

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 8

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Ref: 8EPR-ER

ACTION MEMORANDUM

SUBJECT: Request for a Time-Critical Removal Action at the Golf Tunnel located near St. Elmo, Chaffee County, Colorado.

**FROM: Hays Griswold, On-Scene Coordinators
Emergency Response Team**

**THROUGH: Curtis Kimbel, Supervisor
Emergency Response Unit**

**TO: David A. Ostrander, Program Director
Preparedness, Assessment & Emergency Response**

Site ID#: 08WB

Category of Removal: Time-Critical, Fund-Lead

I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the proposed Removal Action described herein for the Golf Tunnel Site (the Golf Tunnel 'GT', the 'Site', or the 'Tunnel'), located near St. Elmo Chaffee County, Colorado. (See Attachments 1 and 2 for locations).

This Memorandum discusses actions to mitigate threats to public health or welfare or the environment caused by Acid Mine Drainage (AMD) flow containing toxic metals into Chalk Creek, past a branch of the Colorado Division of Wildlife (CDW) Fish Hatchery and to the Arkansas River.

Accordingly, conditions at the Site present an imminent and substantial endangerment to human health or the environment and meet the criteria for initiating a Time Critical Removal Action under 40 C.F.R. Section 300.415(b)(2) of the National Contingency Plan (NCP).

The CERCLIS ID number for this proposed Time Critical Removal Action is CON000802843.

It is important to note here that this Action Memorandum is a brief summary of the information

that has been generated for this Site and the USFS Sites by many detailed and comprehensive investigations. For the full breadth of the information the reader is referred to the Final Phase II EE/CA (478 pages) that can be found on file or on disk in pdf format with this document in the Administrative Record at the EPA Regional Office Records Center or the Administrative Records Repository set up in a library near the Site.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

The Golf Tunnel (Also called an adit driven at the mine's 2200 level) is located on the western slopes of Chrysolite Mountain adjacent to Chalk Creek at an elevation of 10,360 feet. It is known as a "Tunnel" because it originated from a "Tunnel Claim," but it functioned as an adit because it accessed underground mine workings. It is the mill-level cross-cut, driven to access the Mary vein below the main workings, allowing direct tramping of ore to the mill. It discharges a constant 60 to 165 gpm year-round, and is the lowest working level of the Mary Murphy Mine. The Golf adit flows into a small pond that discharges into a small unlined channel prior to entering Chalk Creek (See Attachment 2)

1. Removal Site Evaluation

The watershed first came under scrutiny in 1986 after a fish kill at the CDW Chalk Cliffs Fish Rearing Unit. The kill was attributed to elevated concentrations of metals in Chalk Creek during spring runoff. Water quality sampling at that time found zinc and cadmium at levels exceeding state water quality standards. The effects were reduction of the number of brown trout and elimination of young fish for a 12-mile stretch below the mining district. Metal concentrations in Chalk Creek peaked in the vicinity of the Mary Murphy Mine and the Iron Chest tailing piles. At that time it was suspected that interaction between mine drainage, creek flows, and the tailings piles contributed most of the metals in the stream. A loading analysis developed from flow and metals concentration data showed that 85 percent of the metals load exiting the Main Adit was attributed to one inflow from the north drift on the Mary Vein. The inflow constituted only 1.5 percent of the total discharge from the adit, but at high flow it had a total zinc concentration of 190,200 micrograms per liter (mg/L). The contaminated inflow was traced back to an ore chute on a high-sulfide stope (mined-out portion of vein) on the north vein, which drained 15 gpm. This same high-concentration source also accounts for 70 percent of the zinc load discharging from the Golf adit.

2. Physical Location

The Golf Tunnel (or adit) is one of many mining facilities within the Chalk Creek Mining District. The District is in the upper reaches of Chalk Creek near the

small historical mining town of St. Elmo, Colorado. The Golf Tunnel is located at Latitude 38° 40' 49.44 N and Longitude 106° 21' 31.97" W.

