304397

EXPLANATION OF SIGNIFICANT DIFFERENCES

RECORD OF DECISION (ROD) – CALIFORNIA GULCH/YAK TUNNEL

DECLARATIONS

Considering the new information that has been developed and the changes that have been made to the selected remedy chosen in the original ROD of March 29, 1988 as modified on March 23, 1989, EPA has determined that the remedy remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for this initial remedial action, except those for which an interim action waiver was invoked in the original ROD, and is cost-effective. In addition, the revised remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site.

ADMINISTRATIVE RECORD

FILE PLAN

5.1.4

043341

Jack McGraw Acting

James J. Scherer

Regional Administrator

10/22/91

Date

FINAL

CLEANUP OF DISCHARGE FROM THE

YAK TUNNEL OPERABLE UNIT

CALIFORNIA GULCH SITE

LEADVILLE, LAKE COUNTY, COLORADO

EXPLANATION OF SIGNIFICANT DIFFERENCES

OCTOBER 1991

OVERVIEW

This is the final Explanation of Significant Differences (ESD) which explains the U.S. Environmental Protection Agency's proposed changes in the clean-up plan for the Yak Tunnel Operable Unit of the California Gulch Superfund site. This document explains the significant differences between the remedy outlined in the 1988 Record of Decision (ROD), which was modified in March of 1989, and the remedy proposed herein.

Public Involvement Opportunities

The Administrative Record, which contains the complete documentation for the site and additional copies of the 1988 ROD, as well as the 1989 and 1991 ESDs, is available for public review at the following location:

Lake County Library
115 Harrison Avenue
Leadville, Colorado 80461
(719) 486-0569

Colorado Mountain College Library
Colorado Mountain College
Timberline Campus
Leadville, Colorado 80461
(719) 486-2015

EPA Superfund Records Room
999 18th Street, 5th Floor
Denver, Colorado 80202-2405
(303) 293-1807

INTRODUCTION

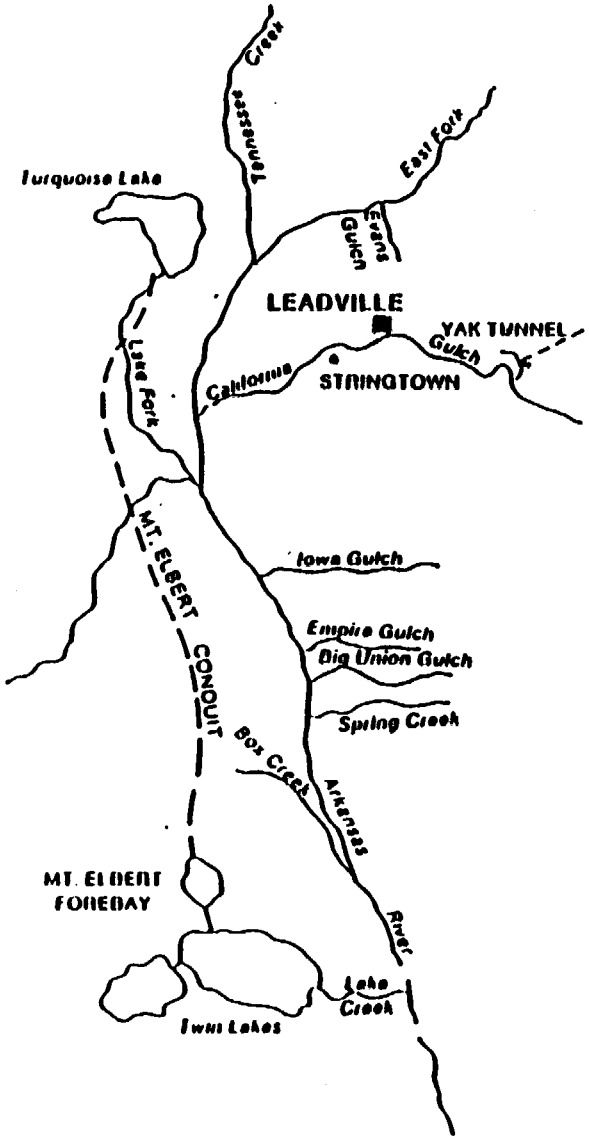
The California Gulch Superfund site is located in Leadville, Lake County, Colorado (see Figure 1). The study area for the site includes the California Gulch watershed and the area drained by the Yak Tunnel. In order to make the site more manageable it has been divided into two operable units. The first Operable Unit addressed by EPA, and the subject of this ESD, is the Yak Tunnel. The remainder of the site is currently under investigation and may result in the definition of additional operable units.

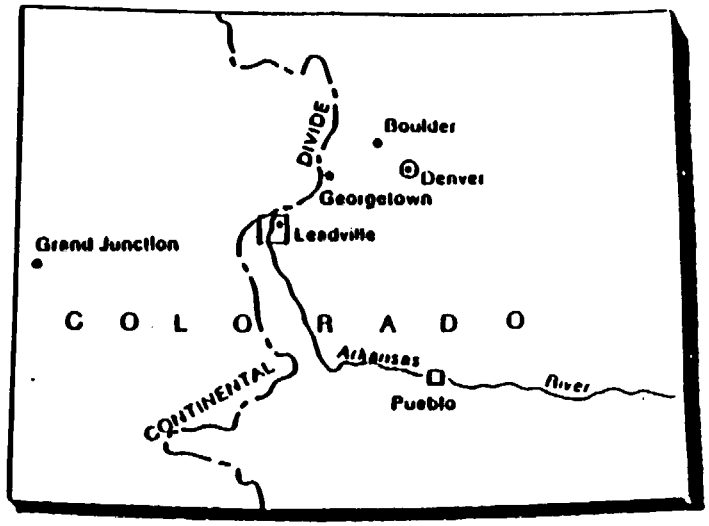
The Yak Tunnel extends approximately 3.5 to 4 miles beneath the mountains southeast of Leadville, Lake County, Colorado, and dewaters numerous mines. The discharge from the Yak Tunnel is contaminated with acid mine drainage containing high concentrations of heavy metals, including cadmium, copper, lead and zinc. These concentrations are affecting aquatic life in the Arkansas River, and pose a potential risk to human health and the environment. Consequently, the site was placed on the Environmental Protection Agency's (EPA) National Priorities List (NPL) for cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (better known as CERCLA or Superfund). Under the Superfund law, EPA is charged with the responsibility of developing and implementing clean-up remedies that protect human health and the environment.

