMAC information, contact Bob Wilson at (303) 757-9431, bob.j.wilson@dot.state.co.us.

PASSIVE SYSTEM TO TREAT NATIONAL TUNNEL WATER

PILOT-SCALE TESTS OF SULFATE-REDUCING BIOREACTORS GUIDE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT AND EPA DECISIONS ON TREATMENT SYSTEM DESIGN

Imagine a treatment system that cleans water without machinery, exotic chemicals or electricity. Engineers plan to install just such a system, featuring a bioreactor and polishing pond straddling State Highway 119 south of Black Hawk.

A bioreactor is like a wetland without plants, explains Linda Figueroa, associate professor of environmental science and engineering at the Colorado School of Mines. She and her colleagues evaluated five bioreactor systems to guide the design of a system to treat water from the National Tunnel, which is both acidic and loaded with dissolved metals toxic to aquatic life.

Anaerobic bacteria, which thrive without oxygen, will live inside the bioreactor. The bacteria "breathe" sulfate and exhale sulfide, and raise the pH of the acidic water. In the process, iron, manganese, zinc and copper in the water change from a dissolved state to a solid state and are trapped in the bioreactor.

The bioreactor will be located on the west side of SH 119, with the system occupying about a half-acre. The exact composition of the substrate — the layered organic material and crushed stone inside the cell — has yet to be determined.

Two designs did not make the cut — one requiring a weekly ethanol fill-up to feed the bacteria and one using pulverized crab shells that removed manganese efficiently, but generated ammonia as a byproduct. Designs using solid substrates included such materials as wood chips, walnut shells, crab shells, hay and corn stover (harvest waste), as well as crushed limestone to maintain a pathway for the water and to further reduce acidity. The test reactors, housed in tanks, were "inoculated" with manure to create a good environment for the bacteria.

After filtering through the bioreactor, water will flow into a "polishing" pond east of the highway. This natural-looking constructed wetland will strip out additional metals before the water enters Clear Creek.

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RESEARCH CREDITS

The Operable Unit 4 Record of Decision calls for passive treatment for water from the National Tunnel in Black Hawk. Two studies to evaluate bioreactor designs, informally known as "Project 47" and "The Project under the Bridge," involved a variety of investigators and funding sources:

"Project 47"
Duration: 2006-2008

Funding Source: EPA Mine Waste Technology Program

Participating Parties: Colorado School of Mines; EPA Mine Waste Technology Program; MSE Technology Applications

"The Project Under the Bridge"
Duration: 2006-Ongoing

Funding Sources: EPA Mine Waste Technology Program, Engineering Support Technology Center; EPA Region 8

Participating Parties: Colorado School of Mines; Colorado State University; EPA Engineering Technology Support Center; EPA Region 8; Golder Associates; JRW Bioremediation; Penn State University; Colorado Department of Public Health and Environment

The sediment-choked channel of Russell Gulch illustrates the need to manage the flow of contaminated runoff as it travels downstream to the North Fork of Clear Creek.

WATER, SEDIMENT MANAGEMENT KEY TO MINE CLEANUPS

Historic mining operations create a variety of lingering environmental impacts involving contaminated water. Rain and melting snow percolate through soil, filling abandoned mine shafts and seeping through waste rock and mill tailings. Sulfur in the disturbed rock raises the water's acid level. The acidic water then dissolves metals including zinc, copper, cadmium and manganese. When this water enters streams and rivers, it is toxic to fish and other aquatic life.

That's why the Central City/Clear Creek Record of Decision for Operable Unit 4 focuses on water quality in Clear Creek and North Clear Creek.

Waste rock piles in or near waterways, such as the Pittsburg Waste Rock Pile in Russell Gulch, pose particular problems. As they erode, they load the sediment with metals that wash downstream. In response to this problem, engineers have devised a number of ways to redirect and slow the movement of water.

A variety of protective measures can be used separately or in combination to reduce erosion of the mine wastes. Regrading a waste pile eliminates steep slopes, while encouraging water to run off and not pond on top of the mine waste. Engineered runoff ditches also help direct water off of a pile without eroding it. If water can enter a pile from above, crews will dig a "run-on" ditch to channel water around the pile. The mine waste can be capped with rock or a vegetated soil cover. Some piles are stabilized further with rock, or "riprap," around the base, or "toe."

Mud on the face of this dam shows how these structures protect water quality by trapping sediment.

Within Russell and Nevada gulches, which are dry most of the time, crews have constructed riprap dams to slow down water during periods of high flow. Wide at the base, each dams' upstream face is more steeply angled than the downstream face. Water can flow through the spaces between the rocks, but sediment tends to be trapped upstream.

Other structures to be built in Russell Gulch this fall feature riprap in wire cages. These "rock-drop" structures are designed to take energy out of rushing water, reducing the amount of metals-choked sediment that reaches North Clear Creek and Clear Creek.

For information about specific sediment-control projects planned for this fall, please see page 2.

BIOREACTORS

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Researchers studied pilot-scale bioreactors to determine the best combination of materials, the most efficient plumbing and the prospects for long-term operation.

"All of them removed copper and zinc effectively, regardless of design, and they all neutralized the water to above pH 6, even though the influent water got as low as pH 4.3," Figueroa explains, noting that manganese and iron removal varied. "The effluent pH was variable, but it was always about six and sometimes as high as eight."

The pH target was between six and nine. Seven is neutral, while numbers below seven indicate acidity, and numbers above seven indicate alkalinity. Extremely acidic and alkaline substances both can be caustic.

Discussions are under way to extend the tests to gather more data.

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www.cdphe.state.co.us/hm/ClearCreek/index.htm
www.epa.gov/region08/superfund/co/ccclearcreek

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