3. Site Characteristics

The Chalk Creek Mining District is about 15 miles west of Nathrop and includes the Alpine, St. Elmo, and Romley sub-districts. The district was a significant producer of gold, silver, copper, lead, and zinc, especially in the 1930's. Most of the production came from the Mary Murphy Mine. Veins in granitoid rocks of the Mt. Princeton Tertiary-age batholith host the ore. This district and region contain the most mines with significant and potentially significant environmental problems, in part because water drains from many of the underground workings. Several mines in this district have been reclaimed as part of a program administered by the Colorado Division of Minerals and Geology. In many cases, physical hazards were addressed, with less emphasis on environmental concerns. However, some of the worst environmental problems were mitigated, and mine and natural waters in this mining district are tested regularly in a monitoring program. Historically, mining was the only land-use in the area. Today the district is a scenic tour route, with very few year-round residents, but with many summer residences scattered about the area.

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

The Golf Tunnel discharges AMD water at 53 gpm containing significantly elevated concentrations of several heavy metals. It is demonstrated that the zinc and other metals have increased and are above acute and chronic concentrations of WQS (Water Quality Standards). For example, zinc was detected at 87 ug/L in Chalk Creek upstream of the Golf Tunnel adit discharge, and at 510 ug/L downstream of the Golf Tunnel discharge. Although survey data indicate the trout population is present and appears to be reproducing, it is noted that the population is less robust in the reaches associated with the adit discharge. The degree of chronic effects to the population cannot be evaluated without a significant level of effort that would have to occur over an extended period of study. The adit flow and measured concentrations of metals indicate that the Golf Tunnel and the associated Mary Murphy 1400 level discharge are significant contributors of mine-related heavy metals into Chalk Creek.

There are relatively elevated toxic metal concentrations detected in surface water in the recent analytical results collected from Chalk Creek. Zinc concentrations in surface water are significantly above state water quality standards in Chalk Creek, and zinc concentrations appear to be increasing at one of the primary sources in the watershed. For example, the 1990 zinc concentrations in surface water collected during low flow from the Golf Tunnel, (discharging into Chalk Creek) ranged from approximately 10,000 ug/L to 19,700 ug/L. The 2007 zinc

concentrations measured at this same location, also during low flow, are now at 28,100 ug/L.

Mining-related releases from the Golf Tunnel create conditions that are toxic to fish in Chalk Creek, as clearly evident by the occasional fish kills in the CDW fish rearing unit. Zinc and cadmium concentrations in the adit discharge results in acute toxicity to aquatic species at the levels reported. The detected concentrations of zinc discharging from the adit, 28,100 ug/L, results in a zinc concentration of 510 ug/L in Chalk Creek downstream of the adit discharge. These concentrations are significantly above the acute and chronic water quality standards for zinc (79 and 69, respectively, based on the site-specific hardness of 50 mg/L). As mentioned above, there is an indication of increasing zinc concentrations from the adit source based on comparison of the 1990 to 2007 data – significantly increasing the threat to the environment. The zinc concentrations have remained constantly above acute and chronic water quality standards in Chalk Creek downstream of the source.

These heavy metals coming from the Mine and out of the Golf Tunnel are “hazardous substances” as defined by Section 101(14) of the Comprehensive Environmental, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. Section 9601(14). Accordingly, release of these hazardous substances into the environment from this Site poses an imminent and substantial threat to public health or the environment.

5. NPL Status

The Golf Tunnel, the Mary Murphy Mine, and the other mining facilities in the Chalk Creek Mining District are not on the National Priority List (NPL).

B. Other Actions to Date

1. Previous Actions

There have been no CERCLA Removal Actions conducted at the Golf Tunnel.

2. Current Actions

There are no other Removal Actions being taken or proposed at the Golf Tunnel.