After study and evaluation of the first operable unit, EPA issued a Record of Decision (ROD) in March 1988 describing the remedy chosen to clean up the Yak Tunnel discharge. The remedy selected was subsequently modified because additional information caused EPA to question the initial clean-up plan. These changes were contained in EPA's March 1989 Record of Decision Modification, which described the differences between the remedy proposed in the ROD and the remedy to be implemented at the site.

The ROD Modification provided greater protection of human health and the environment through collection of contaminated water between the portal plug and second plug. Data indicated that contaminated water from the Yak was seeping into the ground water system near the mouth of the tunnel. The interim

Figure 1 Site Location Map





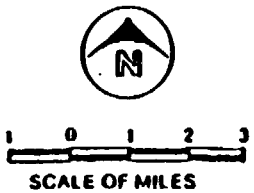


FIGURE 1

LOCATION MAP

treatment system was changed to a permanent treatment system to treat flow collected from the tunnel (between the flow through portal and second plugs).

In August 1988, EPA issued an Administrative Order to several Potentially Responsible Parties (PRPs) requiring these parties to implement an interim remedy, including construction of the Surge Pond and a filtration plant. The PRPs began construction in 1988 and completed most of the construction associated with this interim remedy during the 1989 construction season. The filtration plant was commissioned during December 1989 and is currently treating the discharge from the Yak Tunnel.

In March 1989, EPA issued an Administrative Order (AO) to several PRPs requiring these parties to implement the modified remedy. During preparation of plans to implement the remedy, the PRPs expressed concern with the modified remedy, primarily with the risk of uncontrolled and undetected migration of contaminants in ground water due to tunnel flooding. Thereafter, the PRPs submitted to EPA an alternative proposal for site cleanup, entitled Selected Remedy Component Change Proposal (Res-ASARCO Joint Venture, March 1990). After review of these additional considerations, EPA proposes to make further revisions to the remedy. Following are the basic components to the proposed revision: (1) construction of a surge pond; (2) installation of a water treatment plant; (3) construction of a flow control bulkhead within the tunnel; (4) sealing of inflow into the tunnel; (5) installation of weirs in the tunnel; (6) periodic inspection of the Yak Tunnel; (7) installation of a surface and ground water monitoring network; (8) development of a contingency plan; and (9) operation and maintenance of the remedy. The proposed changes to the remedy will better control ground-water flow and minimize movement of contaminated ground water away from the Yak Tunnel through continued use of the Yak Tunnel as a drain for the mine workings and surrounding area.

Under Section 117 of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA is required to develop and publish a ROD modification or an explanation of Significant Difference when changes to the ROD are proposed. A ROD modification is required when fundamental changes are proposed to the selected remedy. EPA is required to publish an ESD when significant, but not

fundamental, changes are proposed to the previously selected remedy. The proposed changes reflect the rationale presented in the original proposed plan developed prior to the ROD, and therefore, do not constitute a fundamental change to the remedy. In addition, significant public participation in the past has fully supported the proposed changes to the remedy.

The proposed remedy is presented as an ESD because the scope of the remedy is not significantly changed: the remediation goals will remain the same as will the physical area of the response; the treatment methods and the contingency remains the same. The proposed remedy would increase protectiveness of human health and the environment through reducing the potential for migration of contaminated ground water away from the Yak Tunnel. This protectiveness is obtained by allowing free flow through the Yak Tunnel (removal of the plugs except for the flow control bulkhead at the portal), and permanent treatment of the Yak Tunnel flow into perpetuity.

The purpose of this document is to describe the remedial action to be undertaken for this operable unit and explain the significant ways in which this proposal differs from the remedy selected by EPA in 1988 and subsequently modified in 1989. This document also provides a brief history of the site.

This ESD presents only a synopsis of information on the site. For more information on the site or the previous ROD Modification issued in 1989, the reader may wish to refer to the information repositories at the Lake County Library, Colorado Mountain College Library, Timberline Campus, and the EPA offices in Denver.

SUMMARY OF SITE HISTORY AND CONTAMINATION PROBLEMS

Site History

The California Gulch site is located in Lake County, Colorado. The study area includes the California Gulch watershed and the area drained by the Yak Tunnel. The site is within the historic Leadville Mining District where significant quantities of gold, silver, lead, zinc, manganese, and copper have been mined since the 1860s. Hundreds of mines, many mills, more than 40 smelters and several placer operations have been active in the area. As a result, numerous slag piles, tailings ponds and abandoned mine, mill, and smelter sites are found within the study area.

Mining activities in the Leadville area began with placer mining of gold-bearing deposits along California Gulch in 1859. The placer deposits were quickly exhausted and underground mining of lode veins in the upper California Gulch area began. Silver-laden lead carbonate ore was discovered in the area, and silver mining began in 1875. A number of mills and smelters were built to process the mined ores and the town expanded considerably. Underground mining was extensive and mine drainage tunnels were built as a way to dewater these workings. Construction of the Yak Tunnel began in 1889 and it was extended a number of times to the present length of between 3.5 and 4 miles.

