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RECORD OF DECISION

OPERABLE UNIT 5
AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE
LEADVILLE, COLORADO

SEPTEMBER 2000

U.S. Environmental Protection Agency
999 18th Street, Suite 500
Denver, Colorado 80202

RECORD OF DECISION

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CALIFORNIA GULCH SUPERFUND SITE
LEADVILLE, COLORADO

The U.S. Environmental Protection Agency (EPA), with the concurrence of the Colorado Department of Public Health and Environment (CDPHE), presents this Record of Decision (ROD) for Operable Unit (OU) 5 of the California Gulch Superfund Site in Leadville, Colorado. This includes tailing, flue dust, and non-residential area soils for Arkansas Valley (AV) Smelter and Colorado Zinc-Lead (CZL) Mill sites (collectively known as the "AV/CZL" sites). The ROD is based on the Administrative Record for OU5 AV/CZL site, including the Remedial Investigation/Feasibility Study (RI/FS), the Proposed Plan, the public comments received, and EPA responses. The ROD presents a brief summary of the RI/FS, actual and potential risks to human health and the environment, and the selected remedy. EPA followed the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, the National Contingency Plan (NCP), and EPA guidance (EPA, 1999) in preparation of the ROD. The three purposes of the ROD are to:

1. Certify that the remedy selection process was carried out in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act (collectively, CERCLA), and, to the extent practicable, the NCP;

2. Outline the engineering components and remediation requirements of the Selected Remedy; and

3. Provide the public with a consolidated source of information about the history, characteristics, and risk posed by the conditions of OU5 AV/CZL sites, as well as a summary of the cleanup alternatives considered, their evaluation, the rationale behind the Selected Remedy, and the agencies' consideration of, and responses to the comments received.

The ROD is organized into three distinct sections:

1. The **Declaration** section functions as an abstract for the key information contained in the ROD and is the section of the ROD signed by the EPA Regional Administrator.

2. The **Decision Summary** section provides an overview of the OU5 AV/CZL site characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the Selected Remedy and explains how the remedy fulfills statutory requirements; and

3. The **Responsiveness Summary** section addresses public comments received on the Proposed Plan, the RI/FS, and other information in the Administrative Record.

DECLARATION

DECLARATION

SITE NAME AND LOCATION

Operable Unit 5 AV/CZL Sites
California Gulch Superfund Site
Leadville, Colorado
CERCLIS # COD980717938

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for Operable Unit (OU) 5 for Arkansas Valley (AV) Smelter and Colorado Zinc-Lead (CZL) Mill sites (collectively known as the "AV/CZL" sites) within the California Gulch Superfund Site ("the Site") in Leadville, Colorado. The Environmental Protection Agency (EPA), with the concurrence of Colorado Department of Public Health and Environment (CDPHE), selected the remedy in accordance with Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act (collectively, CERCLA) and the National Contingency Plan (NCP)

This decision is based on the Administrative Record for OU5 AV/CZL site within the California Gulch Superfund Site. The Administrative Record (on microfilm) and copies of key documents are available for review at the Lake County Public Library, located at 1115 Harrison Avenue in Leadville, Colorado, and at the Colorado Mountain College Library, in Leadville, Colorado. The complete Administrative Record may also be reviewed at the EPA Superfund Record Center, located at 999 18th Street, 5th Floor, North Terrace in Denver, Colorado.

The State of Colorado has provided a letter for the Administrative Record, indicating its concurrence with the Selected Remedy.

ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of contaminants from the OU5 AV/CZL sites, which may present an imminent and substantial endangerment to public health or welfare.

DESCRIPTION OF THE SELECTED REMEDY

This ROD specifically addresses the portion of OU5 that includes tailing, flue dust, and non-residential area soils at the AV Smelter and the CZL Mill sites, collectively known as the "AV/CZL" sites. The OU5 AV/CZL sites are one of 11 OUs within the Site identified as source areas. The remaining portions of OU5 (the "EGWA" sites) will be addressed separately. The OU5 AV/CZL sites include the tailing, flue dust, and non-residential area soils from former smelter and mill sites. Pursuant to the August 26, 1994 Consent Decree at the California Gulch Superfund Site, it was agreed that the decision on remediation of surface water and groundwater site-wide (i.e., OU12) would be made only after records of decisions for source remediation were

selected and implemented at each OU. Remedial actions selected for OU5 AV/CZL sites are consistent with the ASARCO, Inc. work area management plan (WAMP).

The Selected Remedy for the OU5 AV/CZL sites is the Consolidation/Containment (Flue Dust Repository and Soil Cover) Alternative, which was presented in the Final Focused Feasibility Study Report (FFS) (McCulley, Frick & Gilman, Inc. [MFG], 2000). The FFS evaluated and screened remedial alternatives retained in the site-wide Screening Feasibility Study (EPA, 1993) for tailing, flue dust, and non-residential area soils. The FFS used a comparative analysis to evaluate five alternatives and identify the advantages and disadvantages of each. Selection of the Consolidation/Containment (Flue Dust Repository and Soil Cover) Alternative was based on this analysis.

The Selected Remedy for tailing, flue dust and non-residential area soils includes the following features:

- Excavating and consolidating flue dust into an on-site, lined, fully encapsulated repository. This repository would be lined with a geomembrane liner.

- Demolish to grade all smelter structures within the remediated areas of the Arkansas Valley Smelter site except the easternmost of the two ore bins, the base of two smoke stacks, and the concrete arch. Any salvageable demolition debris, such as metal, would be relocated to a designated location in the southwest junkyard area. A Mitigation Plan would be prepared to address designated historical structures that would be adversely affected.

- Consolidate tailing, non-residential area soils, and non-salvageable materials at the AV and CZL sites. An 18-inch thick vegetated soil cover would be placed over both flue dust repository and consolidated tailing/non-residential area soils.

- Establish institutional controls to warn of potential hazards and to maintain the effectiveness of the remedy by limiting access to or use of property (current and future land use scenarios), including temporary and permanent measures. Modifications to Lake County and/or City of Leadville zoning ordinances will involve the creation of a zoning "overlay district" to provide a screening process to identify properties where special precautions or requirements may be needed.

- Establish a long-term monitoring program to assess the quality of surface water and groundwater following implementation of the remedy.

The Selected Remedy is protective of human health and the environment through the following:

1. The repository and soil covers will eliminate direct contact with and airborne transport of tailing, flue dust, and non-residential area soils particles.

2. The repository and soil covers will minimize both the erosion of flue dust, tailing, and non-residential area soils and deposition into local water sources.

3. The repository will control leaching and migration of metals from flue dust.

4. The remedy will control ecological risks including ingestion or direct contact with contaminated sources by wildlife and plant and soil fauna.

5. Current residential land use will be addressed consistent with the Lake County Community Health Program..

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. Given the type of waste present at this site, this remedy uses permanent solutions (e.g., engineered repository and covers) to the maximum extent practicable. Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. This remedy is acceptable to both the State of Colorado and the community of Leadville.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record for this site.

- Contaminants of concern (COC) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessments and ROD.
- Potential land use that will be available at the site as a result of the Selected Remedy.
- Estimated capital costs, annual operation and maintenance costs, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

Dale Vodehnal Acting ARA

Max H. Dodson
Assistant Regional Administrator
Ecosystems Protection and Remediation
U.S. Environmental Protection Agency, Region VIII

9/29/2000
Date

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
Asarco	ASARCO Incorporated
AV/CZL	Arkansas Valley /Colorado Zinc-Lead
AWQC	Ambient Water Quality Criteria
BARA	Baseline Aquatic Ecological Risk Assessment
BDAT	Best demonstrated available technology
bgs	below ground surface
CD	Consent Decree
CDM	Camp Dresser & McKee Inc.
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
CZL	Colorado Zinc-Lead
EGWA	Elgin Smelter, Grant/Union Smelter, Western Zinc Smelter, and Arkansas Valley South Hillside Slag Pile
EPA	U. S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESI	Engineering-Science, Inc.
FEC	Foothill Engineering Consultants
FS	Feasibility Study
FFS	Focused Feasibility Study
GCL	Geosynthetic clay liner
Golder	Golder and Associates
HQ	Hazard Quotient
LCCHP	Lake County Community Health Program
LDR	Land Disposal Restriction
LHMD	Leadville Historic Mine District
MFG	McCulley, Frick & Gilman, Inc.
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MK	Morrison Knudsen Corporation
mm	Millimeter
NAAQS	National ambient air quality standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRHP	National Register of Historic Places
O&M	Operation and maintenance
OU	Operable Unit
PG	Primary grid
PRP	Potentially Responsible Party
RA	Risk Assessment
RI	Remedial Investigation

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RME	Reasonable Maximum Exposure
ROD	Record of Decision
SFS	Screening Feasibility Study
SIP	State Implementation Plan
SMI/TerraMatrix	Sheppard Miller, Inc. and TerraMatrix, Inc.
SPLP	Synthetic Precipitation Leaching Procedure
State	State of Colorado
TBV	Toxicity Benchmark Values
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TSDF	Treatment, storage and disposal facility
TSS	Total Suspended Solids
UCL	Upper confidence limit of the arithmetic mean
USDC	U. S. District Court
Walsh	Walsh and Associates, Inc.
WCC	Woodward-Clyde Consultants
Weston	Roy F. Weston
µg/L	Microgram per liter
µm	Micron

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Operable Unit 5 AV/CZL Site
California Gulch Superfund Site
Leadville, Colorado
CERCLIS # COD980717938

The California Gulch Superfund Site ("the Site") is located in Lake County, Colorado, in the upper Arkansas River basin, approximately 100 miles southwest of Denver (see Figure 1). The study area at the Site encompasses approximately 16.5 square miles and includes the towns of Leadville and Stringtown, a portion of the Leadville Historic Mining District, and the portion of the Arkansas River from its confluence with California Gulch downstream to the Lake Fork Creek confluence.

The California Gulch Superfund Site has been organized into 12 operable units (OU). Figure 2 shows the Site study area boundaries and the location of 12 OUs within the California Gulch Superfund Site. The U.S. Environmental Protection Agency (EPA) is the lead agency for the site and Colorado Department of Public Health and Environment (CDPHE) is the support agency. ASARCO Incorporated (Asarco), a potential responsible party (PRP), is financing the remedial actions for OU5.

OU5 includes four smelter sites (Elgin Smelter, Grant/Union Smelter, Western Zinc Smelter and Arkansas Valley Smelter, collectively known as the "EGWA" sites) and one mill site (Colorado Zinc-Lead Mill) as shown in Figure 3. This Record of Decision (ROD) specifically addresses the portion of OU5 that includes tailing, flue dust, and non-residential area soils at the Arkansas Valley (AV) Smelter and the Colorado Zinc-Lead (CZL) Mill site, collectively known as the "AV/CZL" sites. The remaining portion of OU5, which includes the EGWA sites, will be addressed separately.

The AV/CZL site is located approximately 1.5 miles southwest of Leadville on the north bank of the California Gulch. The combined area of the AV Smelter and CZL Mill sites is approximately 70 acres. All of the AV/CZL site lies above the adjacent 500-year flood plain of lower California Gulch, which is included in OU8. The OU5 AV/CZL sites are located within the Industrial/Mining and Business/Highway zoning districts established by Lake County, but the sites are not currently being used for industrial or mining operations. One occupied residence has been identified at the AV site. The surrounding properties are also zoned for Industrial/Mining uses, and the property adjacent to the southern boundary is currently used for industrial operations. Stringtown, located immediately south of California Gulch within unincorporated Lake County, is the closest residential area to the AV/CZL sites.

The AV Smelter was the longest operating smelter in the Leadville area, processing lead ore and reprocessing slag to produce lead, silver, and other metals. The plant was built in 1879 and was in operation until 1961. By 1900, the AV Smelter was the only surviving lead smelter operating in the Leadville district. A wide variety of ores were processed over the period of operation. The principal materials produced by the smelter were lead bullion, copper matte, slag, and flue dust.

The CZL Mill operated from 1926 to 1930, processing ores with a custom flotation process to produce zinc, lead, gold, silver, and some copper concentrations. In 1935, the mill was remodeled and continued to use the flotation process until operations ceased in 1938. Ores processed by the mill were received from several local mines and waste dumps. The primary byproduct of mill operation was tailing, which was discharged below the mill and presumably into the CZL Tailing Impoundment.

The majority of smelter and mill structures have been demolished although some buildings and foundations are still present today. The smelter-related materials remaining at the AV Smelter site consist primarily of demolition debris - brick, concrete, metal, tile, wood, and glass - and residual mine waste and smelter materials including slag, coke/charcoal, limestone, ore, matte, tailing, and flue dust. At the CZL Mill site, the concrete foundations of the mill structures remain, and debris associated with the main mill and smaller deposits of tailing, ore, and/or waste rock, and possibly ore concentrates are also present. The CZL tailing impoundment (OU8) was removed during the fall of 1995 (EPA, 1995). Tailing was also removed from a portion of Fluvial Tailing Site 2 within the 500 year floodplain, which defines OU8 in 1998.

Lake County is relatively small (380 square miles) and is predominately rural, with a 1990 population of 6,007 (U.S. Department of Commerce, 1990). About half of this population resides within the City of Leadville. The population of Lake County has fluctuated with the mining industry. The population increased to about 10,000 between 1960 and 1981 and then declined throughout the 1980s. About two-thirds of the land in Lake County is federally owned and is either part of San Isabel National Forest or managed by the Bureau of Land Management. Land surrounding and within California Gulch is predominately dedicated to mining, commercial, and residential uses.

The climate of Lake County is semi-arid continental, characterized by long, cold winters and short, cool summers. The City of Leadville is at an elevation near 10,000 feet above mean sea level. The average annual maximum temperature in the Leadville area is 50.5 degrees Fahrenheit, and the average annual minimum temperature is 21.9 degrees Fahrenheit, with an annual mean temperature of 37.3 degrees Fahrenheit. Average annual precipitation is approximately 16 inches, which represents 59 years of record from the Colorado Climate Center (1997). Prevailing winds in the Leadville area are largely from the west-northwest and to a lesser extent to the northeast (Engineering-Science, Inc. [ESI], 1986), with winds typically ranging from 0 to 20 miles per hour (Woodward-Clyde Consultants [WCC], 1992b).

2.0 OPERABLE UNIT HISTORY AND ENFORCEMENT ACTIVITIES

The California Gulch Superfund Site is located in the highly mineralized Colorado Mineral Belt of the Rocky Mountains. Mining, mineral processing, and smelting activities in the Leadville area have produced gold, silver, lead, and zinc for more than 130 years. The Leadville Historic Mining District includes an extensive network of underground mine workings in a mineralized area of approximately eight square miles located around Breece Hill. Mining in the District began in 1860, when placer gold was discovered in California Gulch. As the placer deposits were exhausted, underground workings became the principal method for removing gold, silver, lead, and zinc ore. As these mines were developed, waste rock was excavated along with the ore and placed near the mine entrances. Many mines were operated in the area as evidenced by more than 2,000 mine waste rock piles identified at the California Gulch Superfund Site. Mined ore was transported to nearby mills where it was crushed and separated into metallic concentrates and waste (mill tailing). The high grade ores and mill concentrates were refined and processed at smelters. Slag and other waste products were generated by the smelters.

Approximately 17 smelter facilities are reported to have once operated within the Site. Most operations ceased by about 1900, although some facilities continued to operate into the 1960s. At present, nearly all the mines within the site boundaries are inactive. All of the mills and smelters that operated on the Site are now inactive and/or demolished.

Due to historic mining, milling, and smelting operations, the Site contains many tailing impoundments, fluvial deposits, slag piles, waste rock piles, and mine water drainage tunnels. Slag on the Site is the waste byproduct of smelting and results from the processing of lead ore in high temperature furnaces.

The California Gulch Superfund Site was placed on the National Priorities List (NPL) in 1983 under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The Site was placed on the NPL because of concerns about the impact of mine drainage on surface waters in the California Gulch and the impact of heavy metals loading in the Arkansas River.

In September 1990, EPA and the PRP entered into an Administrative Order on Consent (AOC) for the performance of soils sampling and air monitoring. EPA issued a Unilateral Administrative Order in 1991 required Asarco to conduct studies and complete RIs.

Several subsequent investigations have been conducted within the California Gulch Superfund Site that have addressed the smelter/slag/mill sites (i.e., OU5). A Smelter Site Reconnaissance (WCC, 1992a) was conducted in 1991 as part of the Smelter RI.

In 1991 through 1992, a Smelter RI was conducted and primarily focused on smelter impacted soils but also included sampling of discrete locations where smelter bag houses, dust chambers, or roasting furnaces may have been located (Walsh and Associates, Inc. [Walsh], 1993). This study was initiated by Asarco and included the Elgin Smelter, Grant/Union Smelter, Western Zinc Smelter, and Arkansas Valley Smelter sites.

A surface water RI (Surface Water RI) of the California Gulch Site was conducted in 1991 and 1992. The final Surface Water RI report was issued in 1996 describing the results of the surface water investigation (Golder and Associates [Golder], 1996a). The study included surface water and sediment sampling in the Arkansas River and its tributaries, including California Gulch.

A groundwater RI (Hydrogeologic RI) at the California Gulch Site was conducted from the fall of 1991 through 1992. The study included installation of monitoring wells and piezometers, water level measurements, and groundwater sampling and analysis. The final Hydrogeologic RI Report describing the results of the investigation was issued in 1996 (Golder, 1996b). Objectives of the study were to investigate groundwater quality and flow directions, evaluate potential impacts to surface water receptors, and characterize background groundwater quality.

In 1993, the EPA conducted a Screening Feasibility Study (SFS) (EPA, 1993) to initiate the overall CERCLA feasibility study (FS) process at the California Gulch Site. The purpose of the SFS was to develop general response actions and identify an appropriate range of alternatives applicable to the various contaminant sources to be considered during feasibility studies for the California Gulch Site. Remedial alternatives retained in the SFS for tailing, flue dust, and non-residential area soils in OU5 for the AV/CZL sites were further evaluated and screened during the focused feasibility study (FFS) (McCulley, Frick & Gilman, Inc. [MFG], 2000).

Asarco entered into a Consent Decree (CD) (U.S. District Court [USDC], 1994) with the United States, the State of Colorado (State), and other PRPs at the California Gulch Site on August 26, 1994. In the CD, Asarco agreed to perform certain remediation work in three operable units (OU5, OU7, and OU9). The Work Area Management Plan, included as Appendix B to the CD (USDC, 1994), defines the scope of work to be performed by Asarco.

In February of 2000, Asarco submitted the *Focused Feasibility Study for Operable Unit 5 Arkansas Valley Smelter and Colorado Zinc-Lead Mill Site* (MFG, 2000), according to the terms of the CD. The FFS provided a detailed analysis of the five retained alternatives from the SFS as applied to tailing, flue dust, and non-residential area soils.

A Proposed Plan describing the EPA's preferred alternative was issued on July 27, 2000. The preferred alternative was Alternative 3, Consolidation/Containment (Flue Dust Repository and Soil Cover).

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Public participation is required by CERCLA Sections 113 and 117. These sections require that before adoption of any plan for remedial action to be undertaken by EPA, the State, or an individual (e.g., PRP), the lead agency shall:

1. Publish a notice and make the Proposed Plan available to the public, and

2. Provide a reasonable opportunity for submission of written and oral comments and an opportunity for a public meeting at or near the site regarding the Proposed Plan and any proposed findings relating to cleanup standards. The lead agency shall keep a transcript of the meeting and make such transcript available to the public. The notice and analysis published under item #1 above shall include sufficient information to provide a reasonable explanation of the Proposed Plan and alternative proposals considered.

Additionally, notice of the final remedial action plan set forth in the ROD must be published, and the plan must be made available to the public before commencing any remedial action. Such a final plan must be accompanied by a discussion of any significant changes to the preferred remedy presented in the Proposed Plan along with the reasons for the changes. A response (Responsiveness Summary) to each of the significant comments, criticisms, and new data submitted in written or oral presentations during the public comment period must be included with the record of decision (ROD).

EPA has conducted the required community participation activities through the presentation of the RI/FS and the Proposed Plan, a 30-day public comment period, a formal public hearing, and the presentation of the Selected Remedy in this ROD. No comments were received during the public comment period. Written comments were received from CDPHE. EPA's response to written comments received during the public comment period is included in the Responsiveness Summary, which is part of this ROD, and is designated Appendix A.

The Proposed Plan for OU5 AV/CZL sites was released for public comment on July 27, 2000. The RI/FS and the Proposed Plan were made available to the public in the Administrative Record located at the EPA Superfund Records Center in Denver and the Lake County Public Library in Leadville. A formal public comment period was designated from July 27, through August 28, 2000.

On August 1, 2000, the EPA hosted a public meeting to present the Proposed Plan for the OU5 AV/CZL sites of the California Gulch Superfund Site. The meeting was held at 7:00 p.m. in the National Mining Hall of Fame and Museum in Leadville, Colorado. Representatives from Asarco presented the Proposed Plan, which discussed the following five alternatives:

- Alternative 1: No Action
- Alternative 2: Containment in Place (Soil Cover)
- Alternative 3: Consolidation/Containment (Flue Dust Repository and Soil Cover)
- Alternative 4: Consolidation/Containment (Flue Dust Repository and GCL/Soil Cover)

- Alternative 5: Consolidation/Containment (Soil Cover) and Excavation/Offsite Disposal

Alternative 3, Consolidation/Containment (Flue Dust Repository and Soil Cover was presented as EPA's preferred alternative. A portion of the public meeting was dedicated to answering questions and accepting formal oral comments from the public. Community acceptance of the Selected Remedy is discussed in Section 10.0, Summary of Comparative Analysis of Alternatives, of this Decision Summary.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

The California Gulch Superfund Site covers a wide area (Figure 2). As with many Superfund sites, the problems at the California Gulch Superfund Site are complex. As a result, EPA established the following OUs for the division of liability in geographically- or media-based areas within the Site. The OUs are designated as:

- OU1 Yak Tunnel/Water Treatment Plant
- OU2 Malta Gulch Fluvial Tailing/Leadville Corporation Mill/Malta Gulch Tailing Impoundment
- OU3 D&RGW Slag Piles/Railroad Easement/Railroad Yard and Stockpiled Fine Slag
- OU4 Upper California Gulch
- OU5 Asarco Smelter/Slag/Mill Sites
- OU6 Starr Ditch/Penrose Dump/Stray Horse Gulch/Evans Gulch
- OU7 Apache Tailing Impoundments
- OU8 Lower California Gulch
- OU9 Residential Populated Areas
- OU10 Oregon Gulch
- OU11 Arkansas River Valley Floodplain
- OU12 Site-Wide Water Quality

The Selected Remedy for OU5 AV/CZL addresses controlling airborne tailing, flue dust, and non-residential area soils particles; erosion; metal loading to surface water and groundwater; and contamination exposure to animals and aquatic life. Remedial actions undertaken within OU5 AV/CZL sites are intended to be consistent with the remedial action objectives and goals identified for the entire California Gulch Superfund Site and other OU investigations.

This decision document makes no determination on whether surface water or groundwater within OU5 AV/CZL requires remediation. Pursuant to the August 26, 1994 CD at this Site (USDC, 1994), it was agreed that the decision on remediation of Site-wide Surface Water and Groundwater (OU12) would be made only after remedies for source remediation were selected and implemented at each OU. As a result, specific water quality goals for Surface Water and Groundwater have not been established at this time.

5.0 SUMMARY OF SITE CHARACTERISTICS

The AV/CZL site is located approximately 1.5 miles southwest of Leadville on the north bank of California Gulch (Figure 3). The combined area of the AV Smelter and CZL Mill sites is approximately 70 acres. All of the AV/CZL site lies above the adjacent 500-year floodplain of lower California Gulch which is included in OU8. The OU5 AV/CZL site is also adjacent to portions of OU3, which includes the AV Smelter slag pile.

The AV Smelter site consists of several features associated with the former smelter and smelter debris and wastes (WCC, 1992a). Most of the larger structures associated with the former smelter were demolished or abandoned after operations ceased in 1961. The smelter-related materials identified at the AV Smelter site consist primarily of demolition debris-brick, concrete, metal, tile, wood and glass - and smaller amounts of slag, coke and charcoal, limestone, ore, matte, tailing, and flue dust. Most of the slag generated by the smelter was placed in an adjacent slag pile that lies within OU3, but slag is also locally present, mixed with soil and debris within the AV Smelter/OU5 boundaries. Also included within the OU5 boundaries of the AV Smelter, but northwest of the former smelter main facility, are a junk yard and a small tailing pile. The junk yard currently contains scrap metal, unused industrial machinery and equipment, vehicles and other large items, which are piled directly on the ground surface. The junk yard is bordered to the east and west by railroad tracks that lead north from the AV slag pile and former AV Smelter facilities. The tailing pile is located between railroad tracks in the northwest portion of the AV Smelter site. The tailing is not associated with the location of any former processing operations and may have been dumped from rail cars as fill material.

At the CZL Mill site the concrete foundations of the mill structure remain; debris associated with the main mill and smaller deposits of tailing, ore and/or waste rock, and possible ore concentrate are also present. Sparsely vegetated tailing mixed with fill and soil are present below the mill site in the area previously described as Fluvial Tailing Site 2 (outside the AV/CZL site). The CZL tailing impoundment (OU8) was removed during the fall of 1995 (EPA, 1995). Tailing was also removed from a portion of Fluvial Tailing Site 2 within the 500 year floodplain, which defines OU8 in 1998.

Several other inactive mining sites are located in close proximity to the AV/CZL site. Approximately 1,000 feet east of the CZL Mill foundations, remnants of a structure reported to be the original Leadville District Mill are visible. These remains include wooden beams and pilings in the hillslope between the railroad grade and California Gulch. Fluvial tailing sites included in OU8 are present in lower California Gulch below the AV/CZL site, and the Hecla/Day Mines Mill and tailing impoundment are located approximately 1/4 mile north of the site within OU2.

5.1 SOURCE MATERIAL DESCRIPTIONS

Residual smelter-and mill-related materials are the primary sources of metals contamination at the site. This section summarizes data obtained through previous investigations to describe the characteristics of these materials and their spatial distribution. Samples have been collected as part of several California Gulch site-wide and AV/CZL site-specific investigations, including the Lead Slag RI (Morrison Knudsen Corporation [MK], 1992), Soils Investigation (Camp Dresser &

McKee, Inc. [CDM], 1994a), Smelter RI (Walsh, 1993a), Smelter Supplemental RI (WESTEC, 1997), and Tailing Disposal Area RI (WCC, 1994).

As discussed in the SFS, two source material types were expected to be present in the AV/CZL site: non-residential area soils and tailing. Subsequent to the SFS report, additional characterization efforts identified flue dust as a different residual smelter material that is sufficiently distinct from other non-residential area soils to warrant a separate classification in the identification and evaluation of remedial alternatives.

5.1.1 AV Smelter Site

Data characterizing the source materials for the AV Smelter site are described in this section.

5.1.1.1 Sources of Data

During the Soils Investigation (CDM, 1994a), eight primary grid points were sampled within the AV Smelter site (PG-058, -059, -067, -068, -077, -078, -079, and -092). Five additional discrete sample points within the AV Smelter site (SO3-004, SO3-005, SO3-006, SO3-007 and SME-143) were sampled during the Smelter RI (Walsh, 1993a). The Soils Investigation and Smelter RI sample locations are shown on Figures 4 and 5.

In 1997, supplemental sampling was performed and targeted different smelter/mill materials present at the site. Samples were collected at a total of 22 locations, as shown on Figure 5. Coke and coal and "mine waste" samples were composited from two or more sampling locations. Samples described as "mine waste" included all materials present at the sampling location, including soil. For the composite samples, the <250 micron size fraction was analyzed for arsenic, cadmium, lead and zinc. In addition, three samples each were subjected to Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leach Procedure (SPLP) testing; those samples were submitted as collected without sieving. Finally, two samples of suspected asbestos-containing material were submitted for analysis by polarized light microscopy to identify the types of fibers present.

Other investigations that provide data pertinent to describing conditions at the AV Smelter site include the Lead Slag RI (MK, 1992) and Metals Speciation Data Report (CDM, 1994b). Four boreholes (AVB101 through AVB104) were drilled through the AV Smelter slag pile (OU3) and into underlying soils as shown on Figure 5. These boreholes provided data describing the thickness of slag, the depth to native soils, and soil types and metals content in soils immediately underlying the slag pile. In addition, the lead speciation study (CDM, 1994b) included three samples (two of smelter material residuals and one of soil) from the AV Smelter site and vicinity and also characterized the typical forms and occurrence of lead in smelter-related materials similar to those at the AV Smelter site.