C. Federal, State, and Local Authorities' Roles

1. Federal, State and Local Actions to Date

The State, USFS, Locals, and EPA have been conducting numerous investigations of the environmental problems in the area, as evident by the documents that can

be found in the Administrative Record for this memorandum. Some mitigating activities have also been conducted with the limited funding available. However, the action proposed in this document is beyond the resources currently available to the State or Local entities.

2. Potential for Continued State/Local Response

The State has funds from USFS and EPA to conduct investigations of the Tunnel, rehabilitate some of the Tunnel and design a bulkhead to block flow from the Tunnel. But, neither the State nor the local authorities have the resources to conduct the proposed Removal at this Site. The State is expected to remain involved in the Removal planning, will have an active role in the Removal Action, and is supportive of this proposed Removal.

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

The conditions at the Site present an imminent and substantial threat to public health or welfare or the environment, and meet the criteria for initiating a Removal Action under 40 CFR Section 300.415(b)(2) of the NCP. The following factors from Section 300.415(b)(2) of the NCP form the basis for EPA's determination of the threat present and the appropriate action to be taken:

Heavy metals are being released from the Site via mechanical transport of solid contaminants (via adit drainage and pile sheet-flow and/or leachate) into Chalk Creek and, subsequently, the Arkansas River. Release also occurs when sulfide-produced, acidified waters drain from the Tunnel into Chalk Creek and, subsequently, the Arkansas River.

Aquatic life in Chalk Creek is significantly impacted. Aquatic life in the Arkansas River segment below the Chalk Creek confluence is being exposed to elevated concentrations of heavy metals being transported from the Site, via Creek waters, into the River. Also, consumption of fish taken from the Arkansas River segment below the Chalk Creek confluence is a potential direct human exposure pathway to toxic concentrations of Creek/River-born, heavy metal contaminants.

- (i). Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.

Humans and the surrounding surface and aquatic environment can be adversely affected by heavy metals released from the Site upon direct contact with Site waste rock fractions, discharge waters, and/or Creek/River waters below the site. In addition, human consumption of fish taken from River segment(s) below the Creek/River confluence could result in adverse human exposure to Site-released contaminants.

- (ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

The ongoing release of elevated concentrations of heavy metals and/or acidic liquids from the Site will have a deleterious affect on downstream aquatic life. In addition, seasonal flooding (snow-melt runoff) can add significant volumes of sulfide-laden waste rock to the Creek and/or River channel.

- (iv). High levels of hazardous substances or pollutants or contaminants, largely at or near the surface, that may migrate;

The Site contains high concentrations of heavy metals, including zinc, cadmium, copper and lead, in ground, surface, and mine drainage waters. These heavy metals are "hazardous substances" as defined by Section 101(14) of the Comprehensive Environmental, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. Section 9601(14). Release of these contaminants from the Site has been documented in the aforementioned studies and reports.

- (v). Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;

Seasonal snow-melt and heavy mountain rain showers will continue to exacerbate the release of the toxic metals from the Tunnel and other mine drainage areas unless some mitigating action is taken soon. In addition, as mentioned previously, studies have indicated that the release of these metals is actually on the increase.

- (vi). The availability of other appropriate federal or state response mechanisms to respond to the release; and

No other agency has the resources to respond to this release.

- (vii). Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

Contamination from this Site can potentially enter the food chain via aquatic life and by human consumption of fish taken from the Arkansas River below the Chalk Creek confluence.

A. Threats to the Public Health or Welfare

The threats to public health via direct contact or via the food chain have been described previously. The following are descriptions of the threats posed to the human population by the specific contaminants found in the tunnel drainage.