Near the turn of the century lead and zinc mining and ore processing also began in the area. Mining of all of these metals has followed a cyclic pattern since, with extensive activity when metals prices were high and very little mining when the metals prices did not justify the mining costs. Current mining activities in the area are limited to the Black Cloud Mine in Iowa Gulch and several other small mining ventures. Total metal production from the Leadville District from 1859 through 1966 totaled about 24 million tons. The principal metals were silver, zinc, lead, gold, and copper.

In 1982 and 1983, EPA conducted a preliminary evaluation of the site, consisting of a site inspection and review of existing data. The site was placed on the NPL in 1983 for cleanup under the Superfund program. The Superfund law requires EPA to identify those who have either contributed to the contamination at the site or who own contaminated property. These persons or companies, called Potentially Responsible Parties (PRPs) may be responsible for conducting clean-up activities and paying clean-up costs. Seven parties were identified as PRPs for the site contamination based on ownership or operation of mining or mineral processing operations in the area. These companies were notified in the spring and summer of 1983 that they were considered potentially responsible for the release of hazardous substances, pollutants, and contaminants at the site. They were all offered opportunity to participate voluntarily in a response action.

The Phase I Remedial Investigation (RI) of the site, including California Gulch and the Yak Tunnel, began in 1984. The Phase I RI report was released in May 1987 (EPA, 1987a). In the spring of 1986, while the RI was in progress, EPA identified and notified six additional parties that they were considered PRPs.

A Feasibility Study (FS) report was released by EPA in June 1987, and in August 1987, a proposed Remedial Action Plan for the Yak Tunnel Operable Unit was released. EPA held a 90-day public comment period and a public meeting to provide an opportunity for the public to review and comment on these plans. A ROD, dated March 1988, was issued detailing the selected remedy for the Yak Tunnel Operable Unit. The ROD specified the components, procedures and goals for cleanup of the Yak Tunnel discharge in this operable unit. Future RODs will specify components, procedures and goals for cleanup of other operable units within the site, possibly including soils, ground water, and surface water.

In August 1988, EPA issued an AO to ASARCO Inc., Res-ASARCO Joint Venture, and Resurrection Mining Company requiring these parties to construct the surge pond portion of the Yak Tunnel remedy. The surge pond construction is essentially complete at the time of the writing of this draft ESD. In March 1989, EPA modified the ROD and issued a second AO to ASARCO Inc., Newmont Mining Corporation, Res-ASARCO Joint

Venture, and Resurrection Mining Company for implementation of the remedy set forth in the ROD Modification. This remedy is under way, and is the subject of this ESD.

Summary of Contamination Problems

EPA studies indicate that the California Gulch site is contaminated with heavy metals, including cadmium, copper, lead, and zinc, coming from both active and abandoned mining and minerals processing facilities.

The Yak Tunnel is the major contributor to site contamination. The tunnel was designed to provide drainage, facilitate exploration, and provide transportation routes for removing ore from mines in the Leadville Mining District. It collects ground water from the mines and then discharges this water into California Gulch. In an average year the tunnel discharges a combined total of approximately 210 tons of cadmium, copper, lead, zinc and other metals into California Gulch. California Gulch, in turn, flows into the Arkansas River. The tunnel contributes 75 to 80 percent of the metal contaminants released into the Arkansas River by California Gulch. Metals from the Yak Tunnel have been shown to move through soils, surface water, ground water, and air at the site.

Cadmium, copper, lead, and zinc are key metals of concern in the Yak Tunnel discharge. The heavy metals can be harmful to aquatic and terrestrial plants and animals, including humans. Aquatic organisms can absorb metals. Plants can take up metals from water and soils through their root systems. Domestic animals and wildlife can drink contaminated water or eat plants (or other animals) that have taken up metals. In turn, humans can be exposed through inhalation of airborne contaminants, or ingestion of contaminated water, sediments, or food.

The metals of concern can be harmful to animals, aquatic life and humans.

- Chronic exposure to cadmium may result in hypertension and kidney and liver damage in humans. In low concentrations, it is toxic to freshwater fish. Terrestrial plants can accumulate cadmium in leafy tissue to concentrations which are dangerous to animals, including humans, without inhibiting the plant growth.

- Copper is not acutely toxic to humans, but is one of the most harmful metals to fish and other aquatic life.

- Long-term human exposures to lead can cause anemia, intestinal cramps, fatigue, and neurological damage. Even at very low levels, lead exposure can cause harmful effects to the nervous systems of children. Studies on laboratory animals have shown that exposure to lead can cause cancer and an increase in reproductive complications. Lead is also toxic to aquatic life.

- Fish, such as rainbow and brook trout, are adversely affected by exposure to zinc. Zinc is rarely damaging to human health or terrestrial animal health; however, when humans are exposed to zinc in combination with other metals, the results may be harmful.

Arsenic, iron, manganese, and other heavy metals are also present in the Yak Tunnel discharge; however, for this operable unit in particular, zinc is the metal of greatest concern at the concentrations of metals known to be in the Yak Tunnel discharge.

Studies of the Arkansas River below the confluence with California Gulch show that metals contamination has reduced the capacity of the river to support well balanced aquatic populations. Both the quantity and variety of fish are reduced in this portion of the river due to contamination from California Gulch.