5.1.1.2 Soil and Source Material Characteristics

The materials present in sampling pits at and near the surface at the AV Smelter site were predominantly heterogeneous fill mixed with residual smelter and mine waste materials, which included slag, waste rock, ore and some tailing. Fill material included soil, brick fragments, charcoal, cinders, metal, glass, lumber/wood fragments, and gravel and cobbles (Walsh, 1993a).

Samples of residual smelter material and fill collected from the former baghouse and flue areas and the roasting area contained the highest metals concentrations. The analytical results for these samples are shown in Tables 1 and 2. These areas were associated with smelter operations that generated or handled flue dust. One sample of flue dust was collected within the former baghouse structure at location SAV12. That sample contained 149,000 milligrams per kilogram (mg/kg) arsenic and 272,000 mg/kg lead, the highest arsenic and lead concentrations measured at the AV Smelter site. At sampling location SO3-004, near the former baghouse structure, arsenic and lead concentrations in the 2 millimeter (mm) size fraction ranged from 1,098 to 3,187 mg/kg for arsenic and from 7,340 to 9,835 mg/kg for lead at depths less than 12 inches below ground surface (bgs). The <250-micron size fraction had much higher arsenic and lead concentrations (up to >7,476 mg/kg arsenic and 55,200 mg/kg lead, Figure 5), indicating that a large proportion of the metals are associated with the fine-grained material in the sample. At sampling location PG-067, near the baghouse and in an area where baghouse debris appears to be present at the ground surface, arsenic concentrations ranged from 140 to 1,230 mg/kg and lead concentrations from 552 to 16,700 mg/kg at depths less than 12 inches bgs.

Although only one sample from the AV Smelter site has been described as flue dust (SAV12), residual flue dust appears to be mixed with other smelter materials, demolition debris and soil in the vicinity of the former baghouse and flues associated with blast furnace and roasting operation.

Near the stack base in the vicinity of the roasting area, a sample collected at location SO3-005 contained black ash and had arsenic concentrations ranging from not detected to 2,149 mg/kg and lead concentrations from 407 to 39,900 mg/kg (Table 2 and Figure 5). At this location, lead concentrations are highest in the top two inches of soil and generally decrease rapidly at depths greater than six inches. At PG-092, located along the alignment of a former dust flue between the roasting area and a second, norther, stack and Cottrel operations, arsenic concentrations ranged from less than 37 to 3,584 mg/kg and lead from 722 to 14,729 mg/kg (Table 2 and Figure 4). Samples collected at SO3-006, located at the base of an older stack near the thaw house/heating plant, were reported by WESTEC to consist primarily of cinders and/or ash for the entire depth interval to 12 inches. At this location, over the 0 to 12 inch depth interval, arsenic concentrations ranged from 290 to 1,325 mg/kg, lead concentrations from 6,649 to 23,700 mg/kg and zinc concentrations from 2,409 to 20,100 mg/kg (Table 2 and Figure 5). The materials collected at SO3-006 contain high lead and zinc concentrations compared to other samples from the site and may contain roasting concentrates (such as matte) which are reportedly enriched in lead and zinc relative to the roasted ore.

Samples collected at SO3-007, SAV22 and PG-068 (Figures 4 and 5), adjacent to the ore bins above the baghouse, had lead concentrations ranging from 9,227 to >77,900 mg/kg, arsenic concentrations from 48 to 5,550 mg/kg and zinc concentrations from 265 to 16,100 mg/kg (Table 3). At locations SO3-007 and SAV-22 lead concentrations remain high to 12 inches below

ground surface, but at PG-068 metals concentrations decrease sharply below two inches. The high lead concentrations relative to the other metals present and relatively lower arsenic concentrations than in flue dust are likely indicative of the presence of residual ore materials, which were transported and stored in this area during smelter operation.

In the other areas, concentrations of one or more metals are not consistently elevated. However, relatively high concentrations of arsenic and lead do occur as local "hot spots" across the site. For example, at PG-059 lead concentrations are relatively high (up to 20,356 mg/kg), but arsenic concentrations were not detectable. PG-059 is located in an area currently used for storing junk and scrap metal on the western edge of the site (Figure 4). At nearby locations SAV23 and SAV24 the lead concentrations are lower (541 to 7,470 mg/kg) and the arsenic concentrations slightly higher (33 to 497 mg/kg) than at PG-059 (Figures 4 and 5).

Analysis of a composite sample (SAV11) from the 0- to 1-inch depth interval at six separate locations across a large area where non-residential area soils (demolition debris mixed with other fill and residual smelter material) is present shows metals concentrations of 290 mg/kg arsenic, 59 mg/kg cadmium, 22,300 mg/kg lead, and 7,870 mg/kg zinc. These metal concentrations represent an average concentration for a random sample of six soils collected from heterogeneous materials at the AV Smelter site and may be representative of average concentrations for non-residential area soils, including mixed soil and residual mine waste and smelter materials, in the western portion of the AV Smelter site. Even after thorough mixing to create a single composite sample, the heterogeneity of these materials is demonstrated by the difference between results obtained from analyses of field duplicates of the composite sample SAV11 (Table 4). A second composite sample (SAV04) was collected from three locations in the northern portion of the western AV Smelter site. Based on the measured arsenic and lead concentrations (Table 4), this material would also be classified as non-residential area soils.

An additional composite sample (SAV19) was collected from material in the western area of the AV Smelter which was visually identified as tailing. The tailing is present between two former rail lines and appears to have been dumped as fill. Metals concentrations (see Figure 5) are relatively low when compared to CZL tailing (see Section 3.2.2 and SMI/TMI, 1995).

For the two samples of suspected asbestos-containing materials submitted for analysis by polarized light microscopy, the results indicate that one of the samples (SAV13) contained no asbestos fibers and the other sample (SAV14) contained approximately 35 percent by volume chrysolite, an asbestos fiber. Sample SAV14 was collected from a suspected transite panel located in the former blast furnace building.

Two soil samples (PG-067, 0- to 1-inch, and PG-068, 0- to 1-inch) and one residual smelter material sample (AVO101) from the AV Smelter site were included in the lead speciation study (CDM, 1994b). As part of that study, the lead-bearing mineral phases in these samples were identified and their relative abundances described. In the sample collected from the area containing baghouse debris, PG-067, a total lead concentration of 8,561 mg/kg was measured and the dominant lead-bearing phases were lead sulfate (anglesite) and lead oxide with lesser amounts of slag, lead sulfide (galena), iron lead oxide and lead arsenate also present. In contrast, the sample from location PG-068, near the ore bins and roasting area, contained 14,926 mg/kg lead with the dominant lead-bearing phases being lead-iron sulfate (plumbojarosite), lead sulfate, lead

sulfide (galena) and iron lead oxide. These phases are typical of lead sulfide ores and their weathering products. A third sample, AVO101-M00, contained predominantly slag that averaged 0.8 percent lead by weight (8,000 mg/kg). The slag contained inclusions of galena, metallic lead, and lead sulfosalt.

As part of the Smelter Supplemental RI (WESTEC, 1997), several samples from the AV Smelter were submitted for leaching tests. Three samples were subjected to the SPLP (EPA Method 1312) and three samples to the TCLP (EPA Method 1311). The results of these tests are provided on Table 5. Only one of the samples tested (SAV12), a sample of flue dust, contained readily leachable metals. The TCLP test results indicate that this material has hazardous leaching characteristics (as defined by 40 CFR Part 261). TCLP results for the two other samples tested (surface soils from near the footprint of the former roasting plant flues and adjacent to the former thaw house, where ores were heated prior to processing) indicate lower leaching characteristics (approximately two to three orders of magnitude for lead and arsenic concentrations than SAV12). SPLP results indicate that non-residential area soils (represented by sample SAV11, which was a composite of six individual samples collected in the western AV Smelter site) has a relatively low potential to leach metals. This sample, which contained 22,300 mg/kg lead, had only 0.52 milligram per liter (mg/L) lead in the SPLP leachate. In addition, a sample of materials visually identified as tailing present between rail lines in the AV Smelter site (SAV19) leached relatively low concentrations of metals; much lower cadmium and zinc concentrations and slightly higher lead and arsenic concentrations resulted from the SPLP testing on tailing compared to non-residential area soils.

In summary, site characterization efforts have resulted in the following principal findings concerning residual smelter/mill materials at the AV Smelter site:

- COCs for the AV Smelter site are arsenic, cadmium, lead and zinc.

- Three types of source materials are identified at the AV Smelter site for the purposes of development and evaluation of remedial alternatives: tailing, flue dust and non-residential area soils. Tailing and flue dust are distinct materials which can be identified by their location with respect to former operations and by visual and chemical characteristics. Non-residential area soils includes a range of other residual smelter and mine waste materials and areas of surface soil with lead or arsenic concentrations above the industrial risk-based action levels possibly due to deposition of air emissions from the smelter during its period of operation.

- The highest concentrations of metals are associated with residual smelter and mine waste materials, which are present at the surface and in near-surface soil, typically in areas where they were managed or stored during smelter operations or in debris resulting from demolition of certain smelter structures.

- Residual flue dust has significantly different characteristics than other residual smelter materials, having higher concentrations of metals, including arsenic and lead and significantly higher potential to release metals to infiltrating precipitation.

- An isolated area of tailing is present between the railroad tracks in the northwest portion of the AV Smelter site. The tailing is not associated with the location of any former processing operations and was likely dumped from rail cars as fill material. Metals concentrations in this material are relatively low compared to tailing at the CZL Mill.

- Asbestos-containing materials may be present in demolition debris from the former blast furnace and roasting areas of the site. Based on visual observations at the site, only a small amount of asbestos-containing materials appears to be present and these materials appear to be limited to the former blast furnace area.

5.1.1.3 Material Volume Estimates

Preliminary estimates of the volumes of flue dust, tailing, and non-residential area soils present at the AV Smelter site were prepared for use in identification and evaluation of remedial alternatives.

Flue dust source materials are estimated to be located in the general vicinity of the former flues and baghouse connected to the blast furnace and the flues and dust collection unit (Cottrell Plant) connected to the roasting plant. These were the principal areas where flue dust was generated and handled during smelter operation. Visual inspection indicates that flue dust is mixed with demolition debris from these structures. Based on the original layout of these smelter structures and visual observations of the extent and thickness of the residual debris, it is estimated that approximately 9,000 cubic yards of flue dust material is present.

A single area of tailing was identified at the AV Smelter site. Based on the observed extent and assumed average thickness of two feet, it is estimated that approximately 3,400 cubic yards of tailing are present in this area.

Non-residential area soils was observed in the majority of the remaining operational areas not identified as flue dust or tailing source areas. In general, the average thickness of the non-residential area soils was estimated to be approximately three feet within main smelter area and approximately 0.5 feet in the uplands rail area and in a small area east of the former blast furnace and roasters. Based on extent and thickness of these materials, it is estimated that approximately 120,000 cubic yards of non-residential area soils are present at the AV Smelter site.

5.1.2 CZL Mill Site

Data characterizing the source materials for the AV Smelter site are described in this section.

5.1.2.1 Sources of Data

The materials present at the CZL Mill site include the mill's concrete foundations and associated demolition debris, residual tailing, and ore from the adjacent rail line area. The mill site is bordered to the south by California Gulch, and mixed soil and tailing are present between the mill foundations and California Gulch.

Three primary grid locations were sampled in the vicinity of the CZL Mill during the Soils Investigation (CDM, 1994a) (PG-134, PG-149 and PG-160 on Figure 6). In 1997, supplemental sampling was performed and targeted different source materials present at the site. Samples were collected at a total of eight locations, as shown on Figure 6. From these eight samples, three composite samples were prepared and analyzed for arsenic, cadmium, lead, and zinc and subjected to SPLP tests. As part of the Tailings Disposal Area RI (WCC, 1994), the chemical composition of tailing present in the CZL tailing impoundment and Fluvial Tailing Site 2 were described, and the SPLP was performed on samples from both the tailing impoundment and fluvial site. The SPLP leachates were analyzed for arsenic, cadmium, lead, and zinc.

A subsequent study of fluvial tailing performed by SMI (Sheppard Miller, Inc. and TerraMatrix, Inc. [SMI/TerraMatrix], 1995) included three samples from Fluvial Tailing Site 2, which were tested for acid-base accounting and AB-EDTA-extractable (i.e., plant available) metals and nutrients. Finally, one sample from the CZL Mill site and two samples collected around the CZL tailing impoundment were included in the lead speciation study (CDM, 1994b).

5.1.2.2 Soil and Source Material Characteristics

The Soils Investigation and Supplemental Smelter RI sample locations are shown on Figure 6. Samples collected during the soils investigation were described as containing imported gravel and mine waste (Walsh, 1993a). The samples collected during the Supplemental Smelter RI are reported as tailing, ore concentrate, and "mine waste" (i.e., mixed residual mill materials and soils on the hillside) samples (WESTEC, 1997). The Tailings Impoundment Area RI (WCC, 1994) evaluated only tailing from the CZL tailing impoundment (OU8).

Results from samples collected at PG-134, located immediately downhill of the mill foundations, indicate that tailing is present to depths greater than 18 inches (see Figure 6). The concentrations of arsenic, cadmium, copper, lead, and zinc remain relatively constant to a depth of 18 inches with average concentrations at this location of no detectable arsenic, 7.7 mg/kg cadmium, 830 mg/kg copper, 17,260 mg/kg lead, and 3,686 mg/kg zinc. Samples were not collected from depths greater than 18 inches.

At PG-149, located on the hillslope adjacent to and east of the mill foundations, the depth of source materials appears shallower. Copper, lead, and zinc concentrations above 12 inches are similar to those measured at PG-134, but they decrease rapidly at greater depth. Samples collected at PG-160, located farther east along the hillslope (in the vicinity of what is presumed to be the original Leadville District Mill site), have generally lower metals concentrations than samples collected in the immediate vicinity of the CZL Mill. At depths to 18 inches below ground surface, metals concentrations range from less than the detection limit to 498 mg/kg arsenic, less than the detection limit to 14 mg/kg cadmium, 9 to 405 mg/kg copper, 58 to 5,874 mg/kg lead and 158 to 799 mg/kg zinc. The highest metals concentrations were generally observed in the upper two inches at this location, but all concentrations are below the action levels established in the BHHRA for a commercial/industrial (worker) exposure scenario.

Results from the three composite samples of surficial soils (0- to 2-inch depth) and residual mining materials collected during the Smelter Supplemental RI (SCZ04, SCZ07, and SCZ11) indicate that, on average, the materials present at the ground surface have lead concentrations

greater than 16,000 mg/kg, zinc concentrations greater than 5,000 mg/kg, arsenic concentrations greater than 210 mg/kg, and cadmium concentrations greater than 100 mg/kg. Based on these concentrations and visual characteristics, these surficial materials are classified as non-residential area soils. SPLP results for these three composite samples (as presented in Table 6) indicate similar leaching characteristics. In general, the samples having relatively high total metals contents produce leachates with the highest metals concentrations.

The chemical compositions of tailing from the CZL impoundment area and from Fluvial Tailing Site 2 were also described as part of the Tailing Disposal Area RI (WCC, 1994). Metals concentrations measured in two tailing samples from the top two feet of Fluvial Tailing Site 2 ranged from 107 to 267 mg/kg arsenic, 13.8 to 17.3 mg/kg cadmium, 9,410 to 10,400 mg/kg lead, and 2,220 to 8,640 mg/kg zinc.

Metals concentrations measured in tailing samples from the former CZL impoundment ranged from non-detectable to 264-mg/kg arsenic, non-detectable to 426 mg/kg cadmium, 2,790 to 20,600 mg/kg lead, and 1,380 to 46,700 mg/kg zinc. SPLP results for 28 samples of tailing indicated maximum metals concentrations in the leachates of 1.31 mg/L arsenic, 1.61 mg/L cadmium, 3.41 mg/L lead, and 210 mg/L zinc. A composite sample of surficial tailing collected from the CZL tailing impoundment and subjected to TCLP testing yielded leachate with an arsenic concentration of 1.31 mg/L, cadmium concentration of 0.48 mg/L, lead concentration of 0.28 mg/L, and zinc concentration of 62 mg/L. These concentrations are generally higher than those observed in SPLP leachate from composite samples of non-residential area soils collected around the mill site. This result suggests that the samples of non-residential area soils collected from around the mill may contain less readily leached forms of metals than the tailing from the CZL Tailing Impoundment.

A sample of tailing from location PG-134 was included in the lead speciation study (CDM, 1994b). The sample was from the 1- to 2-inch depth interval and contained 15,254 mg/kg lead. The dominant lead-bearing phases are lead-iron sulfate and lead sulfate with lesser amounts of iron-lead oxide, lead phosphate, lead carbonate, and lead sulfide. This lead-phase assemblage is typical for tailing which has been subjected to weathering and mineral alteration (Drexler, 1995).

The ability of tailing in the Fluvial Tailing Site 2 area to support vegetation growth was investigated and described as part of the Engineering Evaluation/Cost analysis of the CZL Tailing Impoundment area (SMI/TerraMatrix, 1995). AB-EDTA extractable metals (arsenic, cadmium, copper, lead, and zinc) and nutrients (nitrogen, phosphorus, and potassium) were measured in three composite samples from the site. The results indicate that concentrations of AB-EDTA-extractable macronutrients are deficient to support plant growth. Acid-base accounting procedures were also used to describe the acid generating potential of the tailing. The results indicate that tailing in Fluvial Tailing Site 2 have the potential to generate acid drainage.

In summary, there are fewer types of materials present at the CZL Mill site compared to the AV Smelter site. With the exception of the intact mill foundations, the amount of demolition debris is minor. Tailing is the primary mining-related material present, and some ore and other mining-related material (non-residential area soils) is also present in smaller amounts on the hillside. These materials are generally mixed with native soil or fill.

On average, the tailing has relatively high lead concentrations, and has the potential to release metals at low concentrations to infiltrating precipitation. These materials contain an assemblage of lead-bearing minerals similar to that in impounded tailing and for this reason may have similar leaching characteristics to tailing from the CZL tailing impoundment (and other impoundments in California Gulch) and Fluvial Tailing Site 2. Non-residential area soil is present on the hillside and has lower total and leachable metal concentrations than tailing.

5.1.2.3 Material Volume Estimates

Preliminary estimates of the volumes of tailing and non-residential area soils present at the CZL Mill site were prepared for use in the evaluation of remedial alternatives. Tailing was identified in the small impoundment area south of the mill. Based on the extent of the tailing and an approximate average thickness of four feet, it is estimated that approximately 6,000 cubic yards of tailing are present. Non-residential area soils was identified on the hill slope. Based on the observed extent and an average thickness of one foot, it is estimated that approximately 7,500 cubic yards of non-residential area soils are present.

5.2 GROUNDWATER QUALITY

Monitoring wells and mini-piezometers have been installed adjacent to the lower California Gulch and in surrounding areas to characterize the hydrogeologic conditions of the alluvial aquifer and the nature and extent of groundwater-surface water interactions. The groundwater monitoring locations in the vicinity of the AV/CZL site are shown on Figure 7. The relevant average groundwater quality data collected during these investigations are summarized in Table 7.

Groundwater quality improves between the downgradient end of the CZL Mill area (represented by well CZITMW-8) and well NW-11. Groundwater samples from well NW-11 had a median pH of 6.8, an average sulfate concentration of 199 mg/L, and an average TDS concentration of 461 mg/L. These results compare to a median pH of 5.7, an average sulfate concentration of 2,334 mg/L, and an average TDS concentration of 3,666 mg/L upgradient at CZITMW-8. The concentrations of metals of concern in well NW-11 were typically at or below method detection limits. Some analyte concentrations in groundwater show an increase at NW-8 relative to their concentrations at well NW-11. Median pH and average metal concentrations in monitoring well NW-8 were similar to average concentrations slightly upgradient at well NW-11. However, sulfate and TDS concentrations and conductivity values at well NW-8 were approximately two times greater than their values at upgradient well NW-11. Well NW-8 is located at the upgradient end of Fluvial Tailing Site 8, and tailing may be a source of metals, sulfate, and TDS loading to groundwater in this area.

Farther downgradient, at NW-13 and NW-13A (downgradient of the smelter site), sulfate and TDS concentrations decrease; cadmium and copper concentrations increase; and arsenic, lead, and zinc concentrations show no change relative to groundwater at NW-8. The concentrations of these constituents are higher in groundwater from NW-13A than from NW-13. NW-13A is screened at a shallower depth within the shallow aquifer. Higher constituent concentrations at shallow levels suggest a shallow, or local, source for these parameters.

At NW-12, located approximately 1,000 feet north of well NW-13 in California Gulch and approximately 6,000 feet directly downgradient of the AV Smelter site, metals, TDS, and sulfate concentrations are lower than at any of the California Gulch monitoring locations discussed above. Dissolved arsenic, copper, and lead have not been detected in groundwater from NW-12 (SMI/TerraMatrix, 1997). Although the groundwater quality at NW-13 and NW-13A appears to have been affected by contamination from sources along the axis of California Gulch, groundwater quality at NW-12 is not likely to be affected by sources within California Gulch upgradient of the AV/CZL site. At this time, no metals contamination is evident at NW-12. This condition indicates that any metals leached from sources at the AV Smelter site have not been transported via groundwater flow to NW-12, and because the groundwater flow path from the AV Smelter to NW-13A is similar in distance to the path from the AV Smelter to NW-12, elevated metals concentrations currently observed at NW-13A are probably not due to metals transport from sources at the AV Smelter site.

5.3 SURFACE WATER QUALITY

Surface water flow measurements and water quality samples have been collected at various locations in lower California Gulch to characterize hydrologic conditions and evaluate the effect of potential sources of constituent loading. Surface water data relevant to the AV/CZL sites are summarized below and presented in Table 8.

Along the reach adjacent to the AV/CZL site, surface water flow and quality are monitored at stations CG-4B, CG-4C, CG-5 and CG-6A (Figure 8). CG-4B is located just upstream and CG-4C just downstream of the former CZL Tailing Impoundment area. CG-5 is located approximately 1,000 feet downstream of the confluence of Airport and California Gulches and just upstream of the Leadville Wastewater Treatment Plant. CG-6A is located approximately 2,400 feet downstream of the discharge of the Leadville Wastewater Treatment Plant. Collectively, surface water stations CG-5 and CG-6A monitor California Gulch flow and water quality in the upper portion of Fluvial Tailing Site 8.

Metals concentrations in surface water generally increase from CG-1 to CG-4 due to numerous metals loading sources upstream of the AV/CZL site. However, surface water quality does not degrade significantly and actually improves in some reaches adjacent to and downstream of the AV/CZL site.

Monitoring location CG-4B lies approximately 600 feet upstream of the CZL Mill site and at the downstream end of Fluvial Tailing Site 1. CG-4C is located approximately 1,300 feet farther downstream and at the downstream end of the former CZL tailing area. Water quality data from these two locations indicate a change in average water quality along this reach in terms of generally lower pH and higher total and dissolved metals, sulfate, total dissolved solids (TDS) and total suspended solids (TSS) concentrations at CG-4C compared to CG-4B (under both runoff and baseline flow conditions). The observed changes in water quality may be attributable to inputs from several sources including fluvial tailing (Fluvial Tailing Sites 1 and 2) and the former CZL impoundment.

Between location CG-4C, at the downstream end of the former CZL tailing area, and CG-5, downstream of the AV site and at the upstream end of Fluvial Tailing Site 8, water quality

improves in California Gulch. Monitoring data from these two locations indicate a slight decrease in total and dissolved metals, sulfate and TDS concentrations, no change in TSS, and a slight increase in pH between CG-4C and CG-5.

5.4 LEACHING AND MIGRATION TO SURFACE WATER AND GROUNDWATER

Results of the Hydrogeologic RI (Golder, 1996b) did not identify any of the materials present at the AV/CZL site as sources of groundwater contamination. Based on average source material leaching characteristics, the vertical distance from the potential source materials to the alluvial aquifer, and the attenuating properties of the underlying soils, release of metals and subsequent transport to groundwater is not expected to be a significant migration pathway at the AV Smelter site and over much of the CZL Mill site. In the southern portion of the CZL Mill site, however, groundwater may be in contact or in close proximity with tailing (mixed with soil) and have the potential to leach metals from those materials for subsequent transport via groundwater flow in the alluvial aquifer. If such leaching and transport is taking place its effects are not likely to be distinguishable from the effects of metals release and transport from fluvial tailing located in the same reach (Fluvial Tailing Site 2) of California Gulch.

Potential mechanisms for release of metals to groundwater include: (1) direct contact of leachable smelter-and mill-related materials and contaminated soils by groundwater; (2) leaching of metals from smelter-and mill-related materials and contaminated soils by infiltrating water or surface runoff; and (3) infiltration of surface water containing dissolved metals to groundwater (e.g., infiltration of water from California Gulch to alluvial aquifer).

The depth to groundwater directly beneath the area containing smelter demolition debris and residual mine waste and smelter materials is estimated at more than 50 feet. The thickness of debris and mixed soil and smelter-related materials is not known but is not thought to be more than 10 feet in any portion of the AV Smelter site. Therefore, it is not likely that groundwater in the alluvial aquifer is or will ever be in direct contact with source materials. At the CZL Mill site, the depth to groundwater below the mill site is probably less than 30 feet, and in the southernmost portion of the site, adjacent to lower California Gulch, the depth to groundwater may be as little as one foot below ground surface. The thickness of potential source materials is not known, but tailing may be present at depths greater than one foot in the vicinity of California Gulch. Therefore, direct contact between groundwater and source materials is possible in the southern portion of the CZL Mill site.

At the AV Smelter site, potential source materials include soil and soil mixed with smelter-related materials (slag, ore, tailing, roasting concentrates), flue dust, and demolition debris. Each of the potential source materials has different mineralogic and textural characteristics and resultant leaching potentials in the presence of infiltrating precipitation or runoff. The potential for infiltrating precipitation or surface water runoff to leach constituents of concern from these materials has been preliminarily evaluated using SPLP and column leach procedures. SPLP results for samples of mixed "mine-waste" materials (classified as non-residential area soils in FFS [MFG, 2000]) from the AV Smelter site indicate that these materials are capable of releasing metals to infiltrating precipitation or runoff at low concentrations. In contrast, SPLP results for a sample of flue dust indicate that metals are present in high concentrations and readily leachable forms.

At the CZL Mill site, potential source materials include soil, tailing, and smaller amounts of ore. The leaching potential of these materials was also evaluated with SPLP tests performed on composite samples representing average conditions across the site. SPLP test results indicate that these materials have the potential to release metals at low concentrations. Leaching of tailing produces slightly higher metals concentrations than leaching soils containing residual ore concentrates (non-residential area soils).

The results of leaching tests are consistent with information on the forms of lead present in soils and mine waste materials at the California Gulch Superfund Site (CDM, 1994b; Drexler, 1995; Walsh, 1993b). That information indicates that slag and soil contain relatively less soluble forms of lead and weathered tailing and mine waste piles contain relatively more soluble forms. The types of materials containing relatively leachable forms of lead (e.g., lead sulfate and lead oxides) are flue dust and to a lesser extent tailing, and these are the primary potential sources of metals to groundwater at the AV/CZL site.

Metals released to water migrating downward through soils to groundwater in the alluvial aquifer may be attenuated by adsorption and/or precipitation due to changing chemical conditions (e.g., pH increase). Analysis of soils collected from beneath the AV slag pile (subslag soil) indicate that subslag soils exhibit higher cation exchange capacity than the overlying slag, a property that retards migration of metals to groundwater (MK, 1992). Leaching data for the subslag soil samples indicate that metals in these materials were generally less leachable than from the slag samples (MK, 1992).

5.5 HISTORICAL AND CULTURAL RESOURCES

A cultural resource survey was conducted at the AV Smelter site and the CZL Mill site in 1995, and the results are presented in the *Cultural Resources Investigations of Selected Smelter Sites, Operable Unit 5, California Gulch Superfund Site* (Foothill Engineering Consultants [FEC], 1996) and summarized in the following sections. Cultural features at the AV/CZL site are shown on Figure 9.

5.5.1 AV Smelter Site

A permanent Smithsonian number of 5LK892 was assigned to the AV Smelter site by the Colorado State Historic Preservation Officer (SHPO). The site was reported to be in generally poor condition. Several smaller buildings and structures remained standing, while many large features had collapsed and/or been removed. Significant features are briefly described below.

- Feature 1 - Includes the blast furnace building and the charge house floor/ore house location; the power and blower house; the boiler house; and a safe/vault.
- Feature 2 - The bag house system.
- Feature 3 - Includes the mixing and roasting area and associated features.
- Feature 4 - The ore bins.
- Feature 5 - Stack and flue remains and associated features.
- Feature 6 - Includes a heating plant, coal bin, and four railroad sidings.
- Feature 7 - A concrete arch used to carry the roaster flue across the railroad tracks, identified or known as the Dewey Arch.