Lead

There is a potential for humans to be exposed to the lead coming from the mine drainage by consuming fish caught in the lower reaches of Chalk Creek or from the Arkansas

River. Lead is classified as a B2 carcinogen by EPA, and lead compounds are known to cause acute health effects. (The classification as a carcinogen is the result of animal studies determining that these compounds are probable human carcinogens). Lead can enter the body via ingestion and inhalation. Children appear to be the segment of the population at greatest risk from toxic effects of lead. Initially, lead travels in the blood to the soft tissues (heart, liver, kidney, brain, etc.). Then it gradually redistributes to the bones and teeth where it tends to remain. Children exposed to high levels of lead have exhibited nerve damage, permanent mental retardation, colic, anemia, brain damage, and death.

Cadmium

The same can be said for the cadmium coming from the Tunnel drainage. Cadmium has been shown to be a carcinogen in both animal studies (Takenaka, et al., 1983) and occupationally exposed groups of humans (Thun et al., 1985) via the inhalation route of exposure. The Carcinogenic Assessment Group (CAG) has classified cadmium as a Group B1--Probable Human Carcinogen for inhalation only, based on limited evidence of carcinogenicity in humans from occupational studies (EPA 1985b). Exposure to toxic amounts of cadmium by either inhalation or ingestion will cause cadmium to accumulate in the renal system and eventually cause kidney failure (EPA 1985a).

Copper

Copper in the Tunnel drainage is more deleterious to aquatic life as discussed below. In this case, health effects to humans from copper are unlikely. Copper is an essential element necessary for maintaining good health in humans, but high doses can be harmful. Oral ingestion of high amounts of copper may cause vomiting, diarrhea, stomach cramps and nausea. Chronic ingestion of high amounts of copper can cause liver and kidney damage.

B. Threats to the Environment

The threats to the environment, specifically to the aquatic life in Chalk Creek and the Arkansas River and the sensitive systems in the impacted part of the watershed, have generally been described previously and are thoroughly documented in the in the Administrative Record and the EE/CA document (also in the record) mentioned previously. The following are descriptions of the threats to the environment posed by the specific contaminants found in the Tunnel drainage.

Zinc

Zinc concentrations in the Tunnel drainage range from 4591 ug/L to 65,150 ug/L. Zinc produces acute toxicity in freshwater organisms over a range of concentrations from 90 to 58,100 ug/L, and appears to be less toxic in harder water. Acute toxicity is similar for freshwater fish and invertebrates. In many types of aquatic plants and animals, growth,

survival and reproduction can all be adversely affected by elevated zinc levels. A final acute-chronic ratio for freshwater species of 3.0 has been reported. Some researchers have speculated that exposure to excessive amounts of zinc may constitute a hazard to animals. Laboratory studies and findings in animals living near lead-zinc smelters suggest that excessive exposure to zinc may produce bone changes, joint afflictions, and lameness.

Cadmium

Cadmium is found in the Tunnel drainage to range from 21 ug/L to 322 ug/L. Laboratory experiments suggest that cadmium may have adverse effects on reproduction in fish at levels present in lightly to moderately polluted waters. Cadmium is highly toxic to wildlife; it is cancer-causing and teratogenic and potentially mutation-causing, with severe sublethal and lethal effects at low environmental concentrations. It bio-accumulates at all trophic levels, accumulating in the livers and kidneys of fish. Crustaceans appear to be more sensitive to cadmium than fish and mollusks. Cadmium can be toxic to plants at lower soil concentrations than other heavy metals and is more readily taken up than other metals.

Copper

Copper ranges as high as 326 ug/L. Copper produces acute toxicity in freshwater animals and data is available for species in 41 Genera. At a hardness of 50 mg/l, the genera range in sensitivity from 16.74 ug/l for Ptychocheilus to 10,240 ug/l for Acroneuria. Data for eight species indicates that acute toxicity also decreases with increases in alkalinity and total organic carbon. Chronic values are available for 15 freshwater species and range from 3.873 ug/l for brook trout to 60.36 ug/l for northern pike. Fish and invertebrate species seem to be about equally sensitive to the chronic toxicity of copper. Copper is highly toxic in aquatic environments and has effects in fish, invertebrates and amphibians. Copper will bio-concentrate in many different organs in fish (potential low, however) and mollusks. Copper sulfates and other copper compounds are algacides, with sensitive algae potentially affected by free copper at low ppb concentrations. Toxicity tests have been conducted on copper with a wide range of freshwater plants, and their sensitivities are similar to those of animals.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action described in this Action Memorandum, present an imminent and substantial threat to public health, or welfare, or the environment.