DESCRIPTION OF THE REMEDIES

Summary of the 1988 Record of Decision

In March 1988, EPA signed a ROD outlining a clean-up plan for the Yak Tunnel portion of the California Gulch site. The remedy was designed to minimize the flow of water out of the Yak Tunnel and to prevent the uncontrolled release of tunnel drainage to the environment. Flow from the tunnel would be minimized through

plugging the tunnel and treating the water which may escape from behind the plugs. The remedy consisted of several elements:

- Construction of surge ponds to capture drainage from the tunnel and to minimize the impact of surges on California Gulch and the Arkansas River.
- Installation of an interim water treatment system to treat water from the Yak Tunnel before discharge in California Gulch. Flooding the tunnel would have raised the water level depleting the available oxygen, thus improving the ground water quality. Treatment would only be necessary until water quality improved.
- Construction of plugs at three locations within the tunnel to stop uncontrolled discharge of tunnel drainage into California Gulch and to prevent surges.
- Sealing of shafts, drill holes and fractured rock and diversion of surface water from tunnel recharge areas to reduce the amount of water entering the Yak Tunnel system.
- Grouting of fractured rock, caved-in areas, and drill holes to prevent seepage of contaminated water to the land surface.
- Establishment of a surface and ground-water monitoring system to detect any leakage, seeps or migration of contaminated ground water which may result from installation of the tunnel plugs.
- Installation of a pumping system to control water levels behind the portal plug, if necessary, to prevent uncontrolled seepage. The pumped water would be routed to the interim treatment system to remove contaminants before discharge into California Gulch.
- Development and implementation, as necessary, of a contingency plan to address any adverse effects on surface or ground water resulting from tunnel plugging.
- Operation and maintenance of the remedy.

Summary of the 1989 ROD Modification

The ROD was modified in 1989 because of new information, specifically seepage entering the ground-water system near the portal plug. Therefore, the portal plug was changed to a flow through plug. Also, the interim water treatment system was changed to a permanent system to treat the water from the flow through portal plug in perpetuity.

The elements of the remedy as modified in 1989 are listed below. The changes from the initially selected remedy are noted by **highlighting**, and are discussed within brackets ([ ]).

- Construction of **a surge pond or ponds** to capture drainage from the tunnel and to minimize the impact of surges on California Gulch and the Arkansas River. **[The multiple surge ponds initially selected were replaced with the possibility of a single surge pond.]**

- Installation of a **permanent** water treatment system to treat water from the Yak Tunnel before discharge in California Gulch. **[The interim treatment facility from the initially selected remedy was replaced with a permanent treatment system.]**

- Construction of plugs at three locations within the tunnel to stop uncontrolled discharge of mine drainage into California Gulch and to prevent surges.

- **Implementation of water control measures to reduce surface water inflow into the tunnel system and to minimize uncontrolled ground-water outflow from the tunnel system following plugging, as necessary, for proper performance of the remedy. [Reduction of seepage and recharge was made optional in the modified remedy, contingent upon the ability of the water treatment system to successfully treat seepage and recharge. Grouting of fractured rock, caved-in areas, and drill holes to prevent seepage of contaminated water to the land surface was deleted from the modified remedy.]**

- Establishment of a surface and ground-water monitoring system to detect any leakage, seeps or migration of contaminated ground water which may result from installation of the tunnel plugs.

- Installation of a pumping **or drainage** mechanism to control water levels behind the portal plug. The pumped water would be routed to the treatment system to remove contaminants before discharge into California Gulch. **[The portal plug became a flow through plug, rather than a solid plug. This flow through plug was intended to prevent surges from affecting the treatment system, not to flood the tunnel.]**

- Development and implementation as necessary of a contingency plan to address any adverse effects on surface or ground water resulting from tunnel plugging.

- Operation and maintenance of the remedy.

These changes were discussed in detail in the 1989 ROD Modification. The reader may wish to refer to the 1988 ROD and the 1989 ROD Modification for a more detailed discussion of the remedy selected in 1988 and modified in 1989. These documents are available at the Lake County Library, Colorado Mountain College Library, Timberline Campus, and the EPA offices in Denver.

Summary of the Proposed 1991 Remedy

Both the 1988 ROD and the 1989 ROD Modification will be further altered by the remedy proposed in this Draft ESD upon approval by EPA. Many of the elements have not changed, or have changed in number or location, but remain fundamentally the same as the elements described in the ROD and ROD Modification. These elements are discussed below in greater detail than the foregoing summaries of the previous remedies to help the reader understand what the proposed remedy includes. Refer to the section "Basis for Modifying the Remedy" in this ESD for an explanation of the basis for the changes. In the discussion below, the components which have changed from previous remedies will be noted by **highlighting**, and discussed at the end of the paragraph within brackets ([ ]). The proposed remedy, designed to allow free flow from the tunnel, through elimination of two of the plugs and replacement of the portal plug with a flow control bulkhead. The proposed remedy consists of:

- Construction of **a surge pond** to capture drainage from the Yak Tunnel and to minimize the impact of surges from the tunnel on California Gulch and the Arkansas River. **The surge pond is proposed to be a permanent part of the remedy.** (Construction of this surge pond is essentially complete at the time of the writing of this draft ESD.)

- Installation of a permanent water treatment system to treat water from the Yak Tunnel before discharge into California Gulch.

- Construction of a **flow control bulkhead** within the tunnel to prevent surges. **[Two of the three plugs are proposed to be eliminated from the remedy, leaving the portal plug as a flow control bulkhead to prevent surges (redundant to the surge pond), and to allow for operational flexibility within the water treatment facility. The flow control bulkhead is proposed to be constructed in competent rock, approximately 2,000 feet into the tunnel. The tunnel will be rehabilitated to the extent required for bulkhead placement (construction) and long-term stability of the tunnel discharge outlet.]**

- Sealing of shafts and diversion of surface water from tunnel recharge areas to reduce the amount of water entering the Yak Tunnel system, as necessary, for proper performance of the remedy.