- Feature 8 - The base of a large roasting plant stack.
- Feature 9 - A concrete loading platform.
- Feature 10 - A large trash scatter consisting of industrial artifacts, flue fragments, and other miscellaneous items.
- Feature 15 - A small, tall building identified as the Matte Hoist House on the Sanborn Map.

FEC concluded that the site has been adequately mapped, photographed and recorded (FEC, 1996). Based on the survey results, the AV Smelter (site 5LK892) has been subsequently recommended as being eligible for the National Registry of Historic Places (NRHP) as a contributing feature to the Leadville Historic Mining District (LHMD) under NRHP criteria. The SHPO concurred that the AV Smelter is eligible for listing on the NRHP and contributing to the LHMD; therefore, consideration of additional mitigation or investigative activities may be necessary.

5.5.2 CZL Mill Site

A permanent Smithsonian number of 5LK845 has been assigned to the CZL Mill site. The report described the mill by level and identified and described other features at the site. Significant features are briefly described below.

- The concrete mill foundation is mostly intact, but some sections are disintegrating.
- The wooden mill superstructure has been removed.
- Level 1 consists of a cement foundation, slab concrete floors, wooden beam supports and four cement-walled bins.
- Level 2 consists of a cement foundation and flooring, long concrete "lanes" divided with concrete walls, and numerous concrete floorings. Water tanks may have been located in this area.
- Level 3 consists of a concrete foundation, floors and walls, and wooden beam supports.
- Level 4 consists of concrete floors where a wood-frame concentrator crucible was located.
- Level 5 consists of concrete floors/walls, metal pipe, and a loading chute.
- The foundations of the other associated buildings (Feature A - machine shop, Feature B - assay laboratory, and Feature C - transformer house) are extant.
- The wooden transformer house has collapsed.
- Numerous crucibles are located within the assay laboratory.
-

The CZL Mill and associated Features A through C were recommended as being eligible for the NRHP and contributing to the LHMD (FEC, 1996). The site has been adequately mapped, photographed, and recorded (FEC, 1996). The SHPO concurred that the CZL Mill Site is individually eligible for listing on the NRHP and contributing to the LHMD; therefore, additional mitigation or investigative activities may be necessary.

6.0 CURRENT AND POTENTIAL FUTURE LAND USE

The AV/CZL site is located within the Industrial/Mining and Business/Highway zoning districts established by Lake County, but the site is not currently being used for industrial or mining operations. There is one occupied residence within the site. The properties immediately surrounding the site are also zoned for Industrial/Mining uses, and the property adjacent to the southern boundary is currently used for industrial operations. Stringtown, located immediately south of California Gulch within unincorporated Lake County, is the closest residential area.

Future land use of the OU5 AV/CZL sites would be determined by the owners, consistent with local zoning, and subject to institutional controls to maintain the protectiveness of the remedy. As part of the five-year review process, the land use at AV/CZL sites will be monitored and any available plans or proposals for future land use changes will be evaluated.

7.0 SUMMARY OF SITE RISKS

Baseline risk assessments (RA) characterize potential human health and ecological risks at a site based on current conditions (i.e., no action taken at the site). Remedial action is driven in part by the potential for human health or ecological risk; the RA indicates the media and exposure pathways to be addressed. The human health and ecological RAs were conducted for the California Gulch Superfund Site as a whole site and not for the individual OUs. Therefore, the following RA summaries include information pertinent to the OU5 AV/CZL site. Contaminants, receptors, exposure pathways, and baseline risks at OU5 AV/CZL are described below.

7.1 HUMAN HEALTH RISKS

The following human health RAs are pertinent to OU5:

- Weston. 1991. Preliminary Human Health Baseline Risk Assessment for the California Gulch NPL Site, Leadville, Colorado. Prepared by Roy. F. Weston, Inc. for the EPA. December. (Preliminary RA).

- Weston. 1996a. Baseline Human Health Risk Assessment for the California Gulch Superfund Site, Risk to Residents from Lead (Part A). Prepared by Roy. F. Weston, Inc. for the EPA. January.

- Weston. 1996b. Baseline Human Health Risk Assessment for the California Gulch Superfund Site, Risk to Residents from Contaminants Other Than Lead (Part B). Prepared by Roy. F. Weston, Inc. for the EPA. January.

- Weston. 1995a. Baseline Human Health Risk Assessment for the California Gulch Superfund Site, Part C: Evaluation of Worker Scenario and Evaluation of Recreational Scenarios. Prepared by Roy. F. Weston, Inc. for the EPA. April.

The preliminary RA (Weston, 1991) evaluated residential risks from exposure to contaminated media (i.e., soil, waste rock, tailing, etc). The preliminary RA also evaluated potential risks to workers from future exposure to slag, even though the exposure pathway for lead is incomplete. Since the completion of the preliminary RA, several studies were completed that provided additional data on contaminant concentrations and on human and ecological exposures. Additionally, Leadville officials and business leaders expressed concern over possible risks and liabilities associated with commercial and recreational uses within the Site. The final baseline RA (Weston, 1995a, 1996a, and 1996b) was composed of the following three parts:

- Part A Risk to Residents from Lead - evaluated residential risk from exposure to lead;
- Part B Risk to Residents from Contaminants Other than Lead - evaluated risk to residents from exposure to contaminants other than lead; and
- Part C Evaluation of Recreational Scenarios and Evaluation of Worker Scenario - developed in response to community concerns, presented risk-based action levels to determine whether chemical concentrations presented a risk at locations used for commercial, industrial, or recreational purposes.

The following sections summarize the results of these RAs, including media and COCs, exposure assessment, and risk characterization, as they relate to OU5 AV/CZL.

7.1.1 Media and Contaminants of Concern

Potential media of concern in OU5 include tailing, flue dust, and non-residential area soils at the AV/CZL sites. Results of the preliminary RA (Weston, 1991) and the final RA (Weston, 1996) indicate that human receptors are expected to have minimal exposure to slag. Both the preliminary and final RA indicate that soil is the medium of concern for human exposure. Arsenic and lead were used as indicator contaminants for risk in the final RA (Weston, 1995a). These chemicals were selected based on the results of the preliminary RA (Weston, 1991), which indicate that lead and arsenic are responsible for the majority of human health risks at the California Gulch Superfund Site.

7.1.2 Exposure Assessment

Residential use of OU5 is currently limited to one residence, and future residential use is not expected. If residential use of OU5 occurs in the future, site risk would need to be reevaluated. Otherwise, the AV/CZL sites are currently vacant. Commercial, industrial, and recreational uses are expected at OU5. Therefore, receptors of concern at OU5 are commercial and industrial workers and recreational visitors.

The preliminary RA identified potential primary sources of metals of concern, the mechanisms of releases to the environment, and receptors in a conceptual site model as shown in Figure 10. A conceptual site model was also created for residential use (specifically, exposure to children) and is shown in Figure 11. The final RA identified soil ingestion as the exposure pathway of concern for recreational visitors; ingestion of soil and dust was identified as the exposure pathway of concern for commercial/industrial workers. Exposure to other media (e.g., tailing, waste piles) and exposure to soil/dust through other pathways (e.g., dermal) are considered of insignificant concern for workers and recreational users (Weston, 1991).

7.1.3 Risk Characterization

The final RA (Weston, 1996) developed risk-based action levels for lead and other metals. As described above, arsenic and lead are responsible for the majority of human health risk at the California Gulch Superfund Site. The action levels developed in the final RA represent risk-based chemical concentrations, which are protective of human health and can be compared to contaminant concentrations in soil to identify areas of potential concern to commercial/industrial workers, recreational visitors, or residents. The action levels should be compared to the average concentration across the exposure area; they do not represent maximum allowable concentrations (i.e., concentrations not to be exceeded). The action levels, presented as a range, represent the low and high values calculated based on the uncertainties and variations of the exposure parameters.

For commercial/industrial exposure, the soil action level for lead ranged from as low as 2,200 mg/kg to as high as 19,100 mg/kg, which is based on the widely varying exposure parameters, with central tendency values in the 6,100 to 7,700 mg/kg range. Soil action levels for arsenic

based on commercial/industrial exposure ranged from 330 to 1,300 mg/kg, which is based on the widely varying exposure parameters, with central tendency values in the 610 to 690 mg/kg range.

For recreational exposure, the soil action level for lead ranged from as low as 5,000 mg/kg to as high as 85,000 mg/kg, depending on the input parameters. The lead concentration for recreational exposure was 16,000 mg/kg, which is the action level calculated in the RA (Weston, 1995a). For arsenic, soil action levels for recreational exposure ranged from 1,400 to 3,200 mg/kg based on carcinogenic and systemic effects, respectively. The most appropriate arsenic concentration for use as a recreational action level was 1,400 mg/kg, based on the potential for carcinogenic effects.

For residential exposure, the soil action levels are 3,500 mg/kg for lead and 120 to 340 mg/kg for arsenic. The arsenic action level is presented as low and high range because of a number of uncertain parameters (e.g., ingestion rate for soil, ingestion rate for dust, the contribution of soil to dust, the uptake of metals into vegetables, and the ingestion rate of home-grown vegetables).

The action levels are summarized below:

COC	Soil Action Levels, mg/kg		
	Residential	Commercial/Industrial	Recreational
Lead	3,500	6,100 - 7,700	16,000
Arsenic	120 - 340	610 - 690	1,400 - 3,200

At the AV Smelter site, the arsenic and lead action levels for industrial workers were exceeded in several individual surface samples. The action levels for recreational exposure were exceeded only in certain areas. The highest metal concentrations were measured in flue dust and other residual mine waste and smelter materials in the main smelter area. At the CZL site, the industrial worker action level for arsenic was not exceeded in grab samples but was exceeded in one composite sample of tailing, and the industrial worker action level for lead was routinely exceeded in near surface source materials.

7.2 ECOLOGICAL RISKS

Baseline RAs characterizing ecological risks at OU5 consist of:

- Weston. 1995b. Final Baseline Aquatic Ecological Risk Assessment, California Gulch NPL Site. (BARA).
- Weston. 1997. Ecological Risk Assessment for the Terrestrial Ecosystem, California Gulch NPL Site. Leadville, Colorado. (ERA).

The BARA (Weston, 1995b) characterizes the impacts of mine waste contamination on the aquatic ecosystem of the California Gulch Superfund Site. The BARA provides a conceptual

model of exposure at the California Gulch Superfund Site for aquatic receptors and identifies surface water and sediments as the exposure pathways of concern as these media are the most direct and significant means of exposure for receptors (see Figure 12). Data in the BARA were evaluated by sampling location rather than by OU.

Potential risks to the terrestrial ecosystem from mine waste contamination are characterized in the ERA (Weston, 1997). The EPA provides a conceptual site model for terrestrial receptors at the California Gulch Superfund Site and is shown in Figure 13. In the ERA, the potential for adverse effects was evaluated on a station by station basis and on an OU basis.

7.2.1 Media and Contaminants of Concern

The BARA (Weston, 1995b) identifies the potential for adverse effects to the aquatic ecosystem due to mine waste contamination and evaluates the ecological risks prior to and subsequent to the commencement of operations of the Yak WTP. Data from surface water and sediment sampling events in 1991 were used to represent the period prior to operation of the WTP, and data collected from 1992 to 1994 were considered for the time period subsequent to initiation of water treatment by the WTP. Contaminants evaluated in the BARA consist of aluminum, antimony, arsenic, barium, cadmium, copper, iron, lead, manganese, nickel, selenium, and zinc.

Media evaluated in the ERA included sediment, waste rock, surface soil, slag, tailing, and surface water; the media of concern varied by OU. For OU5, the ERA evaluated tailing, flue dust, and non-residential area soils as the media of concern. Only data from the top two inches of media were evaluated in the ERA. Contaminants evaluated in the ERA consisted of antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, manganese, mercury, silver, thallium, and zinc. The primary COCs at OU5 AV/CZL are arsenic, cadmium, lead, and zinc.

7.2.2 Exposure Assessment

The BARA (Weston, 1995b) evaluated ecological receptors typical of those present or historically present at the California Gulch Superfund Site, consisting of aquatic plants, benthic macroinvertebrates, and fish (primarily trout species). The potential exposure pathways for aquatic receptors were ingestion of surface water, sediments, and dietary items, and direct contact with surface water, sediments, and modeled concentrations of dissolved contaminants in sediment pore water. Only the direct contact pathways were evaluated quantitatively.

An initial screening-level assessment was conducted based on data from individual sampling sites and from entire OUs. Metals concentrations were measured in tailing piles, mine waste piles, slag piles, surface soils, surface waters, and fluvial sediments. These media were considered likely pathways of exposure to biological receptors that would or could occur in the upland and/or wetland areas present in the Leadville area. The potential receptors in upland terrestrial habitats that were included in the risk assessment were bald eagle, red-tailed hawk, mountain bluebird, mule deer, least chipmunk, blue grouse, American kestrel, soil fauna (soil dwelling invertebrates), and plants.

The exposure pathways evaluated in the ERA consisted of direct exposure to contaminated media, incidental ingestion of contaminated media, and indirect exposure through the food chain.

Contaminant intakes for the receptors evaluated were based on exposure assumptions such as food ingestion rates and body weight.

The ERA used the 95 percent upper confidence limit of the arithmetic mean (UCL) of contaminant concentrations in media to evaluate exposure and risks for each OU. If the maximum contaminant concentration was less than the 95 percent UCL, the maximum was used as the exposure point concentration.

7.2.3 Risk Characterization

The ERA (Weston, 1997) reviewed toxicological literature to derive acceptable contaminant intake values for birds and mammals. Resulting benchmark values, referred to as Toxicity Benchmark Values (TBV), were compared to calculated contaminant intakes for upland and riparian receptors.

To estimate risks, the ERA divided estimated intake by the TBV to derive a hazard quotient (HQ). Contaminant intakes greater than TBVs (HQ greater than one) indicated the potential for toxicity to the receptor.

HQs were calculated from metals concentrations at several locations within the AV Smelter site. The HQs for arsenic ranged from 0 to 219 and were highest for terrestrial plants and mountain blue bird. The HQs for lead ranged from 0 to 1,265 and were highest for mountain bluebird and least chipmunk. Hazard quotients for cadmium, copper, and zinc were also calculated at selected locations. The HQs for cadmium and zinc generally exceeded 1 for all receptors except mule deer, whereas the HQs for copper typically were less than 1 for all potential receptors except for plants and soil fauna. At the CZL Mill, HQs were calculated from metals concentrations at four locations. The HQs for arsenic ranged from 0 to35 and were highest for terrestrial plans and mountain bluebird. The HQs for lead ranged from 0 to 489 and again were highest for mountain bluebird and least chipmunk. Hazard quotients for cadmium, copper, and zinc were also calculated, and the HQs for cadmium and zinc were less than one for all receptors except mountain bluebird and plants. The HQs for copper exceeded 1 for bald eagle, mountain bluebird, plants, and soil fauna. These results confirm that certain sources at the AV/CZL sites have metals concentrations that represent potential risk to terrestrial ecological receptors due to direct contact.

7.3 SUMMARY OF RISKS/BASIS OF ACTION

The response action selected in this ROD for OU5 AV/CZL is warranted to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment and of pollutants or contaminants that may present an imminent and substantial endangerment.

8.0 REMEDIAL ACTION OBJECTIVES

This ROD was prepared according to EPA guidance (EPA, 1989). The remedy outlined in this ROD is intended to be the final remedial action for the OU5 AV/CZL sites. The primary objectives of the remedy for tailing, flue dust, and non-residential area soils presented in this ROD are as follow. EPA has included protection of human health because an existing residential use has been identified at the AV site.

Tailing

- Control airborne transport of tailing particles;
- Control erosion of tailing into local water courses;
- Control leaching and migration of metals from tailing into surface water; and
- Control leaching and migration of metals from tailing into groundwater.

Flue Dust

- Control airborne transport of flue dust particles;
- Control erosion of flue dust and deposition into local water courses;
- Control release and migration of metals from flue dust into surface water;
- Control leaching and migration of metals from flue dust into groundwater; and
- Control contamination exposure to humans, animals and aquatic life.

Non-residential Area Soils

- Control airborne transport of contaminated materials;
- Control erosion of contaminated materials and deposition into local water courses;
- Control leaching and migration of metals from soils into surface water;
- Control leaching and migration of metals from soils into groundwater; and
- Control contamination exposure to humans, animals, and aquatic life.

Residential Area Soils

- Prevent direct exposure of the population to elevated concentrations of contaminants in the surficial soil.

The effectiveness of the remedial action alternatives were evaluated with respect to these RAOs. Remedial actions undertaken within OU5 AV/CZL sites are consistent with the remedial action objectives and goals identified for the entire California Gulch Superfund Site.

9.0 DESCRIPTION OF ALTERNATIVES

A brief description of the five cleanup alternatives that were considered in the FFS for the OU5 AV/CZL sites (MFG, 2000) and the Proposed Plan (EPA, 2000) is provided below.

9.1 ALTERNATIVE 1 - NO ACTION

Estimated capital and operating cost: $0
Implementation time: Immediate

The no action alternative provides a baseline for the evaluation of other alternatives in accordance with the NCP. No protective or remediation measures would be taken for the no-action option. In general, the no-action alternative may be viable if constituent concentrations are below remedial action levels. This alternative may also be appropriate for materials or soils, which do not pose unacceptable risks to human health or the environment, when implementation of remedial actions creates a greater risk or when the cost of remediation is excessive when compared to the risk reduction achieved.

9.2 ALTERNATIVE 2 - CONTAINMENT IN PLACE (SOIL COVER)

Estimated capital and operating cost: $3,600,000
Implementation time: 2 years

Under this alternative, the tailing, non-residential area soils, and flue dust would be covered in place with a protective soil cover. The approximate surface area of the soil covers at the AV Smelter and CZL Mill site would be approximately 50 and 5.4 acres, respectively. Limited grading would occur to allow construction of a suitable cover and to control surface water runoff. The principal components of Alternative 2 are as follows:

- All smelter structures within the remediation area of the AV Smelter site except the easternmost of the two ore bins, the base of two smelter smoke stacks, and the concrete (Dewey) arch would be demolished to grade. At the CZL Mill site, non-residential area soils and other mine waste would be removed from the mill foundations, which will remain in place. Any salvageable demolition debris, such as metal, would be relocated to a designated location in the southwest junkyard area. Debris that does not have salvage value would be contained under the cover installed for the non-residential area soils. Prior to demolition, each of the structures would be evaluated by a certified asbestos inspector to identify any asbestos containing materials, which would be removed and/or disposed in accordance with state and federal requirements.

- Limited site grading would be performed to promote positive surface water drainage and to eliminate steep slopes or other features that would make installation of the soil cover difficult. During regrading, any large pieces of demolition debris which do not have salvage value and cannot be further reduced would be placed as fill along the toe of the hill slope near the former blast furnace and covered. In addition, any tailing in contact with groundwater in the southern

portion of the CZL Mill site would be excavated and consolidated uphill, to the north, prior to covering.

- An 18-inch thick soil cover would be placed over all tailing, non-residential area soils, flue dust, and smelter demolition debris at the AV Smelter site and tailing and non-residential area soils at the CZL Mill site. Soil for the cover would be excavated from a designated borrow area near the Hecla/Malta Gulch Tailing Impoundment (OU2) property and would be transported to the site via a temporary haul road. Best engineering practices would be implemented to control any impact and comply with ARARs. Sampling to support remedial design would be performed to further delineate areas where metals concentrations exceed the risk-based action levels and would require covering.

- Dust monitoring and engineering controls would be implemented during activities that could potentially disturb the tailing, non-residential area soils, or flue dust. Conventional dust control measures including water sprays, placement of clean gravel over haul roads, and surfactant sprays could be used, as required, based on air quality monitoring results.

- Upon completion of grading and soil-cover activities, the soil cover would be revegetated to enhance erosional stability and further reduce infiltration of water through the cover by promoting evapotranspiration. If soil amendments are necessary to promote revegetation, those amendments would be made during placement of the cover and prior to revegetation.

- An operations and maintenance (O&M) program will be developed during the remedial design. O&M activities would involve inspection and maintenance of the cover and surface water controls. The site will be inspected for evidence of erosion, differential settlement of the cover, and vegetation.

- Institutional Controls such as deed notices or deed restrictions to provide notification that a barrier is in place, and to restrict land use to protect the integrity of the remedy would be implemented in the cover areas. Lake County and/or City of Leadville zoning ordinances would be modified to create a zoning "overlay district" to provide a screening process to identify properties where special precautions or requirements may be necessary. Restrictions and requirements from the overlay district would be placed on land use activities outside the cover areas. Land use and plans/proposals for future land use at each site would be monitored and evaluated by EPA as part of the five-year review process.

One occupied residence has been identified within the site. Asarco will offer the existing resident services and cleanup consistent with the procedures, requirements, and standards of the Lake County Community Health Program (LCCHP) during the remedial design for OU5. If and when future remediation occurs for the current resident, Asarco would conduct or fund the response activities consistent with the procedures and requirements of LCCHP. These activities would be funded by Asarco separate from the LCCHP trust fund.

9.3 ALTERNATIVE 3 - CONSOLIDATION/CONTAINMENT (FLUE DUST REPOSITORY AND SOIL COVER)

Estimated capital and operating cost: $3,250,000
Implementation time: 2 years

Under this alternative, the flue dust would be consolidated into a single-lined, fully encapsulated repository and the tailing and non-residential area soils would be consolidated and covered with 18 inches of soil. The approximate surface area of the flue dust repository is less than one acre. The approximate surface area of the soil covers at the AV Smelter, which includes the flue dust repository, and CZL Mill site would be approximately 10.5 and 2.25 acres, respectively. The principal components of Alternative 3 are as follows:

- Demolition and salvage of the structures would be conducted as described in Alternative 2..

- The flue dust would be excavated and relocated to a lined repository constructed into the hill slope west of the former baghouse structure or other suitable on-site location. The repository would be lined with a fully-encapsulating 40-mil to 60-mil thick geomembrane liner protected by an 18-inch thick vegetated soil cover. The location and extent of flue dust requiring excavation would be determined by a sampling and analysis program in support of remedial design. In addition, three groundwater wells (one upgradient and two downgradient of the repository) would be installed and monitored periodically.

- Limited site grading would be conducted to promote positive surface water drainage, stabilize any excavated slopes, and facilitate installation of the soil covers.

- The tailing and non-residential area soils located at the AV Smelter site would be consolidated near the former blast furnace and baghouse and covered with an 18-inch thick soil cover. At the CZL Mill site, the non-residential area soils would be consolidated on top of the tailing at the base of the slope and the tailing and non-residential area soils would be covered with an 18-inch thick soil layer. Soil for the covers would be obtained and transported as described for Alternative 2. Best engineering practices would be implemented to control any impact and comply with ARARs. Diversion ditches would be constructed upgradient of the covered areas to prevent stormwater from running onto the covered areas. Excavated areas and the soil cover would be revegetated, with soil amendments as necessary, to reduce the potential for soil erosion and further reduce infiltration through the soil cover.

- Dust monitoring and engineering control measures would be implemented during activities that could potentially cause fugitive dust emissions, as described for Alternative 2.

- An O&M program will be developed during the remedial design. O&M activities would involve inspection and maintenance of the cover and surface water controls. The site will be inspected for evidence of erosion, differential settlement of the cover, and adequacy of vegetation.

- Institutional Controls such as deed notices or deed restrictions to provide notification that a barrier is in place, and to restrict land use to protect the integrity of the remedy would be implemented in the cover areas. Lake County and/or City of Leadville zoning ordinances would be modified to create a zoning "overlay district" to provide a screening process to identify properties where special precautions or requirements may be necessary. Restrictions and requirements from the overlay district would be placed on land use activities outside the cover areas. Land use and plans/proposals for future land use at each site would be monitored and evaluated by EPA as part of the five-year review process.

  One occupied residence has been identified within the site. Asarco will offer the existing resident services and cleanup consistent with the procedures, requirements, and standards of the LCCHP during the remedial design for OU5. If and when future remediation occurs for the current resident, Asarco would conduct or fund the response activities consistent with the procedures and requirements of LCCHP. These activities would be funded by Asarco separate from the LCCHP trust fund.

9.4 ALTERNATIVE 4 - CONSOLIDATION/CONTAINMENT (FLUE DUST REPOSITORY AND GCL/SOIL COVER)

Estimated capital and operating cost: $4,300,000
Implementation time: 3 years

Alternative 4 would include all of the components of Alternative 3, except a geosynthetic clay liner (GCL) would be installed beneath the soil cover that is placed on top of the consolidated tailing and non-residential area soils. The GCL would be covered by a geonet drainage layer to direct any surface water infiltrating through the soil cover away from the liner. The approximate surface area of the flue dust repository is less than one acre. The approximate surface area of the soil covers with the GCL at the AV Smelter, which includes the flue dust repository, and CZL Mill site would be approximately 10.5 and 2.25 acres, respectively. The material excavation and consolidation areas would be the same as for Alternative 3.

9.5 ALTERNATIVE 5 - CONSOLIDATION/CONTAINMENT (SOIL COVER) & EXCAVATION/OFF-SITE DISPOSAL

Estimated capital and operating cost: $15,400,000
Implementation time: 2 years

Under this alternative, flue dust would be excavated and disposed at an off-site hazardous waste facility, tailing would be excavated and disposed at the Apache Tailing Impoundments (OU7) within the California Gulch Superfund Site, and non-residential area soils would be consolidated

and covered with a soil cover of the same type as described for Alternative 3. The approximate surface area of the soil covers at the AV Smelter and CZL Mill site would be approximately 10.5 and 2.0 acres, respectively. The principal components of Alternative 5 are as follows:

- Demolition and salvage of the structures would be conducted as described in Alternative 2. Debris that does not have salvage value would be contained under the cover with the non-residential area soils.

- The flue dust would be excavated and transported to an off-site hazardous waste treatment, storage and disposal facility (TSDF). As with previous alternatives, a sampling and analysis program to support remedial design would be performed to identify the extent of flue dust. At the TSDF, the flue dust would be treated by stabilization, as necessary to allow land disposal.

- The tailing at the AV Smelter site and the tailing at the CZL Mill site would be excavated and transported by truck to the Apache Tailing Impoundments (OU7) located within the California Gulch Superfund Site. The excavated tailing would be managed under the OU7 remedial actions. Excavated areas at the AV/CZL site would be revegetated, with soil amendments as necessary, to reduce the potential for soil erosion.

- Once flue dust and tailing are removed, the non-residential area soils at the AV Smelter site would be consolidated in the vicinity of the former blast furnace and baghouse. The consolidation area would cover approximately the same footprint identified in Alternatives 3 and 4 for the repository and consolidation area. The non-residential area soils at the CZL Mill site would be consolidated along the toe of the slope and covered. Areas excavated to consolidate the non-residential area soils and the soil cover would be revegetated, with soil amendments as necessary, to reduce the potential for soil erosion and further reduce infiltration through the soil cover.

- Dust monitoring and engineering control measures would be implemented during activities which could potentially cause fugitive dust emissions as described for Alternative 2.

- An O&M program will be developed during the remedial design. O&M activities would involve inspection and maintenance of the cover and surface water controls. The site will be inspected for evidence of erosion, differential settlement of the cover, and adequacy of vegetation.

- Institutional controls similar to those described under Alternative 2.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 300.430(e)(9) of the NCP requires that the EPA evaluate and compare the remedial cleanup alternatives based on the nine criteria listed below. The first two criteria, (1) overall protection of human health and the environment and (2) compliance with applicable or relevant and appropriate requirements (ARAR), are threshold criteria that must be met for the Selected Remedy. The Selected Remedy must then represent the best balance of the remaining primary balancing and modifying criteria.

10.1 NCP EVALUATION AND COMPARISON CRITERIA

10.1.1 Threshold Criteria

1. Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or Institutional Controls.

2. Compliance with ARARs addresses whether or not a remedy will comply with identified federal and state environmental and citing laws and regulations.

10.1.2 Primary Balancing Criteria

3. Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

4. Reduction of toxicity, mobility, and volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

5. Short-term effectiveness addresses the period of time needed to complete the remedy and any adverse impact on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability refers to the technical and administrative feasibilities of a remedy, including the availability of materials and services needed to carry out a particular option.

7. Cost evaluates the estimated capital costs, O&M costs, and present worth costs of each alternative.

10.1.3 Modifying Criteria

8. State acceptance indicates whether the State (CDPHE), based on its review of the information, concurs with, opposes, or has no comment on the preferred alternative.

9. Community acceptance is based on whether community concerns are addressed by the Selected Remedy and whether or not the community has a preference for a remedy.