V. EXEMPTION FROM STATUTORY LIMITS

No exemption from statutory limits will be required if the Removal Action construction

can be started in the early part of the short construction season.

VI. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed Action Description

The proposed Removal Action involves installing as many as two engineered reinforced concrete bulkheads (massive plugs) in the Tunnel to stop the flow of the contaminated water from coming out of the Tunnel. The bulkheads will be placed at locations in the Tunnel that have been investigated and determined to be sound enough to withstand the hydrostatic pressures anticipated. The bulkheads are expected to back up the mine drainage and eventually reach a static equilibrium at a point where the retained water would find its way out via the pre-mining natural groundwater seeps. By retaining water in the mine workings the inundated portions of the workings would be denied oxygen to produce acid and leach metals – reducing some of the contamination source areas. It is anticipated that the contamination in the water from the mine, while moving through the fractured bedrock along the pre-mining groundwater courses, would be attenuated to some extent by the non-mineralized and somewhat neutralizing country rock. The bulkhead or bulkheads would be constructed with piping through them fitted with relief valves should any problem arise that would require the system be drained, the hydrostatic head reduced, or the water to be routed for or hooked up to treatment.

2. Contribution to Remedial Performance

This Site is not an NPL site, but the Removal Action would be consistent with and contribute to any remedial performance.

3. Description of Alternative Technologies

Aside from the chosen alternative (bulkhead(s)) the only other viable alternative would be water treatment in perpetuity; no agency has the resources for that alternative at this time.

4. EE/CA

This action will be a Time Critical Removal Action. Because it has been determined that the threats involved warrant a Time Critical Removal Action, no EE/CA is required.

5. Applicable or Relevant and Appropriate Requirements (ARARs)

This Removal Action will attain to the extent practicable, considering the exigencies of the situation, applicable or relevant and appropriate requirements of federal environmental or more stringent state environmental laws.

Should any drainage/channel work be necessary in conjunction with this Removal Action, EPA will conduct such work under the auspices of the nationwide USACE issued Clean Water Act 404 Permit.

RCRA Section 3001(b)(3)(A)(ii), the **Bevill exclusion**, excludes "solid waste from the extraction, beneficiation, and processing of ores and minerals" from regulation as hazardous waste under Subtitle C of RCRA. The planned actions involve only in-place management of the waste and are not subject to RCRA waste storage standards.

A list of potential ARARs is provided below:

FEDERAL

- a. National Historic Preservation Act (16 U.S.C. Section 470; 40 C.F.R. Section 6.301(b); and 36 C.F.R. Part 800).
- b. Endangered Species Act of 1973 (16 U.S.C. Section 1531; 40 C.F.R. Subpart C, Section 6.302(h); and 50 C.F.R. Part 402).
- c. Clean Water Act (33 U.S.C. Sections 1341 and 1344).
- d. Clean Water Act (40 C.F.R. Part 230).
- e. Executive Order 11988 (Floodplain Management, 1977), 40 C.F.R. Subpart C, Section.6.302(b).
- f. Executive Order 11990 (Wetlands Protection), 40 C.F.R. Subpart C, Section 6.302(a).
- g. Fish and Wildlife Coordination Act (16 U.S.C. Section 662), (40 C.F.R. Subpart C, 6.302 (e).
- h. Occupational Safety and Health Act of 1970 (29 U.S.C. Section 651). The Health & Safety Standards for Employees Engaged in Hazardous Waste Operations,(50 Federal Register 45654).
- i. Resource Conservation and Recovery Act (RCRA), Subtitle C (capping and placement requirements are relevant and appropriate), and Subtitle D (solid waste disposal requirements are applicable).
- j. DOT Hazardous Material Transportation Regulations (49 C.F.R. Parts 107, and 171-177).
- k. Toxic Substances Control Act (40 C.F.R. Parts 129, 750, and 761).