- Establishment of a surface and ground-water monitoring system to detect seeps, **ground-water quality and flow direction, and potential gradient reversal resulting in** migration of contaminated ground water away from the tunnel. The gradient reversal may result from **a rockfall or cave-in within the tunnel. This monitoring system is proposed to include a minimum of seven ground-water monitoring wells. [Both the ROD and the 1989 ROD Modification required establishment of a minimum of 23 monitoring wells. Since the remedy proposed in this ESD eliminates flooding of the mine workings, the potential for**

migration of contaminants is greatly reduced. This reduces the number and locations of the monitoring wells needed to detect movement of contaminants.]

- **Placement of six or more weirs, or other flow measuring devices, at key locations in the Yak Tunnel. The weir locations will be selected during an initial inspection of the tunnel.**

- **Periodic inspection of the Yak Tunnel. Qualified mining crews will enter the tunnel annually to inspect and maintain weirs and other structures in the tunnel. Crews will also enter the tunnel to determine the cause of unexpected increases or decreases in flow within the Yak Tunnel.**

- Development and implementation, as necessary, of a contingency plan to address any adverse effects on surface or ground water resulting from tunnel **blockage. [Implementation of the contingency plan will be based upon: 1) decrease in flow from the Yak Tunnel; 2) rise in water levels in monitoring wells located outside the mine workings; 3) indication of gradient reversal (flow away from the tunnel); and 4) degradation of water quality as detected by the monitoring network. A baseline for Yak Tunnel flow, water levels, hydraulic gradient, and water quality will be established for comparison with future data. The remedy will also be monitored for seeps by periodic site reconnaissance looking for surface seeps.]**

- Operation and maintenance of the remedy.

Explanation of Significant Differences

The 1988 remedy, as modified by the 1989 remedy, and the proposed 1991 remedy remain fundamentally the same. The same water treatment processes will be employed. In addition, a flow control bulkhead and a monitoring network will be constructed. The differences between the 1989 ROD Modification and the 1991 proposed remedy are:

1. Removal of two of the three plugs to allow free flow from the tunnel, and placement of a flow through bulkhead at the portal for surge protection;

2. Reduction in the proposed ground-water monitoring system due to the greatly reduced chance of contaminated water movement into the ground water system;

3. Continued use of the Yak Tunnel as a drain for contaminated water; and

4. Treatment of all Yak Tunnel water, not just water between the portal and second plug.

The major differences between the 1988 remedy, which was modified by the 1989 ROD Modification, and the proposed 1991 remedy include:

1. The nature and design of the plugs to be installed in the Yak Tunnel. A flow control bulkhead will be installed approximately 2,000 feet into the tunnel. The bulkhead will control flow from the tunnel to optimize water treatment facility operation and provide surge protection. The two remaining plugs will not be installed allowing for free flow from the tunnel.

   The decision to not install the two plugs was based upon the reduction of exposure to industrial (miner) safety hazards during rehabilitation of the tunnel and the unknown water quality impacts that plugging the tunnel may have caused.

2. The installation of weirs, or other flow measuring devices, in the Yak Tunnel. These weirs will allow for monitoring of the flow in various reaches of the tunnel.

   The exact locations and numbers of weirs will be based upon an investigation of the condition of the Yak Tunnel and its main laterals. This investigation will determine the relative water contribution to the tunnel from each main lateral. The investigation will also determine the condition of fault zones which intersect the Yak Tunnel and its main laterals. Weirs will be located to determine baseline flow and to provide immediate warning of sudden increases or decreases in flow within the Yak Tunnel or its laterals.

   The weirs will serve two purposes:

   - The weirs will measure baseline flow in the tunnel. The seasonal variation of flow from the main laterals may assist in determining sources of surface water inflow into the tunnel system. Significant sources of inflow may then require remedial actions to reduce the volume of water flowing to the treatment plant.

   - The weirs will provide information on rapid changes in flow in the tunnel. In the case of rapid increase in flow, flow measurement will assist the treatment plant operator in protecting the plant from surges. In the case of rapid decrease in flow, flow measurement will trigger implementation of contingency plans, including reinspection of the Yak Tunnel.

   If, during the investigation of the Yak Tunnel, EPA determines that conditions in the tunnel will not allow installation and maintenance of the weirs, EPA will develop an alternate method for monitoring the tunnel. This alternate method will be presented to the public prior to implementation, either in a Fact Sheet or another ESD.

3. The modification of the monitoring network reflects the use of weirs for directly monitoring the changes in water flow rate within the tunnel. In addition, monitoring wells constructed within selected fault zones outside of known mine workings will be used to monitor water level, water quality and flow direction to or from the tunnel. This monitoring system will determine potential contaminant movement away from the tunnel. This change also reflects the change in the flooding component of the remedy, with a greatly reduced chance of movement of contaminated water into the ground water system.

Basis for Modifying the Remedy

Previous investigations at the site indicated that the geological setting of the Leadville Mining District was complex. However, these investigations were not able to fully consider the difficulties associated with monitoring and detecting migration of contaminated ground water in the mining district, including the Yak Tunnel.

New information has become available to EPA following remedial actions at the Eagle Mine near Minturn, Eagle County, Colorado. At that site, after plugging several adits, mine water began seeping from adjacent bedrock fracture zones (very little water seeps from the adits themselves). This surface, and subsurface, seepage has increased the concentrations of heavy metals in the Eagle River below the mine workings and in Rock Creek. EPA has focused on the observed short-term effects of mine plugging at the Eagle site in forming its decision regarding the Yak Tunnel. Although it is not known whether these effects will continue over the long term, EPA recognizes that source control remediation measures which have been implemented may well prove to be effective at Eagle.