10.2 EVALUATING THE ALTERNATIVES WITH THE NCP CRITERIA

This section summarizes the evaluation of the OU5 AV/CZL alternatives against the nine NCP criteria. The following subsections are a brief summary of the evaluation and comparison of the alternatives against each criteria. Additional details of the evaluation of the alternatives are presented in the FFS. Table 9 provides a comparison of the five remedial action alternatives and the nine NCP criteria. Information for this section was obtained from the FFS for OU5 AV/CZL (MFG, 2000).

10.2.1 Overall Protection of Human Health and the Environment

This criterion is based on the level of protection of human health and the environment afforded by each alternative. Alternatives 2, 3, 4, and 5 considered in the comparative analysis meet the requirements of the RAOs and provide overall protection of human health and the environment by covering or removing the source materials to prevent direct contact, control erosion and airborne transport, and minimize the potential for metals transport to groundwater and surface water.

Alternatives 3 and 4 would provide essentially an equal level of long-term protection with respect to preventing direct contact, metals transport to surface water, and preventing airborne transport by covering the source materials present at the site. Alternative 2 would provide less long-term protection because the flue dust would only be protected by a soil cover. Given the industrial site setting, covers would expected to be effective over the long-term. Alternative 5 would provide a slightly higher level of long-term protection, because flue dust and tailing would be removed from the site. Alternatives 3, 4, and 5 would also have advantages over Alternative 2 in that the area of cover would be substantially reduced by consolidation and/or material removal, which would allow unrestricted industrial use over the majority of the site.

In terms of minimizing metals transport from the materials, the focus of remedial actions is on flue dust, which has substantially higher leaching potential than non-residential area soils and tailing. Alternative 2 has the lowest performance, because it would entail covering flue dust in place with a simple soil cover, which would reduce infiltration by approximately 72 percent of current conditions. Placing the flue dust in a fully-encapsulated lined repository (Alternatives 3 and 4) would more significantly reduce infiltration through the material (estimated reduction by 99.99 percent of current conditions) and subsequently reduce the potential for metals to leach and be transported to groundwater. Alternative 5 would remove the flue dust from the site and eliminate the potential for release of metals; however, given the high performance of the repository system, removal would not be expected to result in a measurable difference in metals migration.

For tailing, which has a low to moderate potential to release metals to infiltrating water, covering with soil (Alternative 2) is estimated to reduce infiltration by 72 percent of current conditions, consolidating and covering with soil (Alternative 3) by 81 percent, consolidating and covering with GCL/soil (Alternative 4) by 97 percent, and removal (Alternative 5) would eliminate infiltration through tailing at the site. The principal potential future transport pathway from tailing

is likely to be erosion and subsequent transport to surface water. Covering tailing would control this transport pathway and provide protection of the environment.

Non-residential area soils has a minimal potential to release metals to infiltrating water. Consolidating and covering these materials with soil (Alternative 3) provides a significant reduction in infiltration by 93 percent of current conditions.

With respect to risks to the community and workers during implementation of remedial actions, Alternatives 2, 3, and 4 would entail essentially the same low potential for risk which could be controlled by standard construction and dust control practices. Alternative 5 would entail an increased risk due to the truck transportation of flue dust to an off-site disposal facility and of tailing to the Apache Tailing Impoundments (OU7).

Overall, the highest level of protection of human health and the environment would be provided by Alternatives 3 and 4, which prevent direct contact with source materials and minimize the potential for migration of metals to groundwater, surface water, and air. Alternative 2 has a lower performance, because covering in place would result in a smaller reduction of infiltration through flue dust and it would also be less desirable because the majority of the site would be covered and require long-term management to maintain the remedy. Alternative 5 has a lower performance than Alternatives 3 and 4, because the truck traffic required to move tailing within the California Gulch site and to transport flue dust to an off-site hazardous waste landfill would result in higher potential risks to commercial/industrial workers and the community during implementation.

10.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

All of the remedial alternatives considered in this comparative analysis would be expected to achieve the pertinent chemical-, location-, and action-specific ARARs presented in Tables 10 through 12. A potential difficulty is associated with off-site disposal of flue dust with Alternative 5. If flue dust is determined to be characteristically hazardous prior to disposal (this is highly probable based on existing site data), RCRA Land Disposal Restrictions (LDR) require that it meet specific treatment standards based on best demonstrated available technology before it is placed in either an on-site or off-site landfill. Flue dust is not considered part of the Beville exemption. Discussions with a local disposal facility, which currently receives similar material from copper smelting operations, indicate that the potential to treat flue dust from the AV Smelter would be marginal, depending on specific chemical and physical characteristics.

10.2.3 Short-Term Effectiveness

Alternatives 2, 3, and 4 provide essentially the same high level of short-term effectiveness. Risks to the community and workers during the implementation of these alternatives would be low and could be controlled by standard construction and dust control practices. Alternative 5 would entail an increased risk due to the truck transportation of flue dust to an off-site disposal facility and of tailing to the Apache Tailing Impoundments (OU7). Approximately 450 semi-truck trips would be needed to transport the flue dust to the disposal site. Using the 1997 highway accident rate statistics, it is estimated that the transportation of flue dust to the disposal facility would entail a 22 percent probability of an injury accident and a one percent probability of a fatality due

to increased truck traffic (MFG, 2000). Therefore Alternative 5 has a lower performance against the criterion of short-term effectiveness than Alternatives 2, 3, and 4.

10.2.4 Long-Term Effectiveness and Permanence

Alternatives 2, 3, 4, and 5 would provide long-term protection of human health and the environment by covering or removing the source materials to prevent direct contact, control erosion and airborne transport, and minimize the potential for metals transport to groundwater and surface water. Given the current site setting, implementation of Institutional Controls to maintain the integrity of covers over flue dust, tailing and non-residential area soils is expected to be effective over the long term. Alternatives 3 and 4 provide a higher level of long-term protection over Alternative 2 because the materials would be consolidated and the flue dust would be contained in a fully-encapsulated repository to substantially reduce the potential for release of metals and provide a high safety margin for protection of groundwater. Alternatives 3 and 4 would also provide advantages due to the reduction of the cover area by consolidating materials. This would open up the majority of the site for industrial use subject to institutional controls.

Consolidation and covering with soil (Alternative 3) is predicted to reduce infiltration through non-residential area soils by 93 percent of current conditions and through tailing by 81 percent of current conditions. Consolidation and covering with soil (Alternative 4) is predicted to reduce infiltration through non-residential area soils by 99.99 percent of current conditions and through tailing by 97 percent of current conditions. Since non-residential area soils and tailing have not been identified as significant sources of metals to subsurface soils or groundwater, the long-term performance of Alternatives 3 and 4 in controlling metals release due to infiltration would be essentially the same. Addition of a GCL to the cover system (Alternative 4) would not be expected to provide a measurable increase in protection of the environment even though there is 16 percent difference in the additional reduction in infiltration through tailing by adding the GCL. Removal of flue dust and tailing (Alternative 5) would eliminate the potential for risk or metals transport from these materials, but is not expected to provide a measurable increase in overall long-term protection over Alternatives 3 and 4.

10.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

No treatment processes are being considered to reduce toxicity, mobility, or volume of source materials that will remain on-site. Alternative 5 may require treatment of the flue dust if it has been determined to have hazardous waste characteristics by TCLP testing; this treatment would reduce toxicity and mobility of the flue dust.

10.2.6 Implementability

Alternatives 2, 3, and 4 could be readily implemented with available equipment and personnel using generally standard construction methods. Each of these alternatives would require the cooperation of the current landowner to allow Institutional Controls to be placed on the cover areas. However, the area requiring controls would be significantly reduced by the source material consolidation components of Alternatives 3 and 4, opening up the majority of the site for industrial use subject to institutional controls, and therefore these have a higher performance than Alternative 2. Alternative 5 would be moderately difficult to implement, primarily due to

potential problems with the disposal facility being able to treat the flue dust to meet LDR requirements. If LDRs cannot be met, a treatment variance would be required prior to transporting the flue dust off-site. Administrative procedures for obtaining a treatment variance would be time consuming and would likely delay the remediation, possibly by one to two years, depending on the outcome of the technical and administrative steps required because sequencing requires flue dust to be removed prior to grading and covering non-residential area soils at the AV Smelter site. In addition, it is possible that the disposal facility would accept the flue dust, based on the characteristics of samples provided, but would not be able to treat the actual material delivered if it contained higher levels of leachable metals. The facility contacted has indicated that slight variations in the nature of the copper smelting byproduct that they are currently receiving has significant effects on their ability to stabilize it. Due to these concerns, Alternative 5 has a lower overall level of performance than Alternatives 3 and 4 against the criterion of implementability.

10.2.7 Cost Analysis

The estimated present worth costs for the alternatives, not including the No Action alternative, range from $3.6 million for Alternative 2 to $15.4 million for Alternative 5.

Alternatives 3 and 4 provide essentially the same level of overall protection of human health and the environment. However, Alternative 4 would entail higher costs (approximately 32 percent more) than Alternative 3 and, therefore, Alternative 3 would be more cost-effective.

10.2.8 State Acceptance

The State has been consulted throughout this process and concurs with the Selected Remedy, Alternative 3.

10.2.9 Community Acceptance

Public comment on the RI/FS and Proposed Plan was solicited during a formal public comment period extending from July 27 to August 28, 1999. No comments from the community were received during the formal public comment period.

11.0 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by the site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

The source materials identified at the OU5 AV/CZL site include tailing, flue dust, and non-residential area soils. These source materials do not constitute principal threat wastes; hence, they are considered non-principal threat wastes. Containment of the source materials utilizing a repository and soil covers are reliable remedies.

12.0 SELECTED REMEDY

Based upon consideration of CERCLA requirements, the detailed analysis of alternatives, and public comments, EPA has determined that the Consolidation/Containment (Flue Dust Repository and Soil Cover) alternative presented in the Proposed Plan, with no modifications, is the appropriate remedy for the tailing, flue dust, and non-residential area soils at the OU5 AV/CZL site within the California Gulch Superfund Site.

12.1 RATIONALE FOR SELECTED REMEDY

Based upon consideration of requirements of CERCLA and the NCP, the detailed analysis of alternatives, and public comments, EPA has determined that the Consolidation/Containment (Flue Dust Repository and Soil Cover) alternative presented in the Proposed Plan is the appropriate remedy for the tailing, flue dust, and non-residential area soils within the OU5 AV/CZL sites. Alternative 3 either meets or exceeds benefits associated with the selecting criteria compared to the majority of the other alternatives. This selected remedy will reduce risk to human health and the environment through the following:

- As required, Alternative 3 meets the threshold cleanup evaluation criteria (overall protection of human health and the environment and compliance with ARARs).
- Alternative 3 provides very good long-term effectiveness and permanence.
- Alternative 3 eliminates airborne transport of flue dust, tailing, and non-residential area soils particles and minimizes both the erosion of flue dust, tailing, and non-residential area soils and deposition into local water sources.
- Alternative 3 controls leaching and migration of metals from flue dust.
- Alternative 3 controls the human health and ecological risks (defined by the risk assessments) including direct contact with contaminated sources by wildlife and plants and soil fauna.
- Alternative 3 is readily implementable. The remediation technologies selected for this alternative have been successfully employed at other Superfund sites.

The Selected Remedy best meets the entire range of selection criteria and achieves, in EPA's determination, the appropriate balance considering site-specific conditions and criteria identified in CERCLA and the NCP, as provided in Section 13.0, Statutory Determinations.

12.2 DESCRIPTION OF SELECTED REMEDY

Under the Consolidation/Containment (Flue Dust Repository and Soil Cover)alternative, the flue dust will be excavated and relocated to a single-lined, fully encapsulated repository and the tailing and non-residential area soils will be consolidated and covered with 18 inches of re-vegetated soil. The principal components of Alternative 3 are as follows:

- All smelter structures within the remediation area of the AV Smelter site except the easternmost of the two ore bins, the base of two smelter smoke stacks, and the concrete (Dewey) arch will be demolished to grade. At the CZL Mill site, non-residential area soils and other mine waste will be removed from the mill foundations, which will remain in place. Any salvageable demolition debris, such as metal, will be relocated to a designated location in the southwest junkyard area. Debris that does not have salvage value will be contained under the cover installed for residential area soils. Prior to demolition, each of the structures will be evaluated by a certified asbestos inspector to identify any asbestos containing materials, which will be removed and/or disposed in accordance with State and Federal requirements.

- The flue dust will be excavated and relocated to a lined repository. Preliminary evaluation indicates that the repository could be constructed into the hill slope west of the former baghouse structure, as shown on Figure 14. The repository will be lined with a fully-encapsulating 40-mil to 60-mil thick geomembrane liner protected by an 18-inch thick vegetated soil cover (Figure 15). The location and extent of flue dust requiring excavation will be determined by a sampling and analysis program in support of remedial design. In addition, three groundwater wells (one upgradient and two downgradient of the repository) will be installed and monitored periodically.

- Limited site grading will be conducted to promote positive surface water drainage, stabilize any excavated slopes, and facilitate installation of the soil covers.

- The tailing and non-residential area soils located at the AV Smelter site will be consolidated near the former blast furnace and baghouse and covered with an 18-inch thick soil cover (Figure 14). At the CZL Mill site, the non-residential area soils will be consolidated on top of the tailing at the base of the slope (Figure 16) and the tailing and non-residential area soils will be covered with an 18-inch thick soil layer (Figure 15). Any tailing potentially in contact with groundwater (possible in the southern portion of the CZL Mill site, adjacent to California Gulch) will be excavated and consolidated uphill, to the north. Figure 16 shows the conceptual details of the remedial alternative; however, it should be noted that the materials requiring consolidation and the extent of the excavation and covered areas at both the AV Smelter and CZL Mill sites will be determined by a sampling program in support of remedial design.

- The overall goal of the consolidation will be to reduce average arsenic and lead concentrations in surface soils outside the covered area to below the risk-based action levels established for a commercial/industrial worker exposure scenario in the human health RA. The purpose of consolidating the materials will be to reduce the size of the covers to a single area at the main smelter area and a single area at the CZL Mill area. Soil for the cover will be excavated from a designated borrow area near the Hecla/Malta Gulch Tailing Impoundment (OU2) property and will be transported to the site via a temporary haul road. Sampling to support remedial

design will be performed to further delineate areas where metals concentrations exceed the risk-based action levels and would require covering.

- Diversion ditches will be constructed upgradient of the covered areas to prevent stormwater from running onto the covered areas. Excavated areas and the soil cover will be revegetated, with soil amendments as necessary, to reduce the potential for soil erosion and further reduce infiltration through the soil cover.

- Dust monitoring and engineering controls will be implemented during activities that could potentially disturb the tailing, non-residential area soils, or flue dust. Conventional dust control measures including water sprays, placement of clean gravel over haul roads, and surfactant sprays could be used, as required, based on air quality monitoring results.

- Institutional Controls such as deed notices or deed restrictions to provide notification that a barrier is in place, and to restrict land use to protect the integrity of the remedy would be implemented in the cover areas. Lake County and/or City of Leadville zoning ordinances would be modified to create a zoning "overlay district" to provide a screening process to identify properties where special precautions or requirements may be necessary. Restrictions and requirements from the overlay district would be placed on land use activities outside the cover areas. Land use and plans/proposals for future land use at each site would be monitored and evaluated by EPA as part of the five-year review process.

  One occupied residence has been identified within the site. Asarco will offer the existing resident services and cleanup consistent with the procedures, requirements, and standards of the LCCHP during the remedial design for OU5. If and when future remediation occurs for the current resident, Asarco would conduct or fund the response activities consistent with the procedures and requirements of LCCHP. These activities would be funded by Asarco separate from the LCCHP trust fund.

- An O&M program will be developed during the remedial design. O&M activities will include inspection and maintenance of the cover and surface water controls. The site will be inspected for evidence of erosion, differential settlement of the cover, and adequacy of vegetation.

12.3 ESTIMATED REMEDY COSTS

The detailed cost estimate and present worth analysis for Alternative 3, the Selected Remedy, are presented in Tables 13 and 14, respectively. The net present value of the estimated capital and operating cost for a 30-year period is approximately $3,250,000. The time frame to implement the remedy is anticipated to be two years. The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major cost changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant

Difference, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

12.4 EXPECTED OUTCOME OF THE SELECTED REMEDY

The Selected Remedy for OU5 would make portions of the AV/CZL sites a permanent waste management area. Exposure of source materials would be limited through the use of engineering and institutional controls. The anticipated environmental and ecological benefits would help restore the quality of groundwater environmental conditions in California Gulch, minimize surface water impacts during storm events, and eliminate direct contact of humans and fauna with materials having metals concentrations above risk-based action levels (or representing an ecological hazard).

13.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, EPA must select a remedy that is protective of human health and the environment, that complies with ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that include treatment which permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element.

However, the Selected Remedy, Alternative 3 - Consolidation/Containment (Flue Dust Repository and Soil Cover), does not satisfy the statutory preference for treatment as a principal element of the remedy. In narrowing the focus of the FFS, treatment was determined to be technically and economically impracticable. The following sections discuss how the Selected Remedy meets statutory requirements.

13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Selected Remedy will protect human health and the environment through the prevention of direct contact with contaminants at the site. The Selected Remedy uses soil covers and a geomembrane liner for the flue dust repository, to control erosion and subsequent transport of metals to the environment. Consolidation of materials will reduce the area requiring long-term management. The installation of soil covers for tailing and non-residential area soils will reduce infiltration by as much as 81 percent, and the flue dust repository will reduce infiltration by 99.99 percent.

13.2 COMPLIANCE WITH ARARs

The Selected Remedy will comply with all ARARs identified in Tables 10 through 12. No waiver of ARARs will be necessary. Final performance standards will not include ARARs for Site-wide Surface Water and Groundwater or require a specified decrease in point or non-point source loadings of COCs to Site-wide Surface Water and Groundwater (USCD, 1994). It was agreed that the decision on remediation of Site-wide Water Quality (OU12) will be made between the EPA and the PRPs and memorialized in the CD only after remedies for source remediation were selected and implemented at each OU. As a result, specific water quality goals for surface streams and groundwater have not been established at this time.

13.3 COST EFFECTIVENESS

EPA has determined that the Selected Remedy is cost effective in mitigating the principal risks posed by contaminated tailing, flue dust, and non-residential area soils. Section 300.430(f)(ii)(D) of the NCP requires evaluation of cost effectiveness. Overall effectiveness is determined by the following three balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective. The Selected Remedy meets the criteria and provides for overall effectiveness in proportion to its cost. The estimated cost for the Selected Remedy is $3,250,000.

13.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT POSSIBLE

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions can be utilized in a cost effective manner at the AV/CZL site.

Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy for AV/CZL provides the best balance in terms of long-term effectiveness and permanence, treatment, implementability, cost, and state and community acceptance.

While the Selected Remedy for the tailing, flue dust, and non-residential area soils does not utilize treatment or removal, the use of covers and a repository provides a long-term effective and permanent barrier to contaminated waste materials, thus reducing risk to a near equivalent extent.

13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

Various treatment options for tailing, flue dust, and non-residential area soils were considered in the FS process; however, due to the nature and size volume of the tailing, flue dust, and non-residential area soils, these options were determined to be either technically impracticable and/or not cost-effective (EPA, 1993).

13.6 FIVE-YEAR REVIEW REQUIREMENTS

Because the tailing, flue dust, and non-residential area soils will remain on site, the Selected Remedy will require a five-year review under Section 121© of CERCLA and Section 300.430(f)(4)(ii) of the NCP. The five-year review includes a review of the groundwater and surface water monitoring data and an evaluation as to how well the Selected Remedy is achieving the RAOs and ARARs that it was designed to meet.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for tailing, flue dust, and non-residential area soils at the OU5 AV/CZL site was released for public comment in July 2000. The Proposed Plan identified Alternative 3, Consolidation/Containment (Flue Dust Repository and Soil Cover), as the preferred alternative. Comments were received during the public comment period. EPA determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

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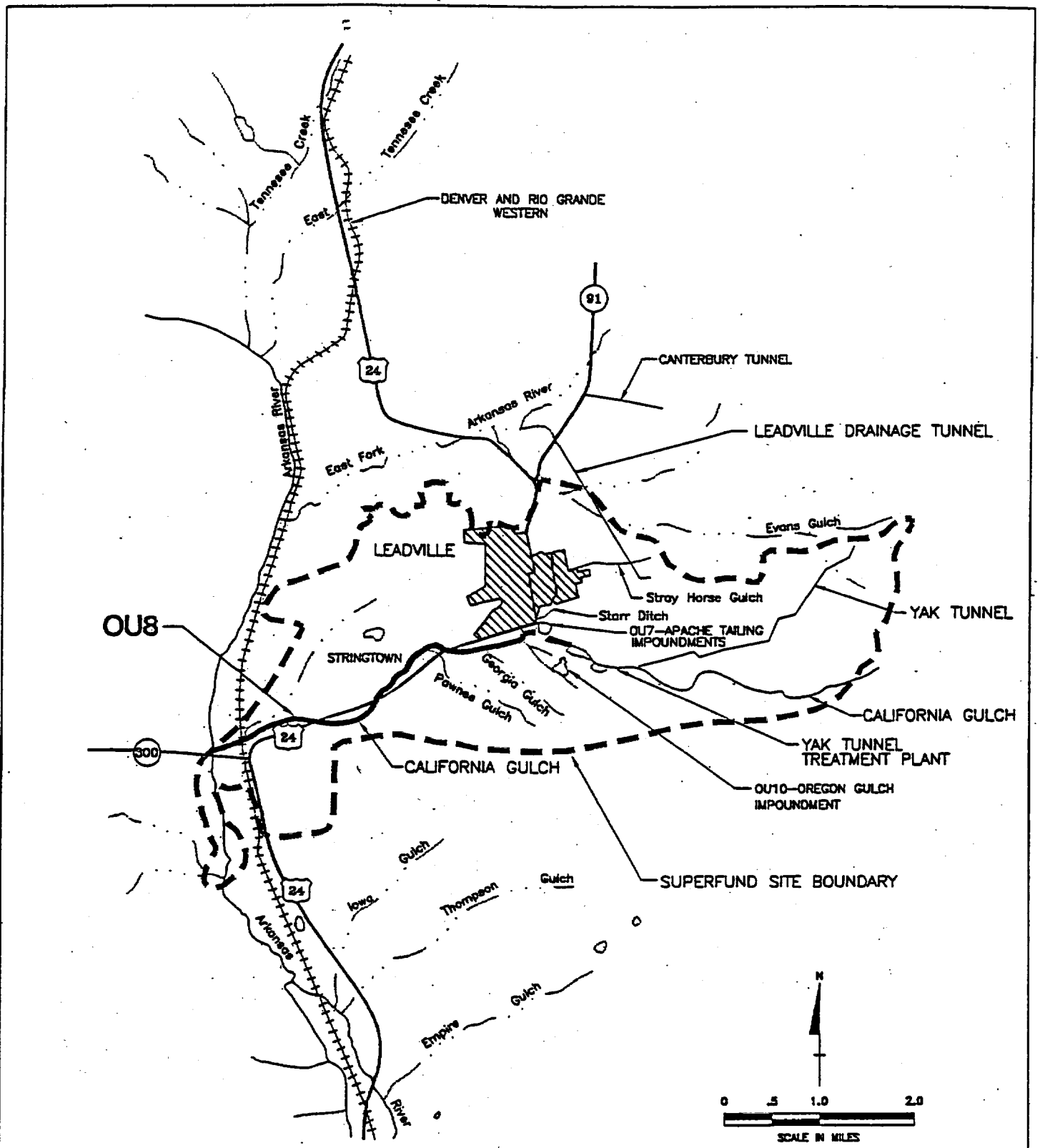
FIGURES



LEGEND

- CITY OF LEADVILLE
- SUPERFUND SITE BOUNDARY
- OPERABLE UNIT 8

Figure 1

SITE LOCATION MAP

California Gulch Superfund Site
Leadville, Colorado

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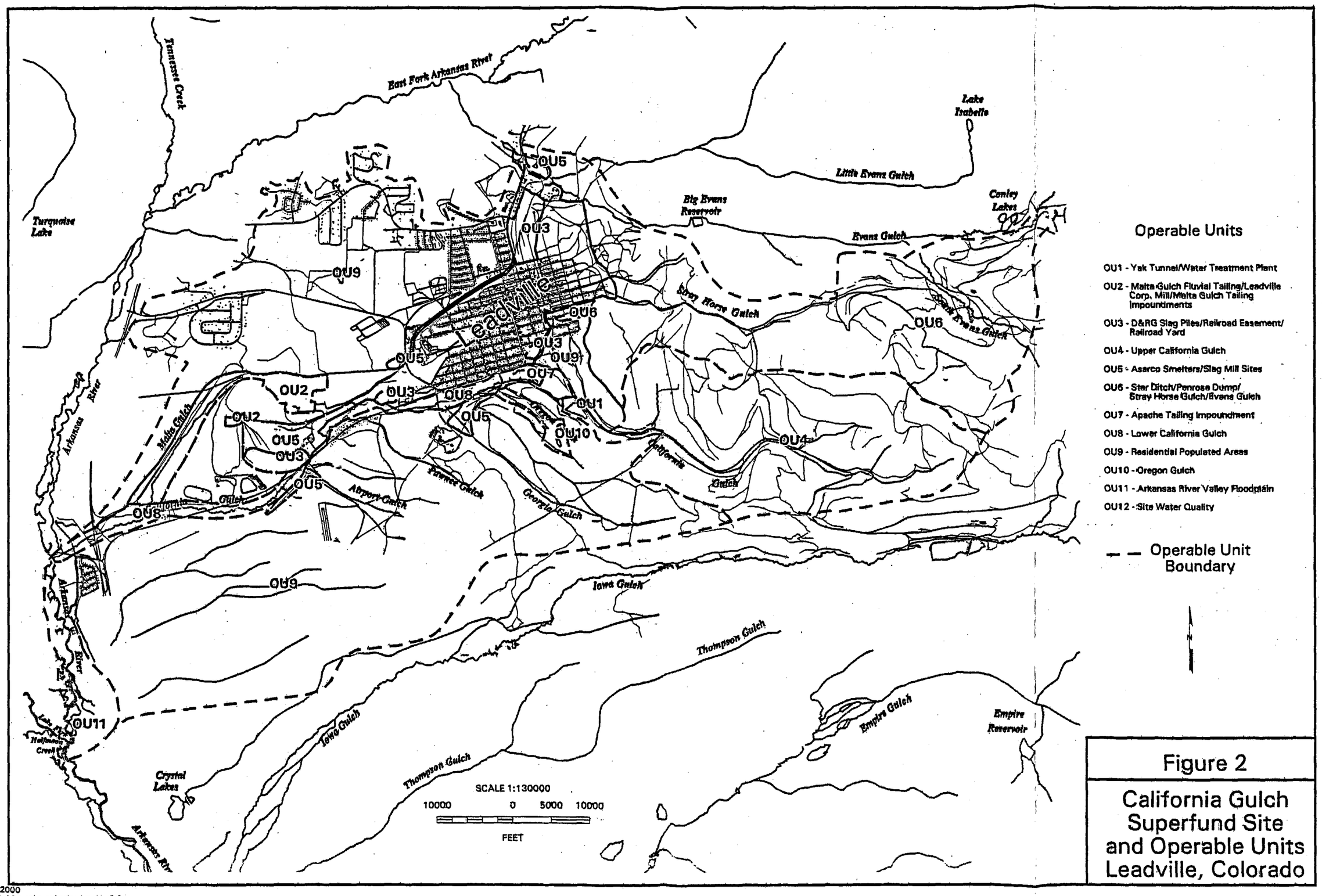