STATE

- a. Colorado Water Quality Control Act (C.R.S. 25-8-101 - 703)

6. Project Schedule

The Removal Action is planned for a late June, 2011 start and a November, 2011 completion.

B. Estimated Costs

EXTRAMURAL COSTS:

Total ERRS (Construction)	\$ 650,000
START 3 Costs (Design and Removal Support)	\$ 15,000
20% Contingency (Construction)	<u>\$ 130,000</u>
TOTAL EXTRAMURAL COSTS	\$ 795,000
REMOVAL PROJECT CEILING	\$ 795,000

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

Heavy metal contaminated water will continue to drain from the Golf Tunnel and continue to impact the aquatic life in Chalk Creek. Heavy runoff flows out of the Tunnel will continue to threaten the aquatic life in the creek and the fish in the CDW Chalk Creek Fishery. Chalk Creek as a fishery would very likely show an increase in aquatic life and fish population if this action is conducted.

VIII. ENFORCEMENT

The enforcement status of the Site is described in the attached Enforcement Addendum.

The total EPA costs for this removal action, based on full-cost accounting practices, that will be eligible for cost recovery are estimated at:

REMOVAL PROJECT CEILING	\$ 795,000
EPA's Direct Intramural Costs	<u>\$ 135,000</u>
Subtotal	\$ 930,000
Regional Indirect Costs, 35%*	<u>\$ 325,500</u>
Estimated EPA Costs for the Removal Action	\$1,255,000

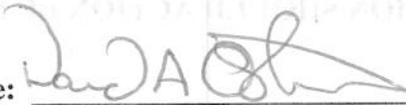
*The total EPA costs for this Removal Action, based on full-cost accounting practices, that will be eligible for cost recovery are estimated to be \$760,000 (direct costs include direct extramural costs and direct intramural costs). Indirect costs are calculated based on an estimated indirect cost rate expressed as a percentage of site-specific direct costs, consistent with the full cost accounting methodology effective October 2, 2000. These estimates do not include pre-judgment interest, do not take into account other

enforcement costs, including Department of Justice costs, and may be adjusted during the course of a Removal Action. The estimates are for illustrative purposes only and their use is not intended to create any rights for responsible parties. Neither the lack of a total cost estimate nor deviation of actual total costs from this estimate will affect the United States' right to cost recovery.

IX. RECOMMENDATION

This decision document represents the selected Removal Action for the Golf Tunnel Site near St. Elmo in Chaffee County, Colorado, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the Site. Conditions at the Site meet the NCP Section 300.415(b)(2) criteria for a removal. I recommend your approval of this proposed Time Critical Removal Action. The total project budget is estimated to be \$1,255,000 of this amount, an estimated \$795,000 comes from the Regional removal allowance.

Approve: _____


David A. Ostrander
Director
Preparedness, Assessment, and
Emergency Response

Date: 6/20/11

Disapprove: _____

David A. Ostrander
Director
Preparedness, Assessment, and
Emergency Response

Date: _____

Enforcement Addendum

SUPPLEMENTAL DOCUMENTS

Support/reference documents which may be helpful to the reader and/or have been cited in the report may be found in the Administrative Record File at the Superfund Records Center for EPA Region 8, 1595 Wynkoop Street, Denver, Colorado 80202.

- Attachment 1: Location Site Map
- Attachment 2: Detail Site Map
- Attachment 3: Analytical Results of Golf Tunnel Drainage Water