EPA has also gained additional information about the difficulties of installing an "accurate" monitoring network in highly faulted areas, such as the Leadville Mining District. During the construction of the Surge Pond in 1989, the presence of a geologic fault immediately downgradient of the Surge Pond made installation of a ground-water monitoring network extremely difficult. The fault had originally been thought to be located several hundred feet down gradient of the surge pond, not immediately down gradient of the surge pond. Due to the fault, the bedrock and the unconsolidated sediments above the bedrock are different upgradient and downgradient of the Surge Pond. The bedrock and unconsolidated sediments upgradient of the pond consist of porphyry or weathered porphyry; the bedrock and unconsolidated sediments downgradient of the pond consist of dolomite or weathered dolomite. Since the chemistry of the geological deposits is different, interpretation of chemical analyses on ground water would be extremely difficult. In addition, the complex step fault appears to be acting as either a dam or a sink, since alluvial ground water is only present on one side

of the fault. These conditions are not expected to be unique to the vicinity of the Surge Pond; there may be other complex faults which intersect the Yak Tunnel. This additional information is presented in Hydrologic Investigation of Surge Pond Area (Res-ASARCO Joint Venture, March 1990); supplemental information is presented in Appendix A, Selected Remedy Component Change Proposal (Res-ASARCO Joint Venture, March 1990). These technical documents are available at the information repositories at the Lake County Library, Colorado Mountain College Library, Timberline Campus, and the EPA offices in Denver.

EPA has worked extensively with the PRPs, including ASARCO, Newmont Mining, Resurrection Mining, and the Res-ASARCO Joint Venture, in developing this ESD. Many components of this remedy have been proposed by the PRPs.

The National Contingency Plan (NCP), the regulations developed by EPA to implement the Superfund law, requires EPA to use nine criteria to evaluate proposed remedies at Superfund sites. These nine criteria were established to provide for consistent evaluation of proposed remedies throughout the country. The following paragraphs present a brief evaluation of the proposed remedy using the nine criteria.

1. Overall Protection of Human Health and the Environment:

   Partial tunnel rehabilitation, collection, and treatment of the mine drainage will adequately protect human health and the environment from unacceptable risks posed by the hazardous substances in both the short term and the long term. The proposed remedy reduces or eliminates impacts on surface and ground water, through collection and treatment of the Yak Tunnel discharge.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):

   The treatment facility will attain compliance with all applicable or relevant and appropriate Federal and State requirements, except for requirements pertaining to instream water quality. Most of the area from which the contaminated discharges to the Arkansas originate has not yet been adequately characterized. Thus, it is not yet possible to perform a wasteload allocation to determine the extent to which the Yak Tunnel discharge and each of the other discharges must be treated in order for the Arkansas River to meet instream water quality requirements. Water quality-based effluent limitations and standards for the upper Arkansas River have therefore been interim waved. Technology-based treatment requirements, however, represent the minimum level of control that has not been waived. Initially upon start-up of the water treatment plant, New Source Performance Standards (NSPS) must be met. By the end of the second year of operation, the water treatment plant effluent must meet best available technology requirements based upon acute toxicity testing. These requirements can be translated into

interim numeric standards as a design basis and compliance threshold. When the area has been studied, the wasteload allocation will be performed, water quality-based treatment requirements for the Yak Tunnel and other discharges will be determined, and the Arkansas River will meet instream water quality standards.

3. Long-Term Effectiveness and Permanence:

The proposed remedy provides for long term maintenance of the collection system and the treatment facility thus reducing or eliminating residual risk remaining from untreated waste. Operation and maintenance procedures and monitoring will be required to ensure the effectiveness of the proposed remedy in perpetuity. Future treatment technologies will be evaluated when the treatment facility requires updating. Tunnel blockage in the form of natural rockfalls may eventually occur, causing a reversal in ground-water gradient which may adversely impact the local or regional ground-water system. However, the contingency plan will mitigate this impact and will allow response time to assess the impact and develop alternatives for effectively collecting contaminated ground water and containing sources of acid mine drainage.

4. Reduction of Toxicity, Mobility, or Volume through Treatment:

The principal threats posed by the site include mine drainage which is contaminated with high concentrations of metals and low pH. The treatment facility will remove the metals from the tunnel discharge and increase the pH to acceptable levels. The sludge produced by the treatment process will contain metal hydroxides which have low mobility under nonacidic conditions. In addition, the sludge will recover sufficient zinc to allow recycling.

5. Short-Term Effectiveness:

No short-term risks posed to the community during implementation are anticipated. Potential impacts on workers during implementation include manageable underground construction safety hazards during tunnel rehabilitation which will be conducted by personnel familiar with the safety hazards sometimes encountered in underground work. The probability of occurrence of safety hazards has been reduced from the original proposed plan because of the reduced duration of exposure in that shorter length of tunnel requiring rehabilitation. No potential environmental impacts are anticipated during implementation.

6. Implementability:

The tunnel rehabilitation and the treatment facility both utilize known technologies which are technically feasible, reliable, and implementable. Monitoring of the collection system by way of monitoring wells and periodic tunnel inspections will be conducted. The effectiveness of the treatment facility will be verified by way of effluent testing. The treatment process may be upset by changing conditions of influent resulting in less than desired effluent quality for short periods of time. Good design, maintenance, and operational practices are required to meet performance standards. The remedy includes a contingency plan to relieve water accumulations occurring behind tunnel blockages.

7. Cost:

EPA is unable to determine a significant difference in cost between the 1989 ROD Modification and the 1991 Proposed Remedy. The 1991 Proposed Remedy provides greater reliability for the collection of contaminated ground water.

8. State Acceptance:

The State of Colorado acknowledged the validity of the additional information evaluated in reconsidering a plugging remedy. The State has determined that the proposed changes are appropriate for the Yak Tunnel situation, but at the same time, maintains that mine plugging remedial alternatives may be effective in other situations.