Figure 2

California Gulch Superfund Site and Operable Units Leadville, Colorado

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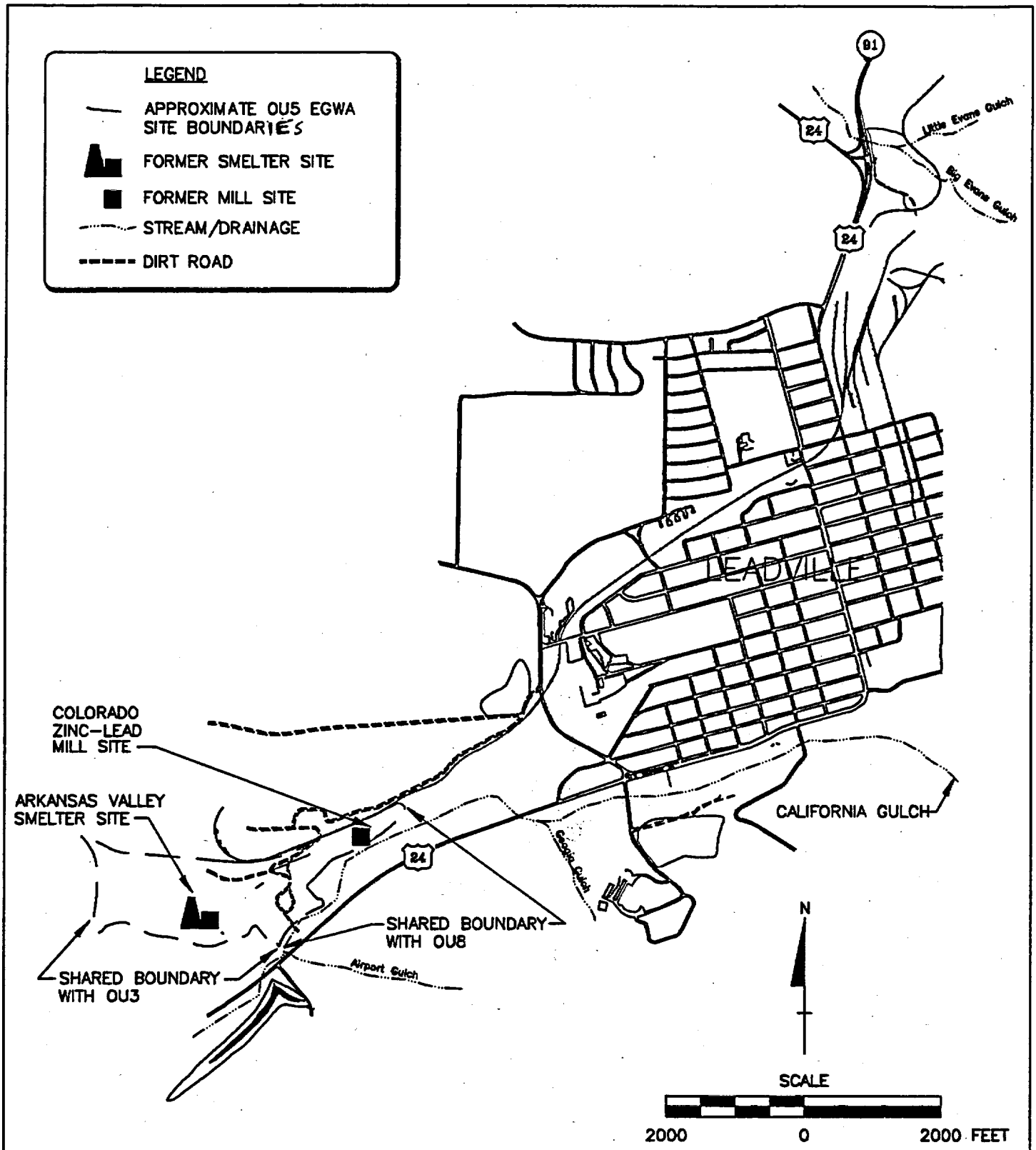

Figure 3

**SITE MAP-
OPERABLE UNIT 5 AV/CZL SITES**

**California Gulch Superfund Site
Leadville, Colorado**

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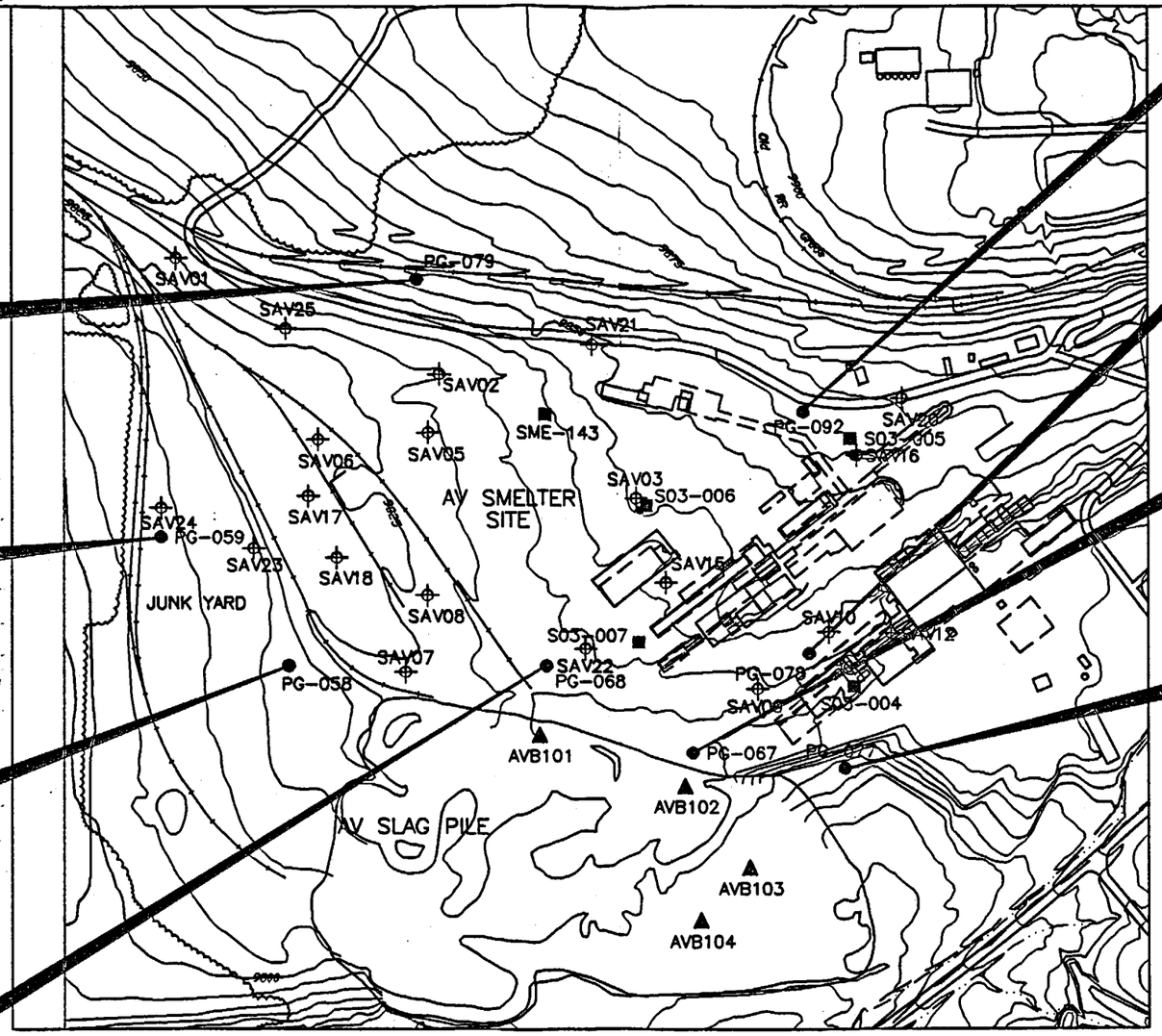

PG-079	As	Cd	Pb	Zn
0-1"	<37	36	921	567
1-2"	<37	35	468	744
2-6"	<37	<2	57	198
6-12"	<37	<2	25	83
12-18"	<37	<2	52	84

PG-059	As	Cd	Pb	Zn
0-1"	<37	24	20,298	1,668
1-2"	<37	<2	20,356	1,717
2-6"	<37	<2	485	162
6-12"	<37	<2	96	247
12-18"	<37	6	241	416

PG-058	As	Cd	Pb	Zn
0-1"	<37	18	2,173	3,599
1-2"	<37	9	632	1,853
2-6"	<37	<2	186	453
6-12"	<37	<2	114	249
12-18"	<37	<2	163	333

PG-068	As	Cd	Pb	Zn
0-1"	584	<2	18,861	1,645
1-2"	1,179	2	25,558	1,419
2-6"	48	4	1,695	265
6-12"	191	<2	351	279
12-18"	223	6	186	478

PG-092	As	Cd	Pb	Zn
0-1"	1,587	130	12,756	6,063
1-2"	2,107	201	14,729	7,783
2-6"	3,584	150	13,454	4,567
6-12"	788	13	3,443	856
12-18"	<37	8	722	320

PG-078	As	Cd	Pb	Zn
0-1"	886	90	8,581	2,316
1-2"	537	18	7,315	1,378
2-6"	587	15	5,848	1,215
6-12"	53	26	4,658	868
12-18"	<37	21	656	748

PG-067	As	Cd	Pb	Zn
0-1"	1,000	7	10,600	5,410
1-2"	1,230	8	16,700	1,350
2-6"	943	5	13,700	736
6-12"	141	3	552	196
12-18"	135	1	213	198

PG-077	As	Cd	Pb	Zn
0-1"	1,555	432	4,871	1,473
1-2"	568	158	1,595	530
2-6"	138	33	209	205
6-12"	164	33	167	209
12-18"	276	28	159	332

LEGEND:

STREAM/DRAINAGE

S03-006 — SOIL/SMELTER RI DISCRETE – ANALYZED BY XRF (WALSH, 1993)

PG-068 — SOIL/SMELTER RI PRIMARY GRID – ANALYZED BY XRF/ICP (IF AVAILABLE) (CDM, 1994; WALSH, 1993)

SAV07 — SMELTER SUPPLEMENTAL RI – ANALYZED BY ICP (WESTEC, 1998)

AVB101 — APPROXIMATE BOREHOLE LOCATIONS THROUGH AV SLAG PILE (MK, 1992)

UNITS ARE mg/Kg, PARTICLE SIZE <2MM UNLESS NOTED.

N

SOIL METALS CONCENTRATIONS, AV SMELTER SITE

SCALE

400 0 400 FEET

Figure 4

SOIL METALS CONCENTRATIONS, AV SMELTER SITE OPERABLE UNIT 5

California Gulch Superfund Site Leadville, Colorado

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Images [none]

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Plot date 01-28-2000

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S03-005	As		Cd		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	2,149	<37	419	46	39,900	8,819	22,100	36,400
1-2"	1,513	<37	316	25	32,100	5,625	31,100	37,600
2-6"	566	424	<15	21	3,996	2,383	616	1,005
6-12"	134	78	17	<15	679	407	559	1,150

S03-006	As		Cd		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	1,325	409	313	94	23,700	8,554	8,520	20,100
1-2"	1,223	517	208	99	14,000	6,649	4,321	12,500
2-6"	713	404	157	106	10,500	6,874	2,706	8,412
6-12"	897	290	204	143	12,900	6,664	2,409	5,296

SME-143	As		Cd		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	404	200	48	22	3,206	1,293	767	433
1-2"	265	173	47	26	2,010	1,024	512	298
2-6"	62	38	26	17	70	78	201	125
6-12"	40	49	19	23	42	137	171	176

SAV24	As	Pb
0-1"	497	6,910
1-2"	424	4,840
2-6"	82	815
6-12"	33	541

SAV23	As	Pb
0-1"	432	7,470
1-2"	340	6,200
2-6"	292	7,360
6-12"	350	5,090

S03-007	As		Cd		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	3,110	2,222	1,022	843	>UDL	>UDL	16,100	13,900
1-2"	1,632	1,372	293	342	45,100	36,500	5,386	5,375
2-6"	296	170	171	175	9,227	3,752	1,895	1,639
6-12"	1,236	693	667	492	33,200	16,000	6,319	4,509

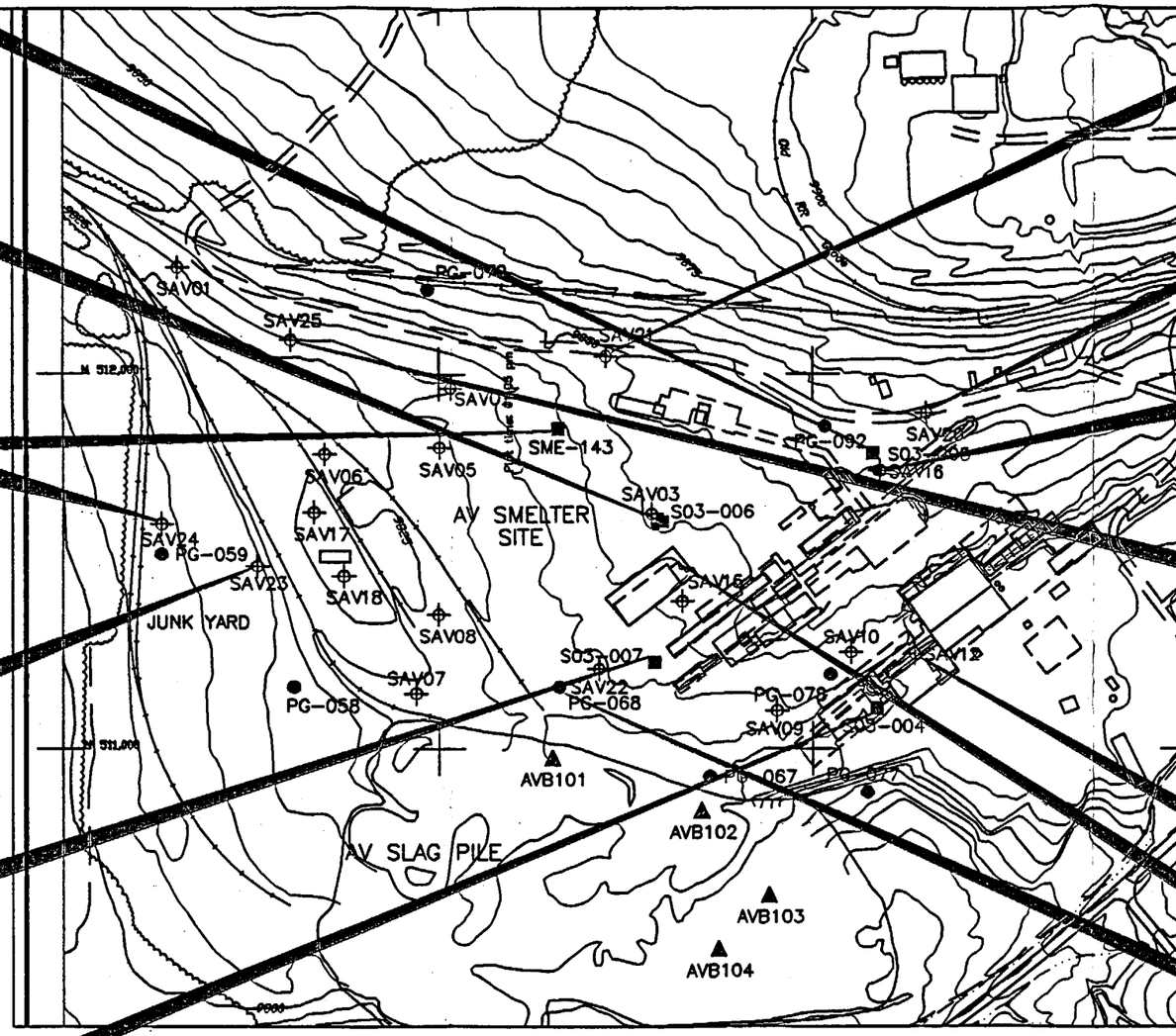
S03-004	As		Cd		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	7,476	1,098	4,783	2,215	43,900	7,724	15,300	3,902
1-2"	>UDL	1,137	4,655	2,462	46,200	7,340	12,400	4,195
2-6"	>UDL	2,615	913	371	47,600	15,800	5,036	1,883
6-12"	>UDL	3,187	930	183	55,200	9,835	4,183	1,014

SAV04	As	Cd	Pb	Zn
0-1"	1,050	76.2	6,990	2,910

NOTE: SAV4 IS A COMPOSITE OF SAV01, SAV02 & SAV03.

SAV11	As	Cd	Pb	Zn
0-1"	290	59	22,300	7,870

NOTE: SAV11 IS A COMPOSITE OF SAV05, SAV06, SAV07, SAV08, SAV09 & SAV10.



SAV21	As	Pb
0-1"	824	8,090
1-2"	911	8,210
2-6"	729	5,960
6-12"	532	5,290

SAV20	As	Pb
0-1"	370	2,440
1-2"	1,200	3,600
2-6"	3,470	4,190
6-12"	2,150	3,360

SAV16	As	Cd	Pb	Zn
0-1"	171	57.5	491	379

SAV19	As	Cd	Pb	Zn
0-1"	463	18.7	3,550	339

NOTE: SAV19 IS A COMPOSITE OF SAV17 & SAV18.

SAV25	As	Pb
0-1"	98	814
1-2"	49	307
2-6"	17	46
6-12"	15	20

SAV12	As	Cd	Pb	Zn
0-1"	149,000	32,200	272,000	62,900

SAV15	As	Cd	Pb	Zn
0-1"	120	20	580	250

SAV22	As	Pb
0-1"	5,550	77,900
1-2"	4,510	63,700
2-6"	3,720	51,300
6-12"	1,930	25,000

LEGEND:

- STREAM/DRAINAGE
- S03-006 — SOIL/SMELTER RI DISCRETE – ANALYZED BY XRF (WALSH, 1993)
- PG-068 — SOIL/SMELTER RI PRIMARY GRID – ANALYZED BY XRF/ICP (IF AVAILABLE) (CDM, 1994; WALSH, 1993)
- SAV07 — SMELTER SUPPLEMENTAL RI – ANALYZED BY ICP (WESTEC, 1998)
- AVB101 — APPROXIMATE BOREHOLE LOCATIONS THROUGH AV SLAG PILE (MK, 1992)

UNITS ARE mg/Kg, PARTICLE SIZE <2MM UNLESS NOTED.

N

SCALE

400 0 400 FEET

Figure 5

SOIL METALS CONCENTRATIONS
AV SMELTER SITE
OPERABLE UNIT 5

California Gulch Superfund Site
Leadville, Colorado

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PG-149	As	Cd	Cu	Pb	Zn
0-1"	62	24	964	9,416	3,220
1-2"	245	31	942	9,840	4,259
2-6"	<37	13	685	10,641	1,715
6-12"	<37	5	1186	9,883	1,211
12-18"	<37	4	232	2,128	543

PG-134	As	Cd	Cu	Pb	Zn
0-1"	<37	4	835	14,965	2,789
1-2"	<37	<2	861	18,290	4,295
2-6"	<37	9	865	17,199	2,315
6-12"	<37	9	766	16,807	5,678
12-18"	<37	16	824	19,038	3,353

SCZ11	As	Cd	Pb	Zn
0-1"	1,340	362	25,000	5,840

NOTE: SCZ11 IS A COMPOSITE OF SCZ08, SCZ09 AND SCZ10

SCZ07	As	Cd	Pb	Zn
0-1"	210	133	16,400	17,000

NOTE: SCZ07 IS A COMPOSITE OF SCZ05 AND SCZ06

SCZ04	As	Cd	Pb	Zn
0-1"	300	100	18,400	16,300

NOTE: SCZ04 IS A COMPOSITE OF SCZ01, SCZ02 AND SCZ03

PG-160	As		Cd		Cu		Pb		Zn	
	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm	<250µm	<2mm
0-1"	423	498	3	8	372	405	5391	5874	766	680
1-2"	131	158	4	7	188	233	4402	4138	322	292
2-6"	<37	<37	14	14	94	75	1511	1121	288	308
6-12"	<37	<37	<2	<2	18	9	69	58	915	799
12-18"	<37	<37	<2	<2	16	17	123	81	204	158

LEGEND:

● PG-068 — SOIL/SMELTER RI PRIMARY GRID – ANALYZED BY XRF (CDM, 1994; WALSH, 1993), PARTICLE SIZE <2mm, UNLESS NOTED.

⌖ SCZ05 — SMELTER SUPPLEMENTAL RI – ANALYZED BY ICP (WESTEC, 1998), PARTICLE SIZE <250 um.

UNITS ARE mg/Kg

N

SCALE

400 0 400 FEET

Figure 6

SOIL METALS CONCENTRATIONS
CZL MILL SITE
OPERABLE UNIT 5

California Gulch Superfund Site
Leadville, Colorado

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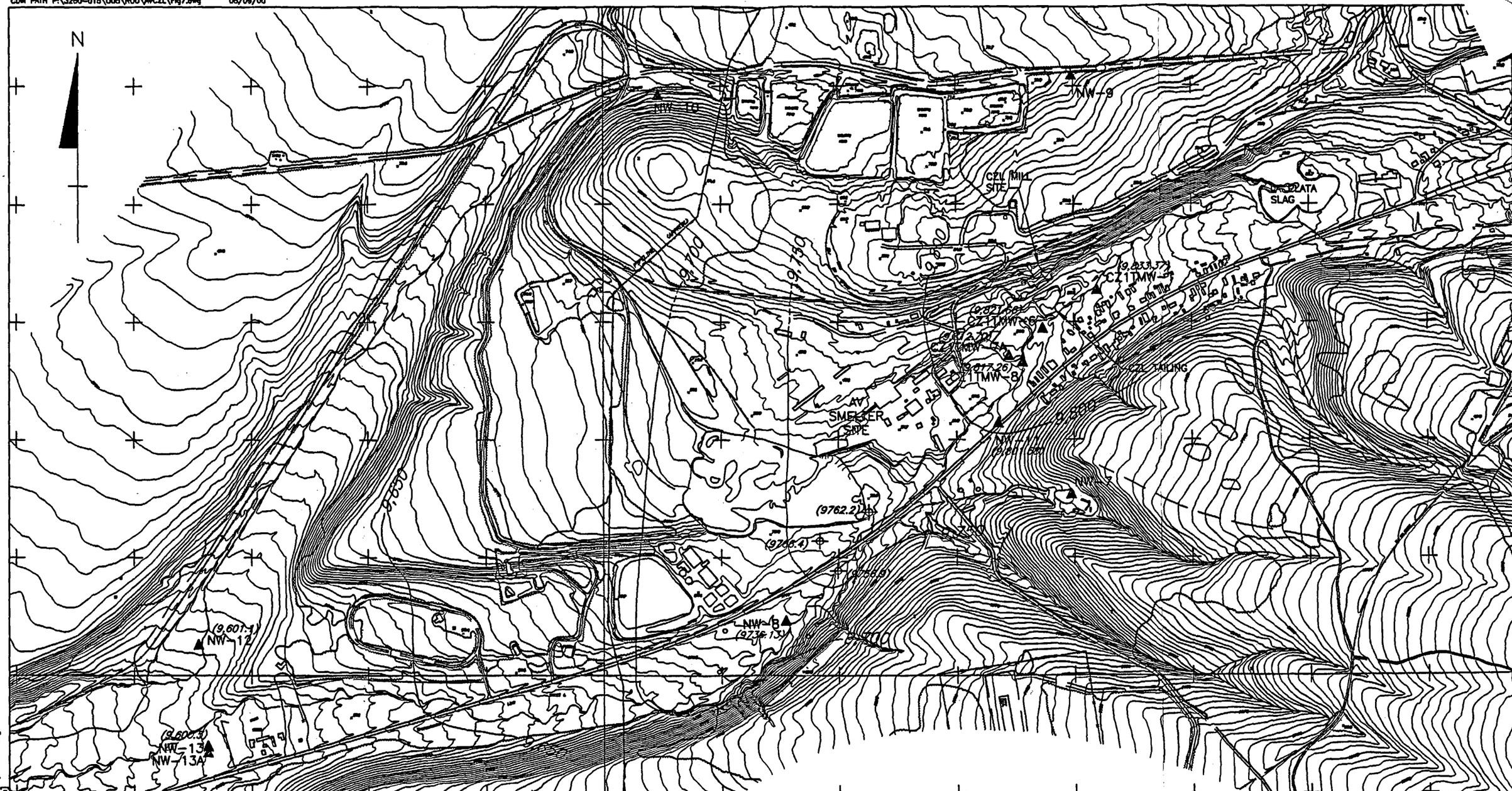

LEGEND:

CZ1TMW-6 ▲	TAILING MONITORING WELL
NW-12 ▲	ALLUVIAL MONITORING WELL
⌖	POND/CAL GULCH LOCATION
9800 ——	APPROXIMATE GROUNDWATER ELEVATION CONTOURS
(9821.66)	GROUNDWATER ELEVATION MEASURED ON 12/17/92 (ft.)
(9766.4)	SURFACE WATER ELEVATION MEASURED DURING THE FALL, 1998 (ft.)

SCALE

800 0 800 FEET

Figure 7

GROUNDWATER MOINITORING WELLS IN VICINITY OF THE AV/CZL SITE OPERABLE UNIT 5

California Gulch Superfund Site
Leadville, Colorado

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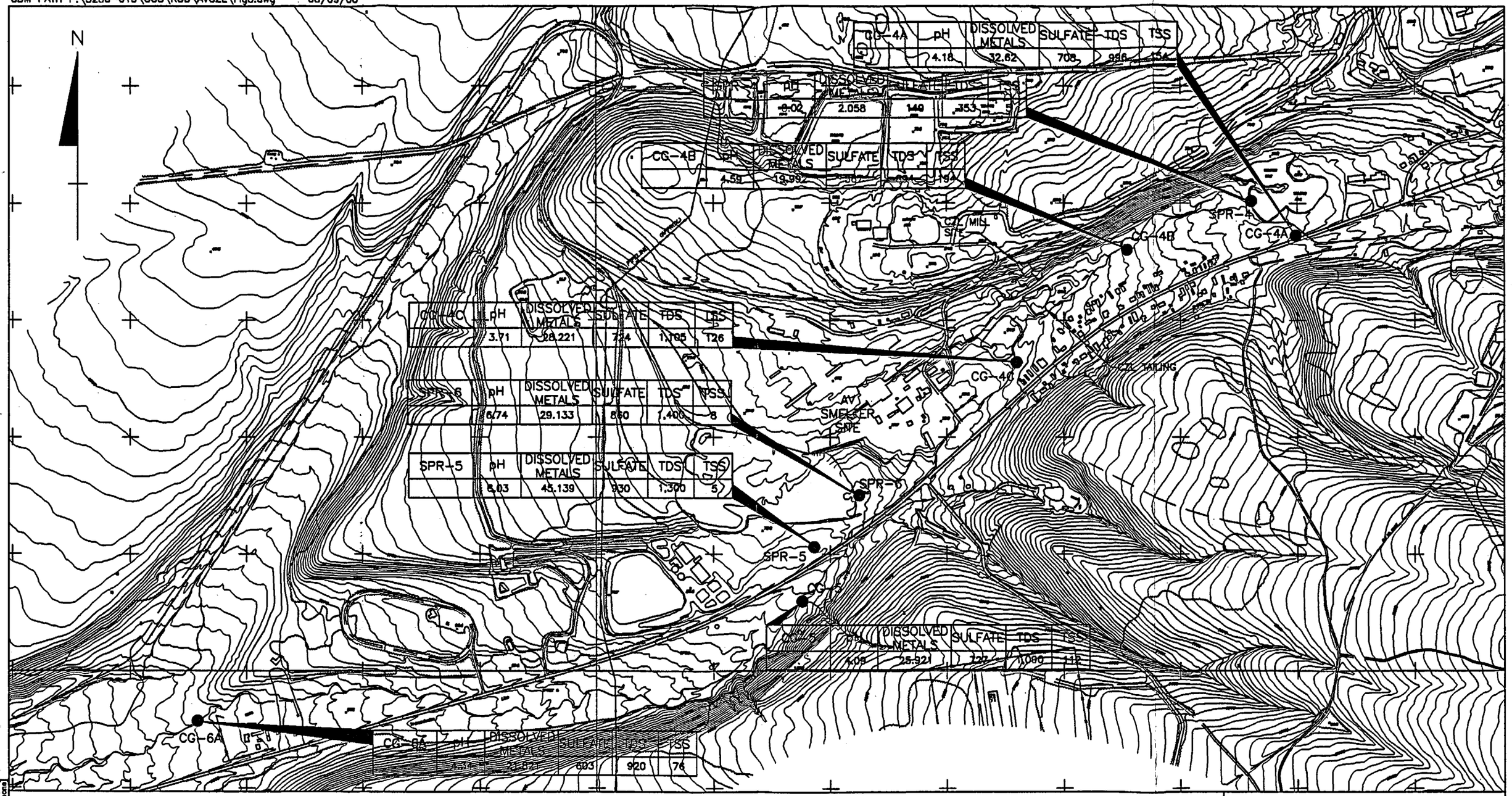

LEGEND:

CG-6A

CG-6A	pH	DISSOLVED METALS	SULFATE	TDS	TSS
	4.34	21.821	603	920	76

SURFACE WATER MONITORING LOCATION

WATER QUALITY CONCENTRATIONS ARE SPRING RUNOFF AVERAGES, EXCEPT FOR SPR-6 WHICH ARE BASE FLOW CONCENTRATIONS (SMI/TMI, 1997). DISSOLVED METALS INCLUDE As, Cd, Cu, Pd AND Zn. UNITS ARE mg/L