9. Community Acceptance:

EPA has worked extensively with the community to understand the residents' concerns regarding the previously selected remedies. EPA believes that the proposed remedy will receive better support from the community than the previous remedies. This is because the proposed remedy will allow continued mining in areas which would have been flooded under the previous remedies. In addition, the proposed remedy removes many of the uncertainties associated with plugging and flooding the mine workings.

Informal public meetings have been conducted and the oral and written comments received have been generally supportive of this proposed change to the remedy. EPA will continue to work with the community and will attempt to address the community's comments regarding this final ESD.

SUPPORTING AGENCY COMMENTS

The Colorado Department of Health has substantively participated in the 1991 ESD development, EPA responded to the State's concerns and incorporated their comments into this ESD. The Colorado Department of Health concurs with EPA in the proposed modifications to the remedy.

STATUTORY DETERMINATIONS

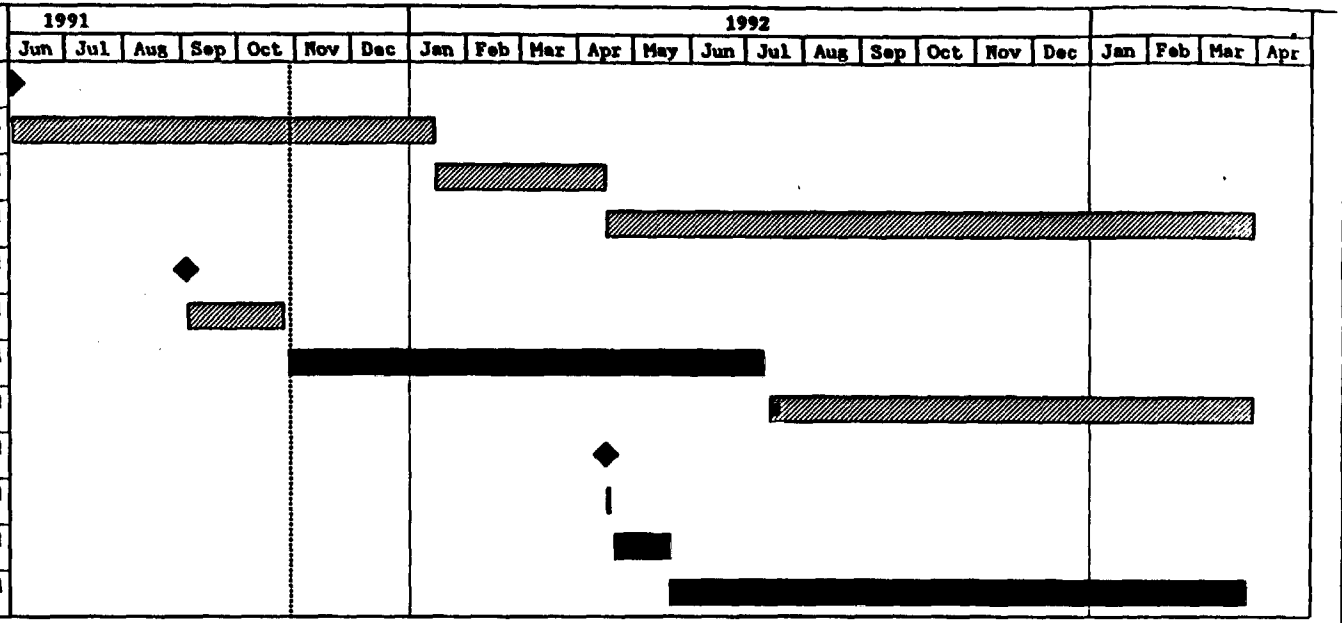
EPA has determined that the remedy, as modified, remains protective of human health and the environment, and is cost effective. In addition, the modified remedy utilizes permanent solutions and innovative treatment or resource recovery technologies to the maximum extent practicable.

As mentioned above, when the area has been adequately studied, a wasteload allocation will be performed, and water quality-based requirements for the Yak Tunnel and other discharges to the Arkansas River will be determined. At that time, instream water quality requirements for the Arkansas River will be achieved.

SCHEDULE FOR THE PROPOSED REMEDY

The schedule for design and construction of the Yak Tunnel remedy is presented in Figure 2. The construction of the water treatment plant is scheduled to be completed during the 1991 construction season; site development work began during 1990 to allow for construction of the plant in 1991.

ID	Name	Duration
1	WATER TREATMENT PLANT	0d
2	Construction	162d
3	Start-up	66d
4	Routine Operation	249d
5	GROUND-WATER MONITORING	0d
6	Well Installation	38d
7	Baseline Monitoring	184d
8	Routine Monitoring	187d
9	TUNNEL FLOW MEASUREMENT	0d
10	Yak Tunnel Inspection	2d
11	Flow Device Installation	22d
12	Routine Flow Measurement	223d



Project:
Date: 10/28/91

Critical
Noncritical
Progress
Milestone
Summary

FIGURE 2. YAK TUNNEL PROJECT SCHEDULE

PUBLIC PARTICIPATION

Persons desiring further information on this Draft Explanation of Significant Differences and those interested in procedures for providing comments to EPA may contact:

James Hanley	Eleanor Dwight
Yak Tunnel Remedial Project Manager	Community Involvement Coordinator
Phone #: (303) 293-1649	Phone #: (303) 294-1130

Toll-free Number: 1 800-759-4372 (in Colorado)

Mailing List Additions

If you did not receive this ESD by mail, and you would like to be added to EPA's mailing list for the California Gulch site, please send the following information to:

Eleanor Dwight

Community Involvement Coordinator

U.S. EPA, Region VIII, 8OEA

999 18th Street, Suite 500

Denver, Colorado 80202-2405

Name:_____

Address:_____

City/State:_____Zip:_____

Company, organization, or governmental entity:_____

GLOSSARY

Adit - An almost horizontal entrance to a mine.

Administrative Order - See Order below.

Cadmium - A heavy metal found in the ores in the Leadville Mining District. Exposure to cadmium may result in hypertension and kidney and liver damage in humans. Cadmium is used in metal plating, pigments, and chemical production.

CERCLA - The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 -A federal law passed in 1980 and modified in 1986 by SARA (see below). The Acts created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the legislation, EPA can either:

- Pay for site clean-up when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work; or
- Take legal action to force responsible parties for site contamination to clean up the site or pay back the Federal government for the cost of the clean-up.

Contaminants - Any chemical that poses a threat to public health and/or the environment. Contaminants may be toxic, ignitable, explosive, or chemically reactive. In the Leadville Mining District, the principal contaminants are toxic heavy metals.

Copper - A heavy metal found in ores in the Leadville Mining District. Copper is not acutely toxic to humans, but is one of the most harmful metals to fish and other aquatic life. Copper is a semiprecious metal used in electrical and electronic equipment, coins, metal plating, and metal alloying.

Dolomite - A form of limestone which is rich in magnesium.

Explanation of Significant Differences (ESD) - A document which EPA is required to prepare when changes are proposed in the remedy for a Superfund site. An ESD is issued if the change in the remedy is significant, but not fundamental. The ROD must be modified or amended if the change is fundamental.

Factor of Safety - Factors of safety are used to incorporate the uncertainties in the design, and to reduce the probability of failure of the design. In engineering design, the ratio of the design property to the required property. For example, a pump station designed to store and pump 150 gpm in a portion of the tunnel in which the average flow rate is 100 gpm would have a factor of safety of 1.5. A factor of safety of 1.5 is common in many engineering designs.

Feasibility Study - See Remedial Investigation/Feasibility Study below.

Gold - A precious heavy metal found in ores in the Leadville Mining District.

Gray porphyry - See porphyry below.

Hazardous Substances - Synonymous with Contaminants.

Head - The pressure exerted by liquid or gas. In the Yak Tunnel, head is equal to the depth of water standing in the tunnel, as long as the tunnel is not flooded.

Hydraulic Gradient - The potential for ground water to move in a given direction due to the difference in pressure between two points in the aquifer.

Lead - A heavy metal found in ores in the Leadville Mining District. Exposure to lead may result in damage to the central nervous system in humans; in addition, exposure to lead may cause cancer. Lead is used in batteries, foil, solder, pigments, and construction equipment, and as an additive in gasoline.

Magnesium - A nonmetal found in limestone and ore bodies in the Leadville Mining District. Magnesium is not a contaminant in environmental media in the Leadville area.

Manganese - A heavy metal found in ores in the Leadville Mining District. Manganese can be toxic to plants in acidic soils.

National Priorities List (NPL) - EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for long-term remedial response using money from the Superfund.

Operable Unit - An action taken as one part of an overall site clean-up. A number of operable units can be used in the course of a site clean-up.

Order - A legal document which describes the actions which PRPs are required to perform at a Superfund site. Several types of Orders may be used, including:

- A Unilateral Administrative Order (UAO) which is a document prepared by EPA without formal concurrence by the PRPs;
- An Administrative Order on Consent (AOC) which is a legal agreement between EPA and the PRPs whereby the PRPs agree to perform or pay the cost of Superfund site clean-up; or
- A Consent Decree (CD) which is a legal agreement (essentially an AOC), approved and issued by a judge, between EPA and the PRPs whereby the PRPs agree to perform all or part of a Superfund site clean-up.

All orders issued to PRPs for the Yak Tunnel Operable Unit have been Unilateral Administrative Orders.

pH - Scientific measure of the relative acidity of a water solution on a logarithmic scale from 1 to 14; low pH numbers in the 3 to 5 range are typical for strongly acidic minewater draining into the California Gulch area.

Porphyry - Rock having relatively large conspicuous crystals in a fine-grained igneous matrix. This type of rock pushed up through the surrounding sedimentary rocks and was formed after rapid cooling from the molten state.

Potentially Responsible Party (PRP) - An individual(s) or company(s) (such as owners, operators, transporters, or generators) potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative or legal actions, to clean up hazardous waste sites they have contaminated. Under SARA, some current landowners are exempt if they did not know about the hazardous substances on their property and exercised due care in acquiring the property.

Record of Decision (ROD) - A public document that explains which clean-up alternative(s) will be used at NPL sites. The ROD is based upon information and technical analysis generated during the RI/FS and consideration of public comments and community concerns.

Remedial Action - The actual construction or implementation phase that follows remedial design of the selected clean-up alternatives at a site on the NPL.

Remedial Design - An engineering phase that follows the ROD, in which technical drawings and specifications are developed for the subsequent remedial action at a site on the NPL.

Remedial Investigation/Feasibility Study (RI/FS) - Investigative and analytical studies usually performed at the same time in an interactive, iterative process, and together referred to as the RI/FS. They are intended to:

- Gather data necessary to determine the type and extent of contamination at a Superfund site;
- Establish criteria for cleaning up a site;
- Identify and screen clean-up alternatives for remedial action; and
- Analyze in detail the technology and costs of the alternatives.

SARA - The Superfund Amendments and Reauthorization Act of 1986. This law amended CERCLA.

Silver - A precious heavy metal found in ores in the Leadville Mining District.

Superfund - The common name for CERCLA.

Unconsolidated sediments - The geologic material above bedrock.

Weathered Dolomite - Physically altered dolomite. The term "weathered" means that the bedrock has begun to break down into soil.

Zinc - A heavy metal found in ores in the Leadville Mining District. Zinc is rarely damaging to human health; however, when humans are exposed to zinc in combination with other metals, the results may be harmful. At high concentrations, zinc can be harmful to fish. Zinc is used in batteries, fuses, pigments, metal plating and metal alloying.