SCALE

800 0 800 FEET

Figure 8

SURFACE WATER MONITORING LOCATIONS AND WATER QUALITY IN VICINITY OF THE AV/CZL SITE OPERABLE UNIT 5

California Gulch Superfund Site
Leadville, Colorado

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Plot date 01-28-2000

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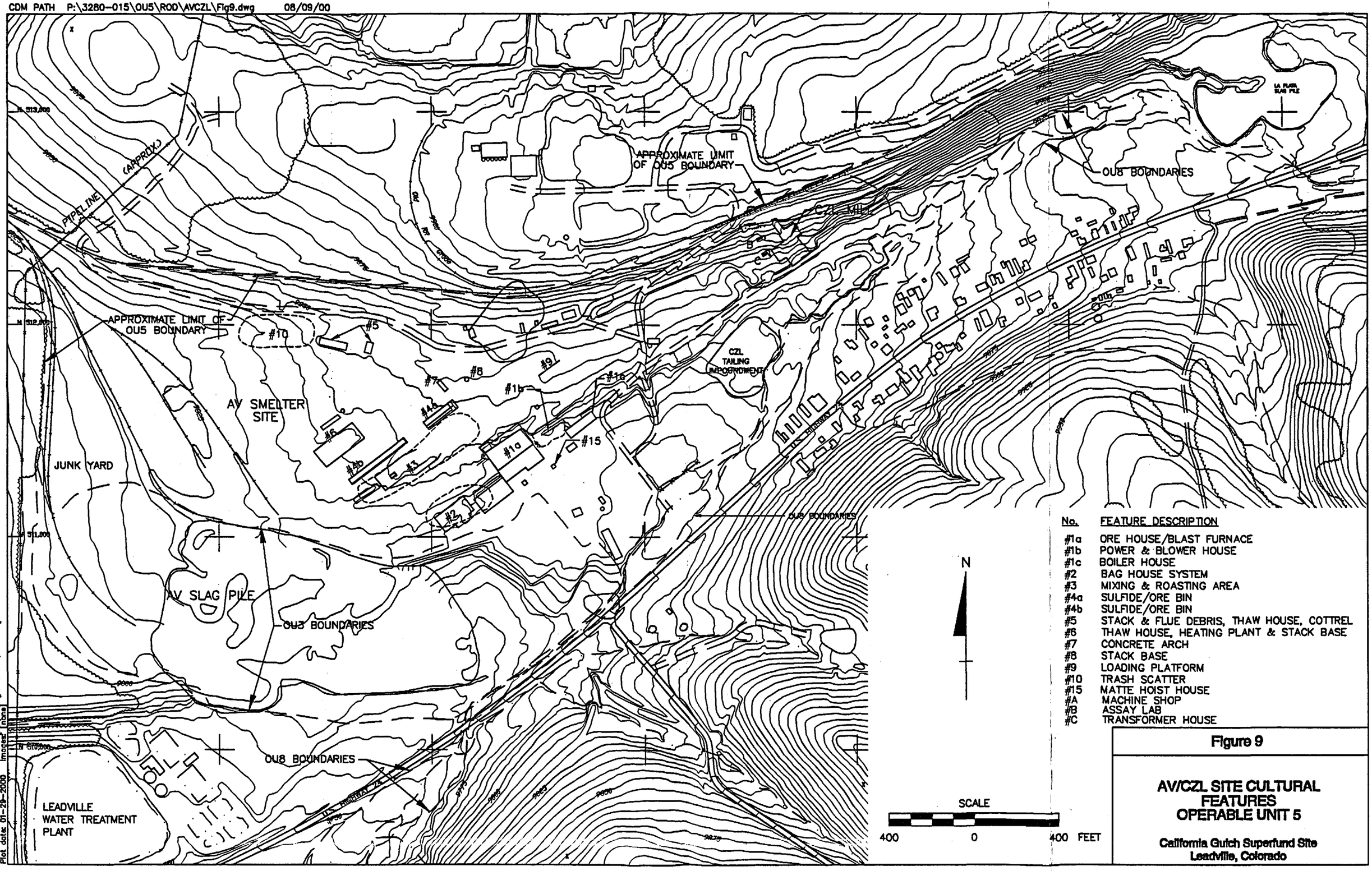

No.	FEATURE DESCRIPTION
#1a	ORE HOUSE/BLAST FURNACE
#1b	POWER & BLOWER HOUSE
#1c	BOILER HOUSE
#2	BAG HOUSE SYSTEM
#3	MIXING & ROASTING AREA
#4a	SULFIDE/ORE BIN
#4b	SULFIDE/ORE BIN
#5	STACK & FLUE DEBRIS, THAW HOUSE, COTTREL
#6	THAW HOUSE, HEATING PLANT & STACK BASE
#7	CONCRETE ARCH
#8	STACK BASE
#9	LOADING PLATFORM
#10	TRASH SCATTER
#15	MATTE HOIST HOUSE
#A	MACHINE SHOP
#B	ASSAY LAB
#C	TRANSFORMER HOUSE

Figure 9

AV/CZL SITE CULTURAL FEATURES OPERABLE UNIT 5

California Gulch Superfund Site Leadville, Colorado

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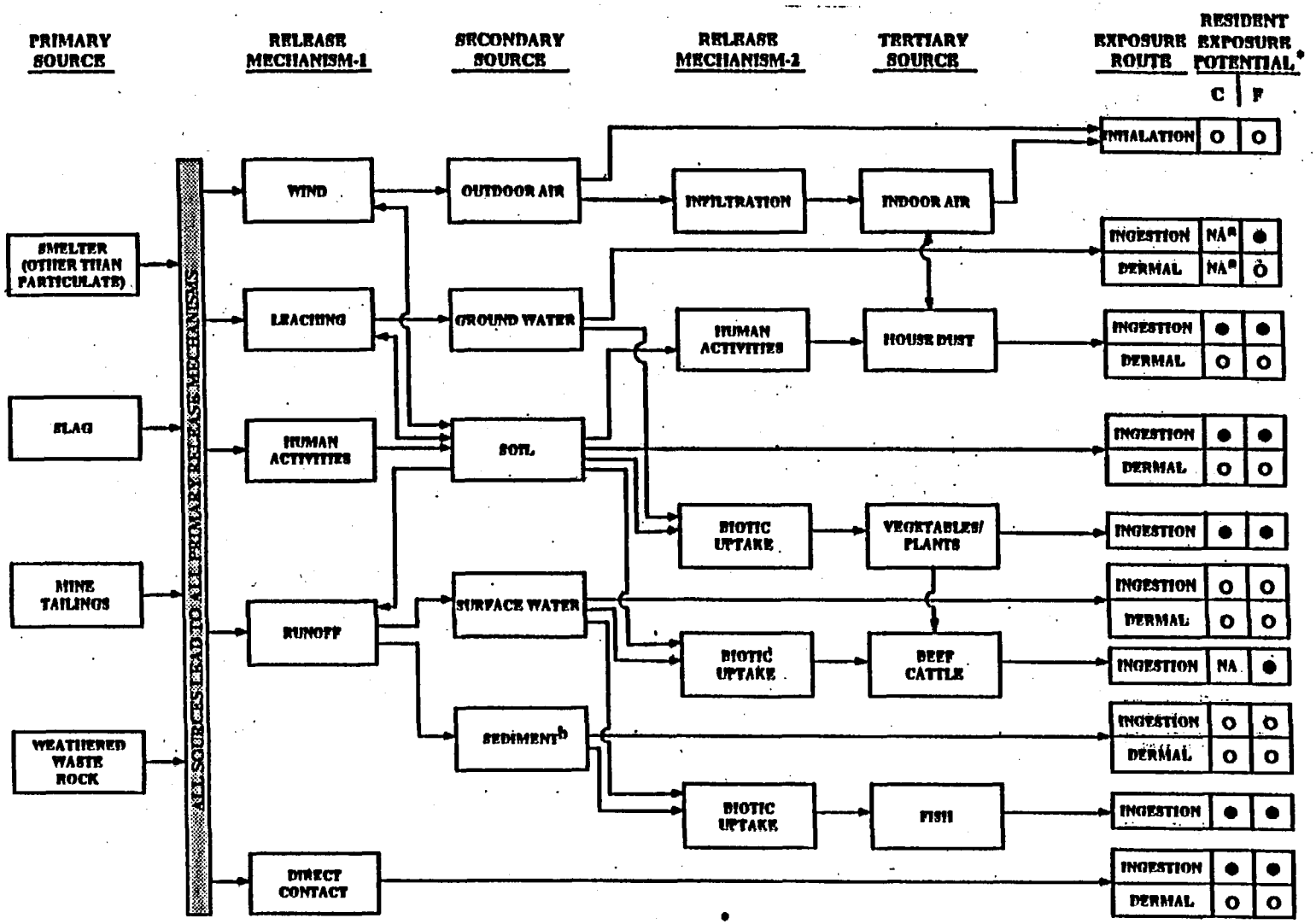


O EXPOSURE OR DOSE POTENTIAL RELATIVELY LOW
● EXPOSURE OR DOSE POTENTIAL RELATIVELY HIGH
NA NOT APPLICABLE SINCE EXPOSURE PATHWAY IS NOT COMPLETE
a CURRENTLY INVESTIGATIONS ARE UNDERWAY TO DETERMINE ANY PRESENT GROUNDWATER USAGE IN THE LEADVILLE AREA
b REFERS TO WET SEDIMENTS. DRY SEDIMENTS WOULD BE SIMILAR TO THE PATHWAYS SHOWN FOR SOIL.

* C=CURRENT USE
F=FUTURE USE

SOURCE: Preliminary Human Health Baseline Risk Assessment (WESTON, 1991)

Figure 10

HUMAN HEALTH SITE CONCEPTUAL MODEL - LEADVILLE AND STRINGTOWN RESIDENTS, MINING AND ORE PROCESSING WASTES

California Gulch Superfund Site, Leadville, Colorado

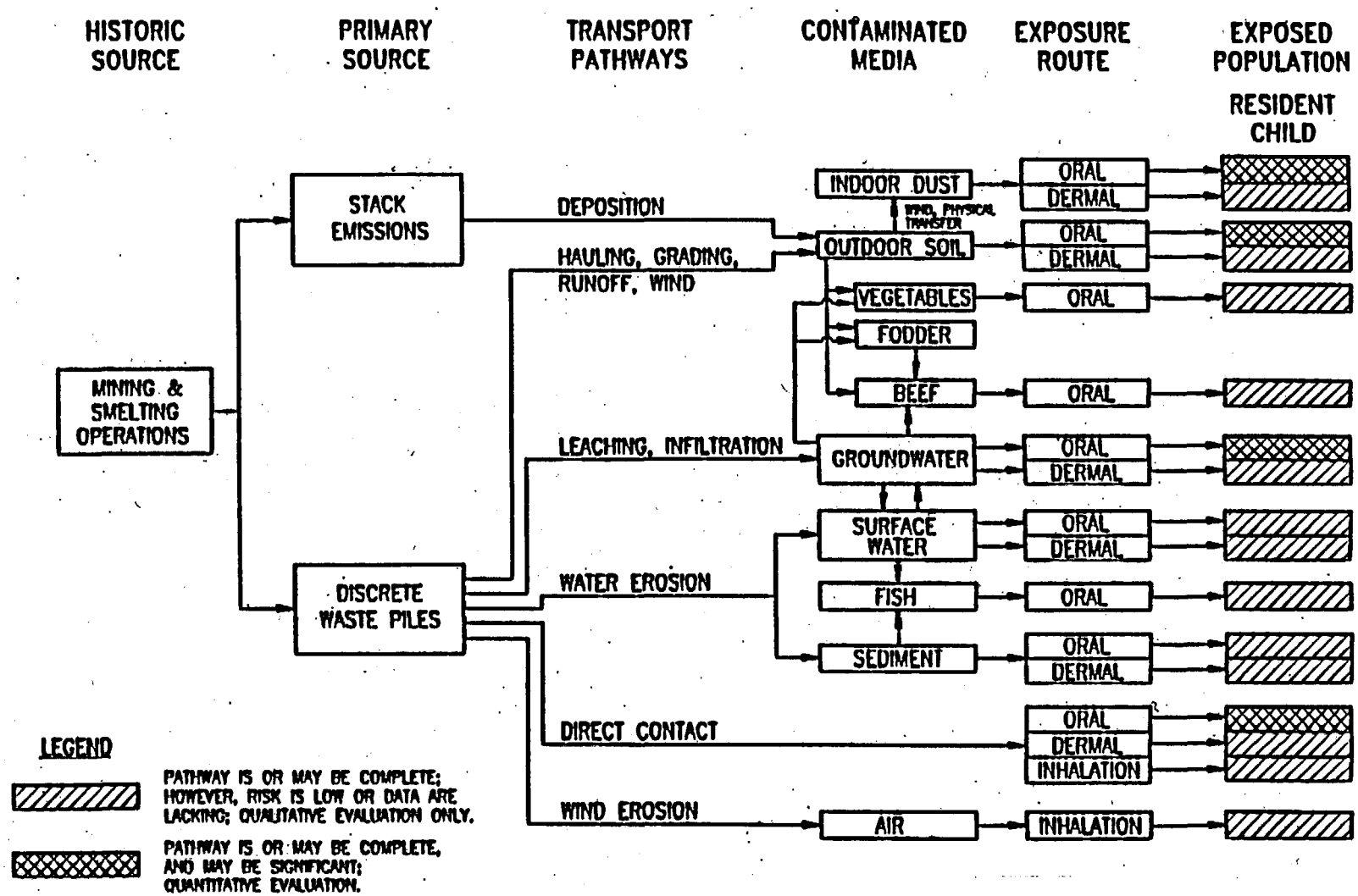
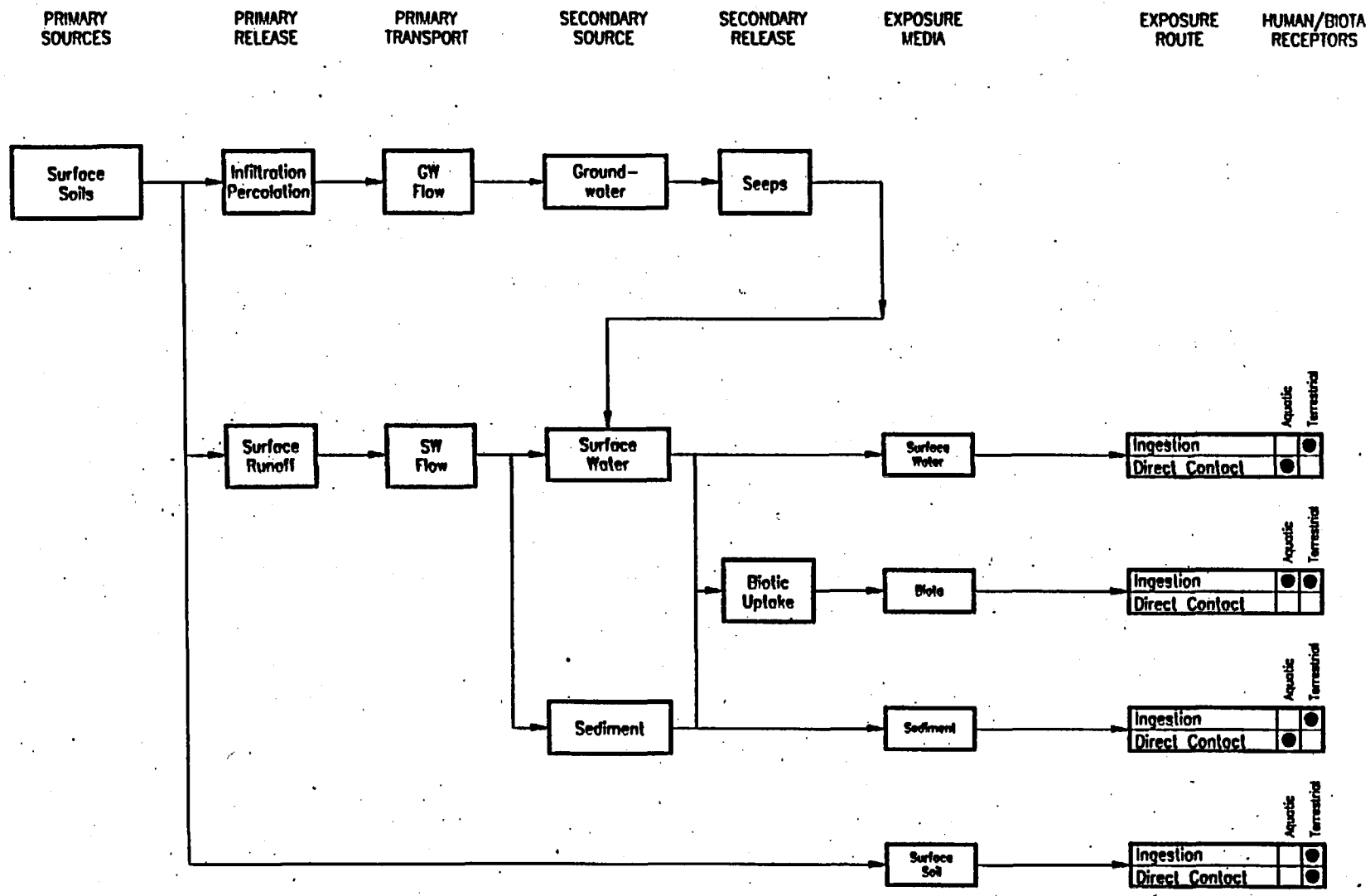


Figure 11

CONCEPTUAL SITE MODEL FOR RESIDENTIAL EXPOSURE

California Gulch Superfund Site, Leadville, Colorado

SOURCE: Baseline Human Health Risk Assessment (WESTON, 1996)

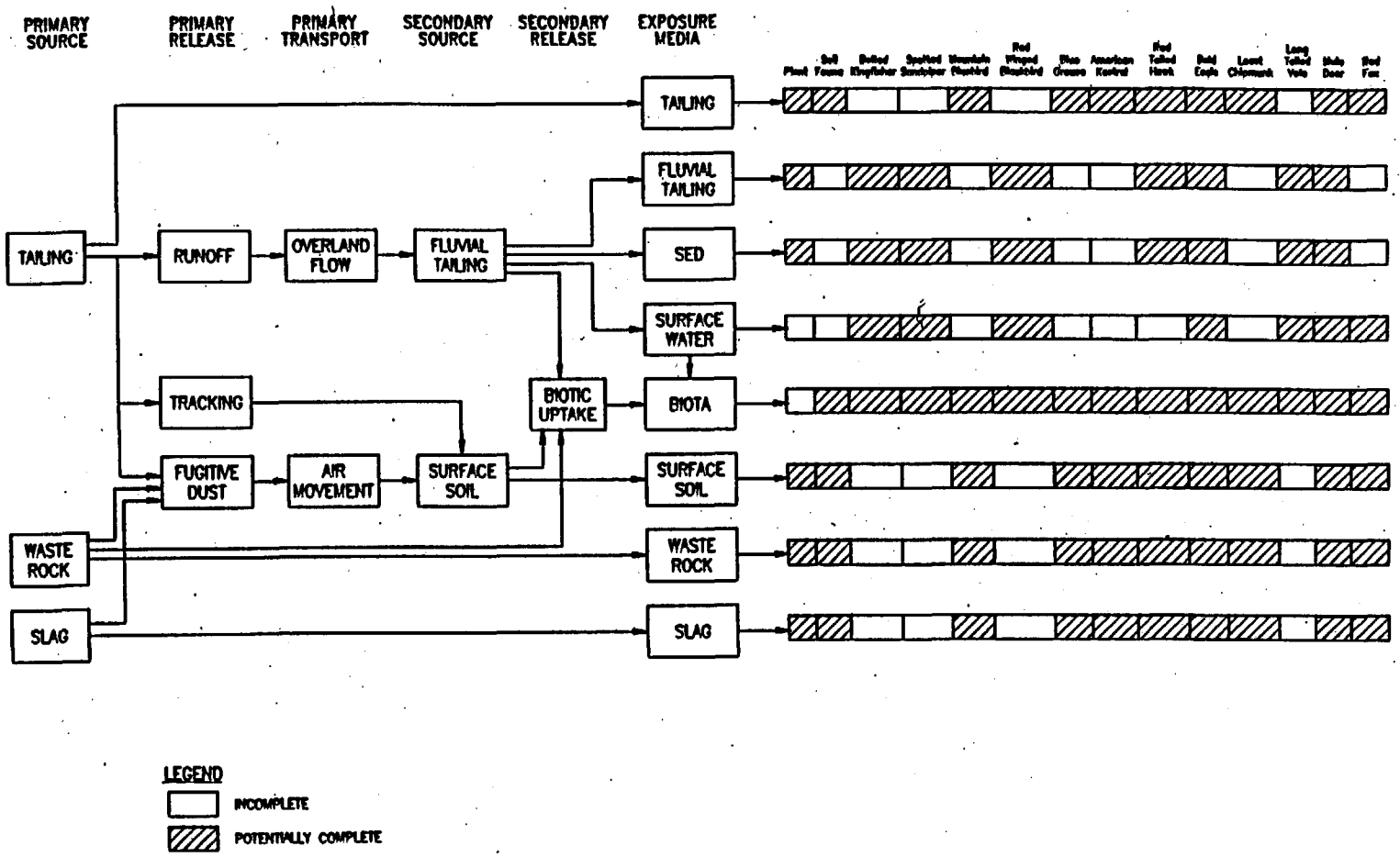


SOURCE: Final Baseline Aquatic Ecological Risk Assessment (WESTON, 1995)

Figure 12

CONCEPTUAL MODEL FOR CALIFORNIA GULCH ECOLOGICAL ASSESSMENT

California Gulch Superfund Site
Leadville, Colorado



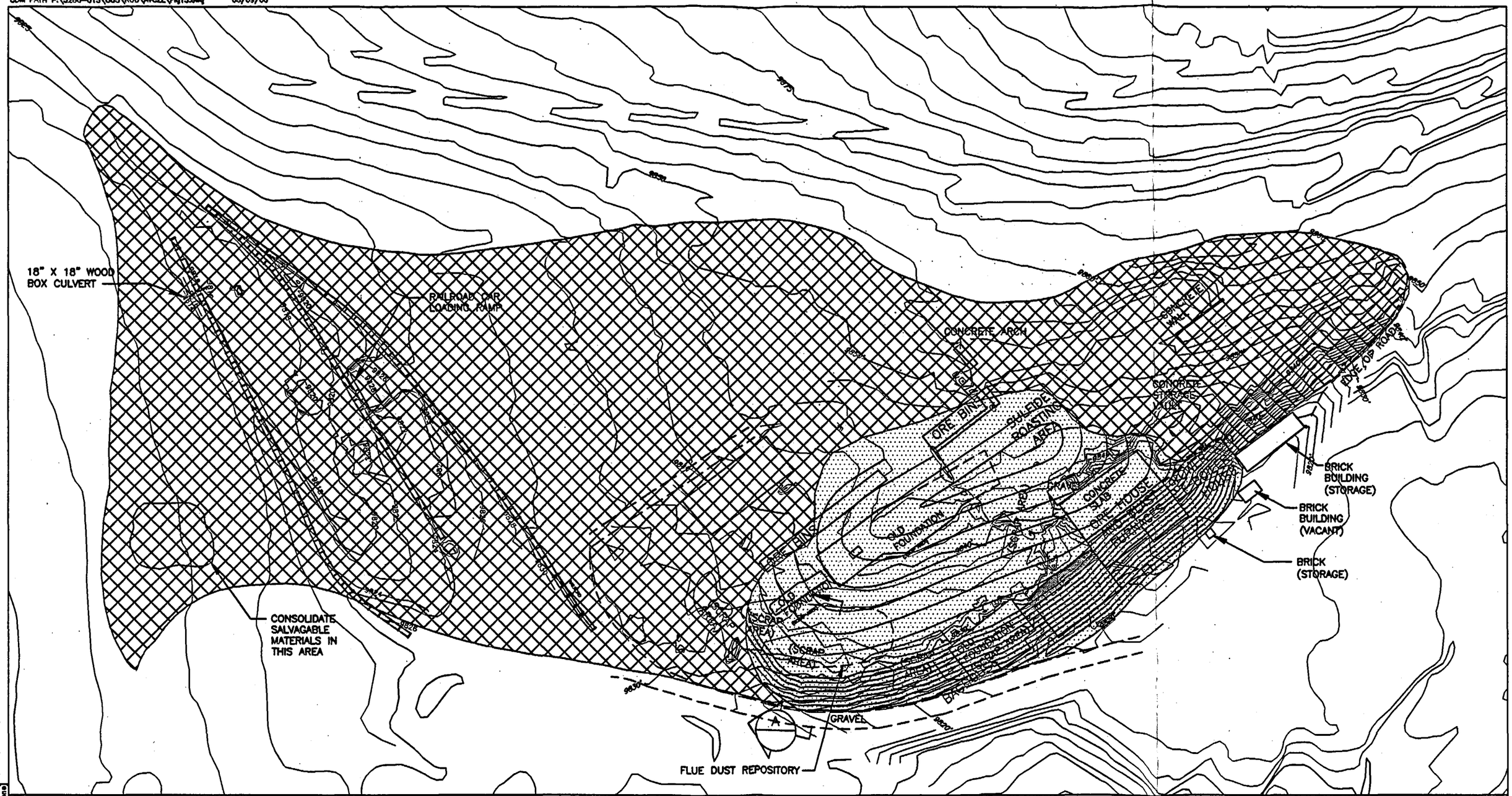
SOURCE: Ecological Risk Assessment for Terrestrial Ecosystem (WESTON, 1997)

Figure 13

CONCEPTUAL SITE MODEL ECOLOGICAL RISK ASSESSMENT FOR THE TERRESTRIAL ECOSYSTEM

California Gulch Superfund Site, Leadville, Colorado

CDM PATH P:\3260-015\OU5\ROD\AVCZL\Fig13.dwg 08/09/00



LEGEND:

REMAINING SITE FEATURES IDENTIFIED BY SURVEY, 1998.

18" VEGETATED SOIL COVER (ALT 3) OR 18" VEGETATED SOIL COVER, DRAINAGE LAYER AND GCL (ALT 4) OVER CONSOLIDATED NON-RESIDENTIAL SOIL AND TAILING.

APPROXIMATE NON-RESIDENTIAL SOIL AND TAILING REMOVAL AREA (REGRADED AND REVEGETATED FOLLOWING REMOVAL).

SCALE

200 0 200 FEET

N

Figure 14

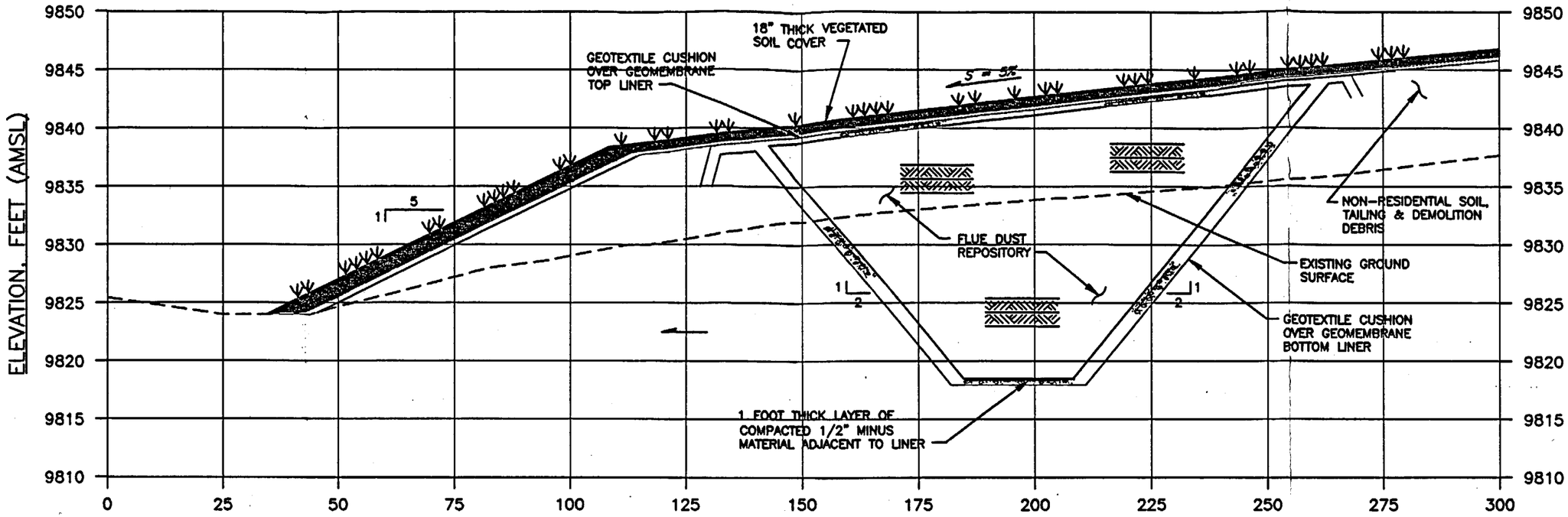
ALTERNATIVES 3 & 4
REPOSITORY & CONSOLIDATION AREA
AV SMELTER SITE
OPERABLE UNIT 5

California Gulch Superfund Site
Leadville, Colorado

Plot time 04:00 pm
Plot date 02-09-2000

SCG D:\3344\3344-230.dwg 02-09-2000 04:23 pm
Xrefs: [D:\3344\base\ AVCZL]
Images: [none]

CDM PATH P:\3280-15\OU5\ROD\AVCZL\Fig14.dwg 08/09/00

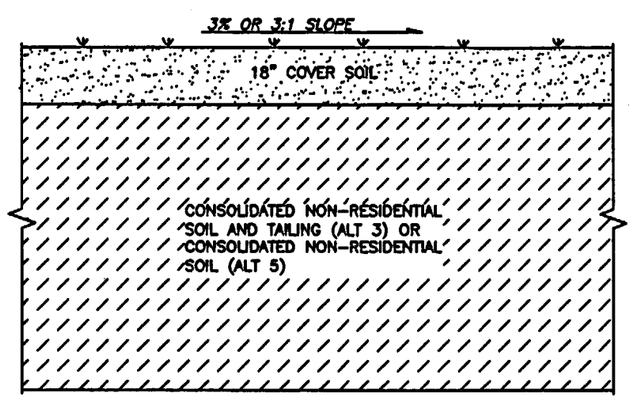


SECTION A
FIG.13

VERTICAL SCALE: 10 0 10 FEET

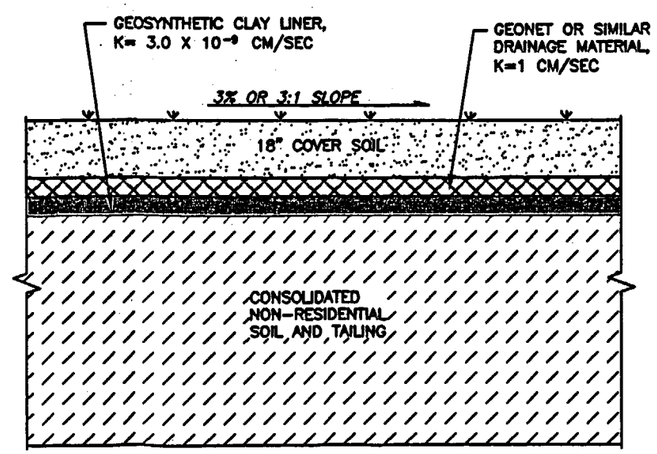
HORIZONTAL SCALE: 25 0 25 FEET

VERTICAL EXAGGERATION = 2.5x



ALTERNATIVES 3 AND 5 – SIMPLE SOIL COVER SECTION DETAIL

NOT TO SCALE



ALTERNATIVE 4 – GCL/SOIL COVER SECTION DETAIL

NOT TO SCALE

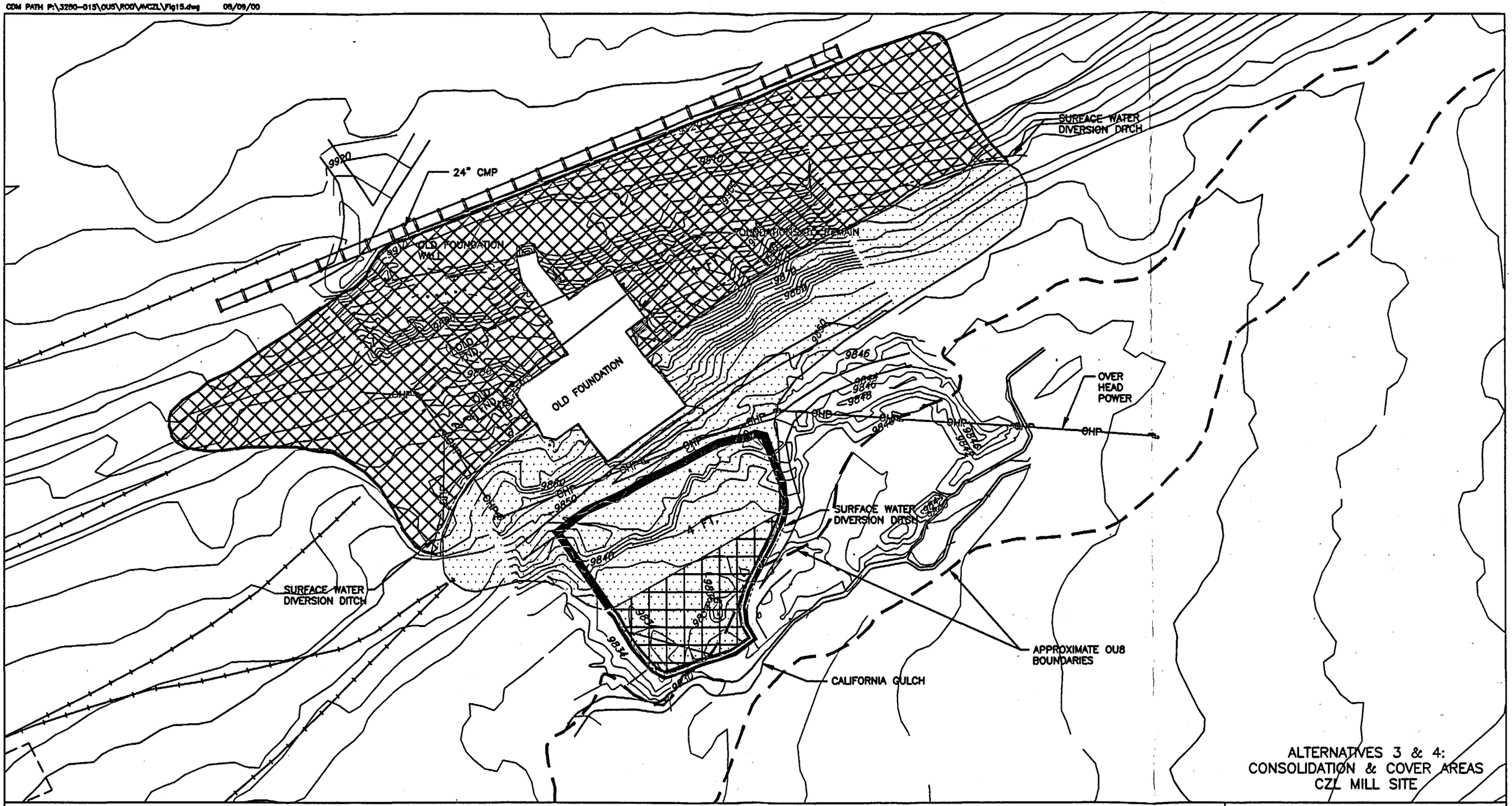
Figure 15

FLUE DUST REPOSITORY SECTION AND ALTERNATIVES 3, 4 AND 5 COVER DETAILS OPERABLE UNIT 5

California Gulch Superfund Site Leadville, Colorado

Plot time 02:12 pm Plot date 08-15-1999 SCG D:\3344\3344-238.dwg 07-31-2000 02:08 pm Xrefs: (none) Images: (none)

CDM PATH P:\3260-015\OU5\ROD\MCZL\Fig15.dwg 06/09/00



LEGEND:

- CONFIGURATION OF FORMER RAIL LINES IN 1937 FROM SANBORN FIRE INSURANCE MAPS.
- CURRENT SITE FEATURES IDENTIFIED BY SURVEY, 1998.
- 18" VEGETATED SOIL COVER (ALT 3) OR 18" VEGETATED SOIL COVER, DRAINAGE LAYER AND GCL (ALT 4) OVER CONSOLIDATED NON-RESIDENTIAL SOIL AND TAILING.
- NON-RESIDENTIAL SOIL REMOVAL AREA (REGRADED & REVEGETATED FOLLOWING REMOVAL)
- REMOVAL OF ANY TAILING IN CONTACT WITH GROUNDWATER (ACTUAL AREA TO BE DETERMINED DURING REMEDIAL DESIGN/REMEDIAL ACTION). AREA WILL BE GRADED AND REVEGETATED FOLLOWING REMOVAL.
- EXISTING TAILING AREA
- APPROXIMATE OU8 BOUNDARIES

SCALE

100 0 100 FEET

N

Figure 16

ALTERNATIVES 3 & 4:
CONSOLIDATION & COVER AREAS
CZL MILL SITE
OPERABEL UNIT 5

California Gulch Superfund Site
Leadville, Colorado

TABLES

TABLE 1
METALS CONCENTRATIONS IN SAMPLES
FROM THE BAGHOUSE AREA - AV SMELTER SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Location	Depth (inches bgs)	Description	Arsenic (mg/Kg)	Cadmium (mg/Kg)	Lead (mg/Kg)	Zinc (mg/Kg)	Copper (mg/Kg)
SO3-004	0 - 1	Fill: 30% to 50% slag, glass, brick fragments (< 250 um, by EDXRF)	7,476	4,783	43,900	15,300	--
	1 - 2		> UDL*	4,655	46,200	12,400	--
	2 - 6		> UDL*	913	47,600	5,036	--
	6 - 12		> UDL*	930	55,200	4,183	--
SAV12	0 - 1	Baghouse or flue dust (< 250 um, by EDXRF)	149,000	32,200	272,000	62,900	--
PG-067	0 - 1	Fill with pyritic ore rock (< 250 um, by ICP/EDXRF)	1,170/1809	13.6/6.4	12,500/8,561	3,180/1,969	--/1,504
	1 - 2		1,450/2070	11.4/7.4	16,600/12,431	1,290/890	--/1,665
	2 - 6		830/1165	7.7/6.1	1,500/11,320	755/582	--/1,751
	6 - 12	Fill with some wood fragments, yellowish orange soil and mine waste (< 250 um, by EDXRF)	113/151	0.6/<2	573/580	166/201	--/155
	12 - 18		116/191	0.7/<2	215/230	154/205	--/117

Notes:
*UDL = upper detection limit
bgs = below ground surface
mg/kg = millagrams per kilogram
um = micron

TABLE 3
METALS CONCENTRATIONS IN SAMPLES
FROM THE ORE STORAGE AREA - AV SMELTER SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Location	Depth (inches bgs)	Description	Arsenic (mg/Kg)	Cadmium (mg/Kg)	Lead (mg/Kg)	Zinc (mg/Kg)	Copper (mg/Kg)
SO3-007	0 - 1	Fill containing 5% charcoal (< 250 um, by EDXRF)	3,110	1,022	> UDL	16,100	--
	1 - 2		1,632	293	45,100	5,386	--
	2 - 6		296	171	9,227	1,896	--
	6 - 12		1,236	667	33,200	6,319	--
SAV22	0 - 1	Mixed debris and smelter waste including fine slag (< 250 um, by EDXRF)	5,500	--	77,900	--	--
	1 - 2		4,510	--	63,700	--	--
	2 - 6	Orange-brown silty clay with gravel and cobbles (< 250 um, by EDXRF)	3,720	--	51,300	--	--
	6 - 12		1,930	--	25,000	--	--
PG-068	0 - 1	Fill with some pyritic ore rock (< 2 mm, by EDXRF)	584	< 2	18,861	1,665	600
	1 - 2		1,179	2.5	25,558	1,419	820
	2 - 6		48	4.1	1,695	265	75
	6 - 12	Fill containing 5% to 25% charcoal, 1% to 5% brick, 1% to 5% slag and 1% to 5% cinders (< 2 mm)	191	< 2	351	279	46
	12 - 18		223	5.7	186	478	55

Notes:
bgs = below ground surface
mg/kg = millagrams per kilogram
mm = millimeter
um = micron

TABLE 2
METALS CONCENTRATIONS IN SAMPLES
FROM THE ROASTING PLANT AND ASSOCIATED FLUE AREAS - AV SMELTER SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Location	Depth (inches bgs)	Description	Arsenic (mg/Kg)	Cadmium (mg/Kg)	Lead (mg/Kg)	Zinc (mg/Kg)	Copper (mg/Kg)
SO3-005	0 - 1	Ash and native soil (< 250 um, by EDXRF)	2,149	419	39,900	22,100	--
	1 - 2		1,513	316	32,100	31,100	--
	2 - 6	Native soil (< 250 um, by EDXRF) Page 1 of 1	566	< 15	3,996	616	--
	6 - 12		134	17	679	559	--
PG-092	0 - 1	Cinders and slag (< 2 mm, by EDXRF)	1,587	130	12,756	6,063	2,445
	1 - 2		2,107	201	14,729	7,783	2,172
	2 - 6	Fill containing cinders and slag (< 2mm, by EDXRF)	3,584	150	13,454	4,567	2,494
	6 - 12		788	13	3,443	856	737
	12 - 18		<37	7.6	722	320	221
SO3-006	0 - 1	Cinders (< 250 um, by EDXRF)	1,325	313	23,700	8,520	--
	1 - 2		1,223	208	14,000	4,321	--
	2 - 6		713	157	10,500	2,706	--
	6 - 12		897	204	12,900	2,409	--

Notes:
bgs = below ground surface
mg/k = millagrams per kilogram
mm = millimeter
um = micron

TABLE 4
METALS CONCENTRATIONS IN COMPOSITE SAMPLES OF RESIDUAL MINE WASTE AND SMELTER MATERIALS (NON-RESIDENTIAL SOIL) FROM THE AV SMELTER SITE OU5 AV/CZL SITES CALIFORNIA GULCH SUPERFUND SITE

Location	Depth (inches bgs)	Description	Arsenic (mg/Kg)	Cadmium (mg/Kg)	Lead (mg/Kg)	Zinc (mg/Kg)	Copper (mg/Kg)
SAV11	0 - 1	Composite of non-residential soil materials collected from surface at 6 locations (SAV05, SAV06, SAV07, SAV08, SAV09, SAV10) (< 250 um, by EDXRF)	290 1,600 (D)*	59 409 (D)*	22,300 27,900 (D)*	7,870 6,760 (D)*	--
SAV04	0 - 1	Composite of coke and charcoal collected from surface at three locations (SAV01, SAV02, SAV03) (<250 um, by EDXRF)	1,050 1,130 (D)*	76.2 79 (D) *	6,990 7,050 (D)*	2,910 2,940 (D)*	--

Notes:

*D = field duplicate of composited sample
bgs = below ground surface
mg/kg = milligrams per kilogram
um = micron

TABLE 5
RESULTS OF LEACHING TESTS PERFORMED
ON SOIL AND SOURCE MATERIALS
FROM THE AV SMELTER SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Sample ID	Description	SPLP (mg/L in leachate)				TCLP (mg/L in leachate)			
		Arsenic	Cadmium	Lead	Zinc	Arsenic	Cadmium	Lead	Zinc
SAV12	flue dust	--	--	--	--	139 [1]	52.6 [1]	22.4 [1]	15.3
SAV15	soil from thaw house area	--	--	--	--	0.05	0.012	<0.04	0.02
SAV16	soil in the vicinity of the roasting plant	0.22	0.007	<0.04	0.03	0.44	0.619	0.25	0.14
SAV11	non-residential area soils	<0.04	0.339	0.52	54.1	--	--	--	--
SAV19	composite of tailing	0.22	0.059	1.13	1.93	--	--	--	--

Notes:

[1] Failed TCLP

SPL = Synthetic Precipitation Leaching Procedure
TCLP = Toxicity Characteristic Leaching Procedure
mg/L = milligrams per liter

TABLE 6
SPLP TEST RESULTS FOR COMPOSITE SAMPLES
OF NON-RESIDENTIAL SOIL FROM THE CZL MILL SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Sample ID	Depth (inches)	Description	SPLP Results (mg/L in leachate)			
			Arsenic	Cadmium	Lead	Zinc
SCZ04	0 - 2	Composite of SCZ01, SCZ02, SCZ03	<0.04	0.447	0.21	69.3
SCZ07	0 - 2	Composite of SCZ05 and SCZ06	0.36	0.273	1.28	29.4
SCZ11	0 - 2	Composite of SCZ08, SCZ09, SCZ10	<0.04	1.42	1.65	11.9

Notes:

SPLP = Synthetic Precipitation Leaching Procedure
mg/L = milligrams per liter

TABLE 7
AVERAGE GROUNDWATER QUALITY[1]
AT MONITORING LOCATIONS IN THE VICINITY OF THE AV/CZL SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Location	NW 11	NW 8	NW 13	NW 13A	NW 12	CZITMW1	CZITMW8	CZITMW7A
Dates	6/28/89 - 10/11/94	6/28/89 - 10/12/94	6/27/89 - 10/12/94	6/27/89 - 11/15/89	6/27/89 - 10/12/94	11/11/91 - 9/22/98	11/19/91 - 9/22/98 [2]	11/11/91 - 9/22/98
Number of Samples	5	5	6	2	4	11	10	7
Field pH	6.87	6.31	6.30	4.75	7.10	6.00	5.69	3.21
Field Conductivity	711	1,467	1,051	1,000	787	1,132	2,518	2,897
TDS (mg/L)	461	1,223	857	955	512	1,009	3,232	3,796
Sulfate (mg/L)	199	807	494	560	322	637	2,053	2,411
Dissolved Metals (mg/L)								
Arsenic	0.003	0.003	0.002	0.01	<0.005	0.002	0.016	0.008
Cadmium	0.002	0.04	0.10	0.41	< 0.005	0.12	0.205	0.299
Copper	0.01	0.01	0.12	0.33	0.01	0.007	0.006	0.642
Lead	0.003	0.003	0.003	0.01	< 0.005	0.003	0.604	0.072
Zinc	0.10	17.8	17.1	53.5	0.01	45.3	134	149
Screened Depth (feet bgs)	17.5' - 52.5'	23.3' - 53.3'	7.4' - 47.4'	7.4' - 17.4'	8.3' - 48.3'	7.4' - 17.4'	1.7' - 11.7'	1.8' - 6.8'

Footnotes:
1 Data for individual samples are included in the FFS, Appendix B, Table B-4 (MFG, 2000).
2 Includes data collected prior to and following the removal of tailing from the CZL Impoundment in 1995.

TABLE 8
AVERAGE SURFACE WATER QUALITY[1] AT MONITORING LOCATIONS IN THE VICINITY OF AV/CZL SITE
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Location	CG-4B	CG-4C	CG-5	CG-6A	SPR5 (Spring)	SPR6 (Spring)
Dates	6/6/89 - 9/23/98	6/6/89 - 9/23/98	6/6/89 - 9/23/98	6/6/89 - 9/23/98	6/6/89 - 9/14/92	1/1/89
Total Number of Samples	12	25	39	24	4	1
Averages for all data[2]						
Field pH	5.72	5.49	5.33	6.04	4.24	6.74
TDS (mg/L)	1098	1139	1009	887	1295	1400
TSS (mg/L)	46	56	114	44	1.5	8
Sulfate (mg/L)	719	738	654	585	879	860
Metals (mg/L)						
Dissolved Arsenic	ND	ND	ND	ND	ND	ND
Total Arsenic	0.005	0.009	0.018	ND	ND	ND
Dissolved Cadmium	0.096	0.104	0.079	0.071	0.0577	0.069
Total Cadmium	0.105	0.105	0.084	0.074	0.056	0.07
Dissolved Copper	0.199	0.228	0.154	0.132	0.007	0.049
Total Copper	0.301	0.475	0.334	0.209	ND	0.064
Dissolved Lead	0.139	0.232	0.146	0.147	0.011	0.01
Total Lead	0.420	0.836	1.56	0.405	0.30	0.03
Dissolved Zinc	26.67	23.40	21.14	16.44	27.63	29
Total Zinc	25.79	23.12	22.05	16.87	25.5	28

Footnotes: 1 Data for individual samples are included in the FFS, Appendix B, Table B-3. (MFG, 2000)
2 Average includes all data (baseflow and spring runoff) on Table B-3. The negative values for non-detect results (Table B-3) were not adjusted.
ND = Non-detect

TABLE 9
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
OVERALL PROTECTIVENESS					
Human Health Protection					
Airborne transport of particles	No reduction in risk.	Soil cover and maintenance would virtually eliminate potential for airborne transport of particles.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a geosynthetic clay liner (GCL) with the soil cover and maintenance.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal.
Erosion of materials into local water courses	No reduction in risk.	Soil cover and maintenance would virtually eliminate potential for erosion into local water courses.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a GCL with the soil cover and maintenance.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal.
Metals leaching into surface water	No reduction in risk.	Soil cover and maintenance would virtually eliminate potential for metals leaching into surface water.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a GCL with the soil cover and maintenance.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal.
Metals leaching into groundwater	No reduction in risk.	Soil cover and maintenance would virtually eliminate potential for metals leaching into groundwater. Slight potential still exists for minor infiltration.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a GCL with the soil cover and maintenance.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
Contaminant exposure to animals and aquatic life	Potential risk to the mountain bluebird, chipmunk, and bald eagle through direct contact of certain sources.	Soil cover and maintenance would reduce exposure to contaminant sources.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a GCL with the soil cover and maintenance.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal.
Environmental Protection	No reduction in risk.	Soil cover and maintenance would virtually eliminate potential for risk to environment. Infiltration reduced by about 72% for all waste.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a flue dust repository. Soil cover would reduce infiltration by about 81% and the flue dust repository would reduce infiltration by about 99.99%.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to the use of a GCL with the soil cover and maintenance. Soil cover would reduce infiltration by about 97%; flue dust repository would reduce infiltration by about 99.99%.	Greater degree of risk reduction compared to simple soil cover (Alt. 2) due to off-site disposal. Soil cover would reduce infiltration by about 93%.
COMPLIANCE WITH ARARs					
Chemical-Specific ARARs	Chemical-specific ARARs are met.	Chemical-specific ARARs are met.	Chemical-specific ARARs are met.	Chemical-specific ARARs are met.	Chemical-specific ARARs are met.
Location-Specific ARARs	Location-specific ARARs are met.	Location-specific ARARs are met.	Location-specific ARARs are met.	Location-specific ARARs are met.	Location-specific ARARs are met.
Action-Specific ARARs	Action-Specific ARARs are met.	Action-Specific ARARs are met.	Action-Specific ARARs are met.	Action-Specific ARARs are met.	Action-Specific ARARs are met.
Other Criteria and Guidance	None identified.	None identified.	None identified.	None identified.	None identified.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Airborne transport of particles	No significant increase in long-term effectiveness and permanence.	Soil cover, regraded slopes, maintenance, and institutional controls would provide good long-term effectiveness and permanence.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Off-site disposal effective in eliminating flue dust as a metal source.
Erosion of materials into local water courses	No significant increase in long-term effectiveness and permanence.	Soil cover, regraded slopes, maintenance, and institutional controls would provide good long-term effectiveness and permanence.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Off-site disposal effective in eliminating flue dust as a metal source.
Metals leaching into surface water	No significant increase in long-term effectiveness and permanence.	Soil cover, regraded slopes, maintenance, and institutional controls would provide good long-term effectiveness and permanence.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Same as Alternative 3. Addition of GCL in soil cover would further reduce infiltration by 4% in non-residential area soils and 16% in tailing. Since non-residential area soils and tailing do not pose a significant risk, controlling metals release due to infiltration would essentially be the same in Alt. 3 and Alt. 4.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Off-site disposal effective in eliminating flue dust as a metal source.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
Metals leaching into groundwater	No significant increase in long-term effectiveness and permanence.	Soil cover, regraded slopes, maintenance, and institutional controls would provide good long-term effectiveness and permanence.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Same as Alternative 3. Addition of GCL in soil cover would further reduce infiltration by 4% in non-residential area soils and 16% in tailing. Since non-residential area soils and tailing do not pose a significant risk, controlling metals release due to infiltration would essentially be the same in Alt. 3 and Alt. 4.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Off-site disposal effective in eliminating flue dust as a metal source.
Contaminant exposure to animals and aquatic life	No significant increase in long-term effectiveness and permanence.	Soil cover, regraded slopes, maintenance, and institutional controls would provide good long-term effectiveness and permanence.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Repository effective in eliminating flue dust as a metal source.	Same as Alternative 3. Addition of GCL in soil cover would further reduce infiltration.	Soil cover, maintenance, and institutional controls would provide good long-term effectiveness and permanence. Off-site disposal effective in eliminating flue dust as a metal source.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	Soil cover would provide good control of source materials. Reliability can be high if maintained. Failure to maintain cover can increase potential for airborne transport, erosion, and leaching. Institutional controls are limited in effectiveness due to enforceability.	Reliability would be slightly greater than Alternative 2 due to the use of an on-site repository. Institutional controls are limited in effectiveness due to enforceability.	Reliability would be slightly greater than Alternative 2 due to the use of a GCL in soil cover thereby further reducing infiltration. Institutional controls are limited in effectiveness due to enforceability.	Reliability would be slightly greater than Alternative 2 due to off-site disposal. Institutional controls are limited in effectiveness due to enforceability.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Reduction of Toxicity, Mobility, or Volume	Does not include treatment.	Does not include treatment.	Does not include treatment.	Does not include treatment.	Does not include treatment.
SHORT-TERM EFFECTIVENESS					
Community Protection	No disturbance to the community.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Low short-term effectiveness due to increased risks during excavation and truck transportation.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
Worker Protection	No risk to workers.	Low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Low short-term effectiveness due to increased risks during excavation and truck transportation.
Environmental Impacts	Not effective in reducing short-term risk to the environment.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.	Minimal disturbance and low risk during structure demolition and consolidation activities. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants. Road traffic would increase over the short-term.	Low short-term effectiveness due to increased risks during excavation and truck transportation. Engineering controls would be used to reduce the risk from dust emissions and exposure to contaminants.
Time Until Action is Complete	Not applicable.	Two years.	Two years.	Three years.	Two years.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
IMPLEMENTABILITY					
Ability to Construct and Operate	No construction or operation.	Standard construction methods used.	Standard construction methods used.	Standard construction methods used.	Standard construction methods.
Ease of Doing More Action if Needed	May require ROD amendment if future action is taken.	May require ROD amendment if future action is taken. The integrity of the cover would have to be compromised to implement additional actions.	May require ROD amendment if future action is taken. The integrity of the cover would have to be compromised to implement additional actions.	May require ROD amendment if future action is taken. The integrity of the cover would have to be compromised to implement additional actions.	May require ROD amendment if future action is taken. The integrity of the cover would have to be compromised to implement additional actions. Additionally, if treatment is not possible at disposal facility, a treatment variance would be required, which could take one to two years to obtain.
Ability to Monitor Effectiveness	No monitoring.	Monitoring and maintenance inspections will give notice of failure before significant exposure occurs.	Monitoring and maintenance inspections will give notice of failure before significant exposure occurs.	Monitoring and maintenance inspections will give notice of failure before significant exposure occurs.	Monitoring and maintenance inspections will give notice of failure before significant exposure occurs.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approval necessary.	Coordination and cooperation with property owners and local agencies will be necessary.	Better cooperation anticipated than for Alt. 2 since the covered areas are less than for Alt. 2, thus opening up the majority of the site for unrestricted industrial use.	Better cooperation anticipated than for Alt. 2 since the covered areas are less than for Alt. 2, thus opening up the majority of the site for unrestricted industrial use.	Moderately difficult to implement due to problems with the disposal facility being able to treat the flue dust to meet RCRA land disposal restriction requirements.
Availability of Equipment, Specialists, and Materials	None required.	Standard equipment is readily available.	Standard equipment is readily available.	Standard equipment is readily available.	Standard equipment is readily available.

TABLE 9 (continued)
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Evaluation Criteria	No Action Alternative 1	Containment In Place (Soil Cover) Alternative 2	Consolidation/Contain-ment (Flue Dust Repository and Soil Cover) Alternative 3	Consolidation/Contain-ment (Flue Dust Repository and GCL/Soil Cover) Alternative 4	Consolidation/Contain-ment (Soil Cover) and Excavation/Off-Site Disposal Alternative 5
Availability of Technologies	None required.	Containment technology is readily available.	Containment and repository technology is readily available.	Containment and repository technology is readily available.	Containment and removal technology is readily available.
COST					
Capital Cost	$0	$3,230,000	$2,815,000	$3,900,000	$15,000,000
Annual O&M Cost	$0	$14,000	$19,000	$19,000	$14,000
Present Worth Cost (5% Rate of Return, 30 year period)	$0	$3,600,000	$3,250,000	$4,300,000	$15,400,000
STATE ACCEPTANCE					
State Acceptance	Alternative not preferred by the State.	Alternative not preferred by the State.	Alternative preferred by the State.	Alternative not preferred by the State	Alternative not preferred by the State
COMMUNITY ACCEPTANCE					
Community Acceptance	Alternative not preferred by the community.	Alternative not preferred by the community.	Alternative preferred by the community.	Alternative not preferred by the community	Alternative not preferred by the community

TABLE 10
SUMMARY OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
			FEDERAL	
RCRA Subtitle C	40 CFR Part 261.4 (b)(7) and RCRA Section 3001 (b) (Bevill Amendment)	No	Yes	The sources of contamination at the OU5 AV/CZL Sites are various combinations of the following: tailing, waste rock, slag, non-residential area soils and baghouse flue dust from processing of primary lead ore. Based on 40 CFR 261.4(b)(7) and Section 3001 (b) (Bevill Amendments), tailing, waste rock, and slag waste are excluded from RCRA Subtitle C. However, any bag house/flue dust is potentially subject to RCRA if these materials fail TCLP and are disposed. Consolidation or on-site management of flue dust within area of contamination would not constitute disposal and, therefore, RCRA subtitle C would not be applicable. However, provisions of RCRA are potentially relevant and appropriate to flue dust. (See action-specific ARARs below.)
Clean Air Act, National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	No	No	National ambient air quality standards (NAAQS) are implemented through the New Source Review Program and State Implementation Plans (SIP). The federal New Source Review Program addresses only major sources. Emissions associated with proposed remedial action at the AV/CZL site would be limited to fugitive dust emissions associated with earth moving activities during construction. These activities will not constitute a major source. Therefore, attainment and maintenance of NAAQS pursuant to the New Source Review Program are not ARARs. See Colorado Air Pollution Prevention and Control Act concerning applicability of requirements implemented through the SIP.
RCRA Subtitle C	40 CFR Part 268	No	No	Land Disposal Restrictions (LDR) implemented through RCRA Subtitle C require that hazardous wastes meet specific treatment standards based on best demonstrated available technology (BDAT) before being disposed in a landfill. This requirement would be applicable if flue dust is determined to have hazardous waste characteristics by TCLP testing before it is disposed. Consolidation or on-site management of flue dust within an Area of Contamination does not constitute placement therefore the LDRs would not be triggered.

TABLE 10 (continued)
SUMMARY OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
STATE OF COLORADO				
Colorado Air Pollution Prevention and Control Act	5 CCR 1001-14; 5 CCR 1001-10 Part B, C (I) Regulation 8	Yes	---	Pursuant to the Colorado Air Pollution Prevention and Control Act, applicants for construction permits are required to evaluate whether the proposed source will exceed NAAQS. Applicants are also required to evaluate whether the proposed activities would cause an exceedance of the Colorado ambient standard for particulate 10 microns or less in aerodynamic diameter (PM10). Construction activities associated with proposed remedial action at the AV/CZL site would be limited to generation of fugitive dust emissions. Colorado regulates fugitive emissions through Regulation No. 1. Compliance with applicable provisions of the Colorado air quality requirements would be achieved by adhering to a fugitive emissions dust control plan prepared in accordance with Regulation No. 1. This plan will discuss monitoring requirements, if any, necessary to achieve these standards. Colorado Regulation 8, Part B asbestos is applicable to demolition and disposal of asbestos containing material encountered during demolition activities. Regulation No. 8 sets emission limits for lead. Applicants are required to evaluate whether the proposed activities would result in an exceedance of this standard. The proposed remedial action at the AV/CZL site is not expected to exceed the emission levels for lead, although some lead emissions may occur. Compliance with Regulation No. 8 would be achieved by adhering to a fugitive emissions dust control plan prepared in accordance with Regulation No. 1. This plan will discuss monitoring requirements, if any, necessary to achieve these standards.

TABLE 11
SUMMARY OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
			FEDERAL	
National Historic Preservation Act (NHPA)	16 USC § 470 et seq.; 40 CFR § 6.301(b); 36 CFR Part 63, Part 65, Part 800	Yes	---	Expands historic preservation programs; requires preservation of resources included in or eligible for listing on the National Register for Historic Places (NRHP). The AV/CZL site has been recommended as eligible for listing on the NRHP and is considered contributing to the Leadville Historic Mining District. Therefore, the NHPA is applicable. Archaeological/ cultural resource surveys have been conducted at the California Gulch Superfund Site in satisfaction of the requirements of the NHPA.
Executive Order 11593 Protection and Enhancement of the Cultural Environment	16 USC § 470	Yes	---	Directs federal agencies to institute procedures to ensure that programs contribute to the preservation and enhancement of non-federally owned historic resources. The Order is applicable, due to the historic status of the site. Consultation with the Advisory Council on Historic Preservation is required if removal activities should threaten cultural resources. Compliance with the applicable provisions of the Order will be achieved by adhering to an approved mitigation plan, and through working with the Advisory Council to ensure that any threatened cultural resources are appropriately preserved.
The Historic and Archaeological Data Preservation Act of 1974	16 USC 469 40 CFR § 6.301(c)	Yes	---	Establishes procedures to preserve historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity program. The Act is potentially applicable if the remedial actions include alteration of the site terrain. Compliance with the requirements of the Act would be addressed by an approved mitigation plan.
Historic Sites Act of 1935	16 USC § 461-467	Yes	---	Preserves for public use historic sites, buildings, and objects of natural significance. Is potentially applicable if any site features are determined to be of natural significance. Compliance with the applicable requirements of the Act would be addressed by the approved mitigation plan.

TABLE 11 (continued)
SUMMARY OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
The Archeological Resources Protection Act of 1979	16 USC §§ 470aa-47011	No	Yes	Requires a permit for any excavation or removal of archeological resources from public lands or Indian lands. May be relevant and appropriate if archeological resources are encountered during removal activities.
Executive Order No. 11990 Protection of Wetlands	40 CFR § 6.302(a) and Appendix A	No	No	Minimizes adverse impacts on areas designated as wetlands. Not applicable as wetlands have not been designated at the AV/CZL site.
Executive Order No. 11988 Floodplain Management	40 CFR § 6.302 & Appendix A	Yes	—	Pertains to floodplain management and construction of impoundments in such areas. Is applicable if the remedial actions require the occupation or modification of flood plains. The remedial actions would be designed to comply with the applicable requirements of the Order.
Section 404, Clean Water Act (CWA)	33 USC 1251 et seq. 33 CFR Part 330	No	No	Regulates discharge of dredged or fill materials into waters of the United States. Portions of the AV/CZL site are adjacent to waters of the U.S. Substantive requirements of portions of Nationwide Permit No. 38 (General and Specific Conditions) would be applicable to AV/CZL site remedial activities conducted within waters of the United States, although none are anticipated.
Fish and Wildlife Coordination Act	16 USC § 661 et seq.; 40 CFR § 6.302	No	No	Requires coordination with federal and state agencies to provide protection of fish and wildlife in water resource development programs; regulates actions that impound, divert, control, or modify any body of water. However, proposed remedial action activities at the AV/CZL site will not affect fish or wildlife. If it appears that remedial activities may impact wildlife resources, EPA would coordinate with both the U.S. Fish and Wildlife Service and the Colorado Department of Natural Resources.
Endangered Species Act	16 USC § 1531 et seq.; 50 CFR §§ 200 and 402	No	No	Provides protection for threatened and endangered species and their habitats. However, site-specific studies did not document the presence of threatened or endangered species. If threatened or endangered species are encountered during remedial activities at the AV/CZL site, then requirements of this Act would be applicable.

TABLE 11 (continued)
SUMMARY OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
Wilderness Act	16 USC 1311; 16 USC 668; 50 CFR 53; 50 CFR 27	No	No	Limits activities within areas designated as wilderness areas or National Wildlife Refuge Systems. Remedial activities planned for AV/CZL site will not impact any designated areas. The Act is, therefore, not a potential ARAR.
Resource Conservation and Recovery Act (RCRA), Subtitle D	40 CFR Part 257, Subpart A, § 257.3-1 Floodplains, paragraph (a)	No	Yes	Provides general classification criteria for solid waste disposal facilities pertaining to floodplains and other siting criteria. May be relevant and appropriate for remedial activities at the AV/CZL site that involve on-site management of materials.
STATE OF COLORADO				
Colorado Historical, Prehistorical, and Archaeological Resources Act	CRS §§ 24-80-401 to 410 1301 to 1305	No	Yes	Concerns historical, prehistorical, and archaeological resources; applies only to areas owned by the State or its political subdivisions. May be relevant and appropriate if remedial action impacts an archaeological site.
Colorado Register of Historic Places	CRS §§ 24-80.1-101 to 108	Yes	---	Authorizes the State Historical Society to nominate properties for inclusion on the State Register of Historic Places. Applicable if remedial action activities impact an area listed on the Register.
Nongame, Endangered or Threatened Species Act	CRS §§ 33-2-101 to 108	No	No	Standards for regulation of nongame wildlife and threatened and endangered species. Site-specific studies did not document the presence of threatened or endangered species. If threatened or endangered species are encountered during remedial activities at the AV/CZL site, then requirements of the Act would be applicable.
Colorado Species of Special Concern and Species of Undetermined Status	Colorado Division of Wildlife Administrative Directive E-1, 1985, modified	No	No	Protects species listed on the Colorado Division of Wildlife generated list. Urges coordination with the Division of Wildlife if wildlife species are to be impacted. No evidence of species of special concern have been identified at the AV/CZL site.

TABLE 11 (continued)
SUMMARY OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
Colorado Natural Areas	Colorado Revised Statutes, Title 33 Article 33, § 104	No	No	Maintains a list of plant species of special concern. Although not protected by State statue, coordination with Division of Parks and Outdoor Recreation is recommended if activities will impact listed species.
Colorado Hazardous Waste Regulations	6 CCR 1007-3 Subpart B 264.14, 264.15 (a)(c), 264.18 (a) Subpart C 264.31 (a)		Yes	General RCRA security, location and design requirements may be relevant and appropriate.

TABLE 12
SUMMARY OF FEDERAL AND STATE ACTION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
FEDERAL				
National Emissions Standards for Hazardous Air Pollutants (NESHAP) and Colorado Air Quality Control Act	40 CFR Part 61 5 CCR 1001 - Regulation 8, Part B - Asbestos	Yes	---	Contain requirements for notification, worker and supervisor training and certification, safe work practices, demolition, and disposal of asbestos containing material (ACM). These regulations are applicable to demolition and disposal of ACM encountered during demolition activities. Compliance to the applicable requirements would be achieved by adhering to a work plan prepared in accordance with the regulations.
Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (RCRA)	40 CFR Part 257, Subpart A: § 257.3-1 Floodplains, paragraph (a); § 257.3-7 Air, paragraph (b)		Yes	Selected portions of Part 257 pertaining to floodplains and safety are applicable. These provisions establish criteria for classification of solid waste disposal facilities and practices.
Hazardous Materials Transportation Act	49 USC § 1801-1813 49 CFR 107, 171-177	No	Yes	Regulates transportation of hazardous materials. Relevant and appropriate if the remedial action entails off-site transportation of hazardous materials. Compliance with the applicable requirements would be achieved by adhering to a transportation and disposal plan prepared in accordance with the requirements.
STATE OF COLORADO				
Colorado Air Quality Control Act	5 CCR 1001-3; § III.D.1.a,b,c,d. § III.D.2.a,b,c,e,f,g,h. Regulation No. 1	Yes	---	Regulation No. 1 provisions concerning fugitive emissions for roadways, construction activities, storage and stockpiling activities, haul roads, haul trucks, and tailing ponds are applicable (5 CCR 1001-3; Sections III.D.2.a,b,c,e,f,g.). Construction activities at the AV/CZL site will be conducted in accordance with a fugitive emissions dust control plan.

TABLE 12 (continued)
SUMMARY OF FEDERAL AND STATE ACTION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
Colorado Air Quality Control Act	5 CCR 1001-5 Regulation No. 3, APENs	Yes	---	Requirements for filing an Air Pollution Emission Notification (APEN) are applicable if the removal actions disturb contaminated soil. Substantive provisions of APENS will be met. Establishes emissions control regulations for construction or modification of stationary sources. An APEN will be filed if future remedial actions disturb contaminated soils.
Colorado Air Quality Control Act	5 CCR 1001-4 Regulation No. 2, Odors	No	No	Applicable only if removal action activities cause objectionable odors. Remedial action at the AV/CZL site is not expected to produce odors.
Colorado Solid Waste Disposal Sites and Facilities Act	6 CCR 1007-2	No	Yes	Establishes standards for licensing, locating, constructing and operating solid waste facilities. Portions of the Act may be relevant and appropriate for remedial activities involving on-site management of source materials.
Colorado Solid Waste Disposal Sites and Facilities Act	6 CCR 1007-2, Part B, Section 3	No	Yes	Establishes regulations for solid waste management facilities, including location standards. May be relevant and appropriate for remedial activities that include on-site management of source materials.
Colorado Water Quality Control Act, Storm Water Discharge Regulations	5 CCR 1002-2	Yes	---	Establishes requirements for storm water discharges (except portions relating to site-wide surface and groundwater). Substantive requirements for storm water discharges associated with construction activities are applicable. A Storm Water Management Plan will be prepared, if required.
Colorado Mined Land Reclamation Act	CRS 34-32-101 to 125; Rule 3 of Mineral Rules and Regulations	No	Yes	Regulates all aspects of land use for mining, including the location of mining operations and related reclamation activities and other environmental and socio-economic impacts. Substantive requirements of portions of Rule 3 regarding Reclamation Measures, Water - General Requirements (except portions relating to Site-wide Surface and Ground Water), Wildlife, and Revegetation are potentially relevant and appropriate.

TABLE 12 (continued)
SUMMARY OF FEDERAL AND STATE ACTION-SPECIFIC ARARS
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Potentially Applicable	Potentially Relevant and Appropriate	Description
Colorado Noise Abatement Act	CRS §§ 25-12-101 to 108	Yes	---	Establishes maximum permissible noise levels for particular time periods and land use related to construction projects.
Colorado Hazardous Waste Regulations	6 CCR 1007-3, Part 264	No	Yes	Consolidation or on-site management of flue dust within an Area of Contamination does not constitute placement, thus RCRA provisions related to the handling of the flue dust are not applicable because the proposed activities do not constitute disposal. However, the provisions of the hazardous waste regulations may be relevant and appropriate for the flue dust remedial actions proposed for OU5.
Colorado Solid Waste Disposal Sites and Facilities Act	6 CCR 1007-2, Part B, Section 5	Yes	No	May be applicable for the on-site disposal of friable and non-friable asbestos.
Regulations on the Collection of Aquatic Life	2 CCR 406-8, Ch. 13, Article III, § 1316	No	No	Requirements governing the collection of aquatic life samples for scientific purposes. Remedial action activities within the AV/CZL sites will not include biological monitoring.

TABLE 13
DETAILED COST ESTIMATE
ALTERNATIVE 3 - CONSOLIDATION/CONTAINMENT (FLUE DUST REPOSITORY AND SOIL COVER)
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Item/Description	Quantity	Unit	Unit Cost	Extension	Total Cost
DIRECT CAPITAL COSTS					
Demolition of Structures					$259,800
Heavy Demolition and Salvage	30	day	$6,900.00	$207,000	
Wood Chipping	5	day	$900.00	$4,500	
Dust Control	30	day	$510.00	$15,300	
Dust Monitoring	30	day	$1,100.00	$33,000	
Relocation of Flue Dust to Repository					$362,250
Relocation of Flue Dust in Repository (Incl. construction and covering of repository)	9000	cy	$40.25	$362,250	
Consolidate NRS and Tailing (Smelter Area)					$653,900
Excavate & Haul NRS and Tailing	70000	cy	$3.00	$210,000	
Place and Rough Grade NRS and Tailing	70000	cy	$3.00	$210,000	
Compact NRS and Tailing	70000	cy	$0.63	$44,100	
Reveg Excavated Areas (less than 3:1 slopes)	39	ac	$1,750.00	$68,250	
Survey Control	10	day	$885.00	$8,850	
Dust Control	70	day	$510.00	$35,700	
Dust Monitoring	70	day	$1,100.00	$77,000	
Consolidate NRS and Tailing (Mill Site)					$102,945
Excavate & Haul NRS	7500	cy	$2.50	$18,750	
Place and Rough Grade NRS	7500	cy	$3.00	$22,500	
Compact NRS	7500	cy	$0.63	$4,725	
Reveg Excavated Areas (greater than 3:1 slopes)	4.6	ac	$8,500.00	$39,100	
Survey Control	2	day	$885.00	$1,770	
Dust Control	10	day	$510.00	$5,100	
Dust Monitoring	10	day	$1,100.00	$11,000	
Soil Cover Construction (Smelter Area)					$246,925
Excavate Borrow Soil	25000	cy	$1.60	$40,000	
Screen Borrow Soil	25000	cy	$4.00	$100,000	
Haul and Place	25000	cy	$3.40	$85,000	
Survey Control	5	day	$885.00	$4,425	
Reveg Slopes less than 3:1	10	ac	$1,750.00	$17,500	
Soil Cover Construction (Mill Site)					$24,045
Excavate Borrow Soil	2300	cy	$1.60	$3,680	
Screen Borrow Soil	2300	cy	$4.00	$9,200	
Haul and Place	2300	cy	$3.40	$7,820	
Survey Control	2	day	$885.00	$1,770	
Reveg Slopes less than 3:1	0.9	ac	$1,750.00	$1,575	
Groundwater Well Installation	3	well	$7,000.00	$21,000	$21,000
Institutional Controls					$50,000
Implement Program	1	ls	$50,000.00	$50,000	
SUBTOTAL DIRECT CAPITAL COSTS					$1,720,865
INDIRECT CAPITAL COSTS					
Mob/Demob			10%	$172,087	
Engineering/Administration Costs			10%	$172,087	
Construction Management Costs			10%	$172,087	
Health & Safety			3%	$43,022	
SUBTOTAL INDIRECT CAPITAL COSTS					$559,281
Capital Cost Contingency			25%	$570,037	
TOTAL ESTIMATED CAPITAL COST					$2,850,183
ANNUAL OPERATION & MAINTENANCE COSTS					
Incremental Annual O&M Costs					
Inspection	1	yr	1,280.00	$1,280	
Erosion Repairs	1	yr	3,000.00	$3,000	
Vegetation Maintenance	1	yr	6,000.00	$6,000	$10,280
Groundwater Sampling and Analysis	1	event	3,400.00	$3,400	$3,400
SUBTOTAL ANNUAL O&M COSTS					$13,680
O&M Administrative Costs			10%	$1,368	
O&M Contingency			25%	$3,762	
TOTAL ANNUAL O&M COSTS					$18,810
FIVE YEAR REVIEW COSTS					
Labor - 2 Engineers ($70/hr) & 2 Technicians ($50/hr) - 1 week @ 40 hrs/wk	40	mh	$240.00	$9,600	
Travel	4	each	$600.00	$2,400	
Per diem	20	mndy	$77.00	$1,540	
Lab Costs	15	each	$500.00	$7,500	
Office/Admin	120	mh	$140.00	$16,800	
SUBTOTAL FIVE YEAR REVIEW COSTS					$37,840
Five Year Review Contingency			10%	$3,784	
TOTAL FIVE YEAR REVIEW COSTS					$41,624
TOTAL PRESENT WORTH (5% rate of return, 30 year period)					$3,255,000

TABLE 14
PRESENT WORTH ANALYSIS
ALTERNATIVE 3 - CONSOLIDATION/CONTAINMENT (FLUE DUST REPOSITORY AND SOIL COVER)
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE

Year	Capital Costs	O&M Costs	Total Annual Expenditure	Rate of Return = 3% Discount Factor	Rate of Return = 3% Present Worth	Rate of Return = 5% Discount Factor	Rate of Return = 5% Present Worth	Rate of Return = 10% Discount Factor	Rate of Return = 10% Present Worth
0	$2,850,183		$2,850,183	1.0000	$2,850,183	1.0000	$2,850,183	1.0000	$2,850,183
1		$18,810	$18,810	0.9709	$18,262	0.9524	$17,914	0.9091	$17,100
2		$18,810	$18,810	0.9426	$17,730	0.9070	$17,061	0.8264	$15,545
3		$18,810	$18,810	0.9151	$17,214	0.8638	$16,249	0.7513	$14,132
4		$18,810	$18,810	0.8885	$16,712	0.8227	$15,475	0.6830	$12,847
5		$60,434	$60,434	0.8626	$52,131	0.7835	$47,352	0.6209	$37,525
6		$18,810	$18,810	0.8375	$15,753	0.7462	$14,036	0.5645	$10,618
7		$18,810	$18,810	0.8131	$15,294	0.7107	$13,368	0.5132	$9,653
8		$18,810	$18,810	0.7894	$14,849	0.6768	$12,731	0.4665	$8,775
9		$18,810	$18,810	0.7664	$14,416	0.6446	$12,125	0.4241	$7,977
10		$60,434	$60,434	0.7441	$44,969	0.6139	$37,101	0.3855	$23,300
11		$18,810	$18,810	0.7224	$13,589	0.5847	$10,998	0.3505	$6,593
12		$18,810	$18,810	0.7014	$13,193	0.5568	$10,474	0.3186	$5,993
13		$18,810	$18,810	0.6810	$12,809	0.5303	$9,975	0.2897	$5,449
14		$18,810	$18,810	0.6611	$12,436	0.5051	$9,500	0.2633	$4,953
15		$60,434	$60,434	0.6419	$38,790	0.4810	$29,070	0.2394	$14,467
16		$18,810	$18,810	0.6232	$11,722	0.4581	$8,617	0.2176	$4,094
17		$18,810	$18,810	0.6050	$11,380	0.4363	$8,207	0.1978	$3,721
18		$18,810	$18,810	0.5874	$11,049	0.4155	$7,816	0.1799	$3,383
19		$18,810	$18,810	0.5703	$10,727	0.3957	$7,444	0.1635	$3,076
20		$60,434	$60,434	0.5537	$33,461	0.3769	$22,777	0.1486	$8,983
21		$18,810	$18,810	0.5375	$10,111	0.3589	$6,752	0.1351	$2,542
22		$18,810	$18,810	0.5219	$9,817	0.3418	$6,430	0.1228	$2,311
23		$18,810	$18,810	0.5067	$9,531	0.3256	$6,124	0.1117	$2,101
24		$18,810	$18,810	0.4919	$9,253	0.3101	$5,832	0.1015	$1,910
25		$60,434	$60,434	0.4776	$28,864	0.2953	$17,846	0.0923	$5,578
26		$18,810	$18,810	0.4637	$8,722	0.2812	$5,290	0.0839	$1,578
27		$18,810	$18,810	0.4502	$8,468	0.2678	$5,038	0.0763	$1,435
28		$18,810	$18,810	0.4371	$8,221	0.2551	$4,798	0.0693	$1,304
29		$18,810	$18,810	0.4243	$7,982	0.2429	$4,570	0.0630	$1,186
30		$60,434	$60,434	0.4120	$24,898	0.2314	$13,983	0.0573	$3,463
TOTAL PRESENT WORTH				@ 3% $3,373,000		@ 5% $3,255,000		@ 10% $3,092,000	

APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
OU5 AV/CZL SITES
CALIFORNIA GULCH SUPERFUND SITE
LEADVILLE, COLORADO

1.0 OVERVIEW

The U.S. Environmental Protection Agency (EPA) has prepared this Responsiveness Summary to document and respond to issues and comments raised by the public regarding the Proposed Plan for the Operable Unit 5 (OU5) for Arkansas Valley (AV) Smelter and Colorado Zinc-Lead (CZL) Mill sites (collectively known as the "AV/CZL" sites) of the California Gulch Superfund Site. EPA's preferred alternative and the remedy selected in the Record of Decision (ROD) involves excavating and consolidating flue dust in a fully-encapsulated, lined, on-site repository. In addition, tailing and non-residential area soils will be consolidated and covered with a vegetated soil cover and institutional controls will be implemented for the covered areas. A public meeting was held on August 1, 2000 at 7:00 p.m. at the Mining Hall of Fame and Museum in Leadville, Colorado to present the preferred alternative to the public. Comments were received during the public comment period, which was from July 27 through August 28, 2000.

Comments received during the public comment period and EPA's responses, are outlined in this document. By law, the EPA and the Colorado Department of Public Health and Environment (CDPHE) must consider public input prior to making a final decision on a cleanup remedy. Once public comment is reviewed and considered, the final decision on a cleanup remedy is documented in the ROD.

This document includes the following sections:

- Background on Recent Community Involvement
- Summary of Public Comments Received During Public Comment Period and Agency Responses
- Remaining Concerns
-

2.0 BACKGROUND ON RECENT COMMUNITY INVOLVEMENT

The OU5 AV/CZL Proposed Plan was published in July 2000 and describes the preferred cleanup alternative for AV/CZL sites. Based upon consideration of National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria, EPA determined that Alternative 3 - Consolidation/Containment (Flue Dust Repository and Soil Cover) is the appropriate remedy for the tailing, flue dust, and non-residential area soils at the OU5 AV/CZL sites. A portion of the public meeting held on August 1, 2000 was dedicated to accepting formal oral comments from the public; however, no oral comments were received. The only written comments received during the public comment period were from the CDPHE in a letter dated August 28, 2000.

3.0 SUMMARY OF PUBLIC COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND AGENCY RESPONSE

The following written comments were received during the public comment period. No oral comments were received. The comments are presented in italicized type and the responses are presented in regular type.

No. 1:

Under 4.2.6 of the local Land Development Code, residential use is allowed in areas zoned for business and recreation. Since at least one residence has been identified at the site, and a portion of the Colorado Zinc-Lead Mill Site is zoned business, the AV/CZL remedy must include measures that will protect for residential use unless, for other reasons, EPA believes that residential use is not reasonably anticipated.

Response:

EPA agrees that the AV/CZL remedy must include measures that will be protective for any existing or potential future residential uses. The selected remedy includes a requirement for institutional controls. Lake County and/or City of Leadville zoning ordinances will be modified to create a zoning "overlay district" to provide a screening process to identify properties where special precautions or requirements may be necessary. The overlay district would provide protection for any future land uses, including residential.

In addition, the selected remedy requires that any existing residential land use be eligible for the Lake County Community Health Program.

No. 2:

Since the flue dust at the AV/CZL fails TCLP, it is considered a characteristic hazardous waste. According to EPA's letter to ASARCO dated July 24, 1996, entitled "ARARs for the California Gulch Superfund Site," such materials are subject to the Resource Conservation and Recovery Act (RCRA), and any more stringent state requirements under the State counterpart. Accordingly, compliance can be achieved by adhering to all of the regulations addressing final disposal of hazardous waste, or by meeting the substantive requirements of the State Corrective Action Management Units (CAMU) regulation. See 6 CCR 1007-3, Part 264.552 (58 Federal Register 8679, February 16, 1993). It is not clear from the Proposed Plan that the selected remedy will comply with these ARARs.

Response:

The analysis of applicable or relevant and appropriate requirements (ARAR) identifies RCRA Subtitle C 40 CFR Part 261.4(b)(7) and RCRA Section 3001(b) as both potentially applicable and potentially relevant and appropriate. RCRA Subtitle C 40 CFR Part 268 is also identified as potentially applicable. RCRA requirements are triggered as applicable only if there is storage, treatment or disposal. In this case, the preferred alternative entails consolidation within an area of contamination therefore there is no placement and disposal, so RCRA is not applicable.

However, the Colorado Hazardous Waste Regulations Act 6 CCR 1007-3, Part 264, Subpart N is identified as potentially relevant and appropriate.

No. 3:

The text states that "[a]ny existing land use will be eligible for the Lake County Community Health Program." The description of the LCCHP in the OU-9 ROD indicates that it only applies to OU-9 residential soils, and only to lead contamination. Do you intend that the LCCHP be modified to incorporate other land uses? Please explain.

Response:

Operable Unit 9 includes all properties within the Superfund Site that are under current residential use. The residence identified near the AV Smelter Site is included in the Lake County Community Health Program. The Lake County Community Health Program is intended for residential use only.

No. 4:

The preferred alternative acknowledges that the cooperation of current landowners is required (see Proposed Plan, page 8, Table 1 [implementability]). However, there is no indication that the landowners will cooperate or have ever been contacted. Therefore, the implementability of the preferred alternative is questionable.

Response:

EPA agrees that the cooperation of the current landowners is necessary to implement any of the remedies under consideration, with the exception of No Action.

No. 5:

The PP states that EPA has not considered reduction of mobility, toxicity, or volume. Since this is weighted NCP consideration, some explanation of why it was not considered should be included.

Response:

The preferred alternative does not consider a treatment process to reduce toxicity, mobility, or volume of source materials which will remain on-site. Treatment alternatives were eliminated in the Screening Feasibility Study. Alternative 5 might require treatment of the flue dust if it is determined to have hazardous waste characteristics by TCLP testing; this treatment would reduce toxicity and mobility of the flue dust.

4.0 REMAINING CONCERNS

Based on review of the written comments received during the public comment period (no oral comments were received), there are no outstanding issues associated with implementation of the proposed remedial action.