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DRAFT
MINE WASTE ENGINEERING EVALUATION/COST ANALYSIS
CALIFORNIA GULCH SUPERFUND SITE
LEADVILLE, COLORADO

Prepared For:

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EXECUTIVE SUMMARY

General Background

This Engineering Evaluation/Cost Analysis (EE/CA) has been performed to identify removal action alternatives for the mine waste piles located within OU-9, Residential Populated Areas, of Asarco's Work Area of the California Gulch Superfund Site, Leadville, Colorado. The EE/CA was conducted for the mine waste piles as required by Asarco's Work Area Management Plan (WAMP), Appendix B of the Consent Decree. The EE/CA was performed in accordance with the Final Mine Waste EE/CA Work Plan (Asarco, 1994b), 40 CFR 300(b)(4)(i) (1994) for Non-Time Critical Removal Actions, and Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA (USEPA, 1993a).

The mine waste piles examined as part of this EE/CA are located throughout the populated area of eastern Leadville (Figure 3-1). During the Mine Waste Remedial Investigation Report (RI) (Asarco, 1994c), eight of the 38 piles were found to be stockpiles of construction materials or to contain no minerals of concern. To be certain that these piles pose no threat to human health or the environment, one pile representing this group was evaluated with the remaining 30 piles. Therefore, a total of 31 piles were investigated in detail. Only those piles which were found to contain surface concentrations of total lead greater than 2000 ppm will be subject to the removal/remedial action (Figure 3-1).

Project Objectives and Scope

The objective of this EE/CA is to allow for selection of the most appropriate action for the mine waste piles located within the Leadville community. The accomplish this objective, the EE/CA included:

- characterization of the mine waste piles by assessing the physical features;
- evaluation of the metals present;
- identification of appropriate removal/remedial actions;
- screening of the removal/remedial actions;
- evaluation of each action;
- ranking of the actions based on their relative effectiveness, implementability, and cost; and,
- recommendation of a removal/remedial action.

The mine waste piles are being addressed in this EE/CA prior to a Record of Decision (ROD). The final remedial actions are to be established at the time of the ROD based on results from the Baseline Human Health Risk Assessment (BHHRA).

Removal/Remedial Actions Analyzed

Based on the screening of the potential removal/remedial actions, four alternatives were selected for detailed analysis:

1. No Action
2. Institutional Controls
3. Containment (Capping In-Place)
4. Resource Utilization (Material Reuse)

These potential removal/remedial actions were evaluated based on numerous criteria listed in the EE/CA guidance, all of which fall into the broad categories of effectiveness, implementability, and cost. A ranking system incorporating all of the evaluation criteria was utilized to compare the alternatives.

Recommended Removal/Remedial Action

The results of the comparative analysis performed using the ranking system indicated that Alternative 4, Resource Utilization, scored the highest. This alternative consists of relocating all mine waste piles with surface total lead levels in excess of 2000 ppm to a remote area for temporary stockpiling. For the purposes of this EE/CA, it was assumed that the removed material would be stockpiled in OU-1 near the Yak Tunnel Water Treatment Plant. Mine waste piles with surface total lead levels less than 2000 ppm would be left in place and no action would be taken. Mine Waste Pile 12 would require regrading to stabilize the pile slopes. This pile is the only "no action" pile which would require regrading. This alternative allows for the use of the contaminated mine waste materials as potential construction materials for other reclamation activities. The geotechnical characteristics of the mine waste materials may be beneficial for construction uses. The resource utilization alternative provides the best overall environmental protection since the source is completely removed from the residential area. It is implementable both technically and administratively, and the cost is not significantly higher than for the other alternatives. The cost and efficiency of this alternative could be further improved if the mine waste could be used directly as construction material without intermediate stockpiling.

The second-ranked alternative, capping in-place, also provides good environmental protection and implementability at a slightly lower cost. This alternative, or a combination of capping in-place and resource utilization, could also be considered if there are limited identifiable construction uses for the mine waste material, or if the intermediate stockpiling costs prove excessive.

1.0 INTRODUCTION

This document presents Asarco's Draft Mine Waste Engineering Evaluation/Cost Analysis (EE/CA). The Mine Waste Piles undergoing evaluation are included in Asarco's Work Area, Operable Unit (OU) 9 (Residential Populated Areas) of the California Gulch Superfund Site, Leadville, Colorado (Figure 1-1). This EE/CA has been prepared pursuant to 40 CFR 300(b)(4)(i)(1994) for Non-Time-Critical Removal/Remedial Actions.

1.1 Purpose and Scope

The mine waste piles are being addressed prior to a Record of Decision (ROD). The mine waste piles may contribute to lead exposure in the residential area, therefore, it is necessary to evaluate alternatives for each pile according to its chemical content and behavior. The final remedial actions are to be established at the time of the ROD based on results from the Baseline Human Health Risk Assessment (BHHRA).

The EE/CA conducted for the mine waste piles is outlined in Asarco's Work Area Management Plan (WAMP) (Asarco, 1994a), attachment to the Consent Decree. The Final Mine Waste EE/CA Work Plan July, 1994 (Asarco, 1994b), identifies the work conducted for this EE/CA.

The main objective of this EE/CA is to:

- characterize the mine waste piles by assessing the physical features;
- evaluate the metals present;
- identify appropriate removal/remedial actions;
- evaluate effectiveness, implementability, and screen the removal/remedial actions;
- evaluate each action;

- rank each action according to cost; and,

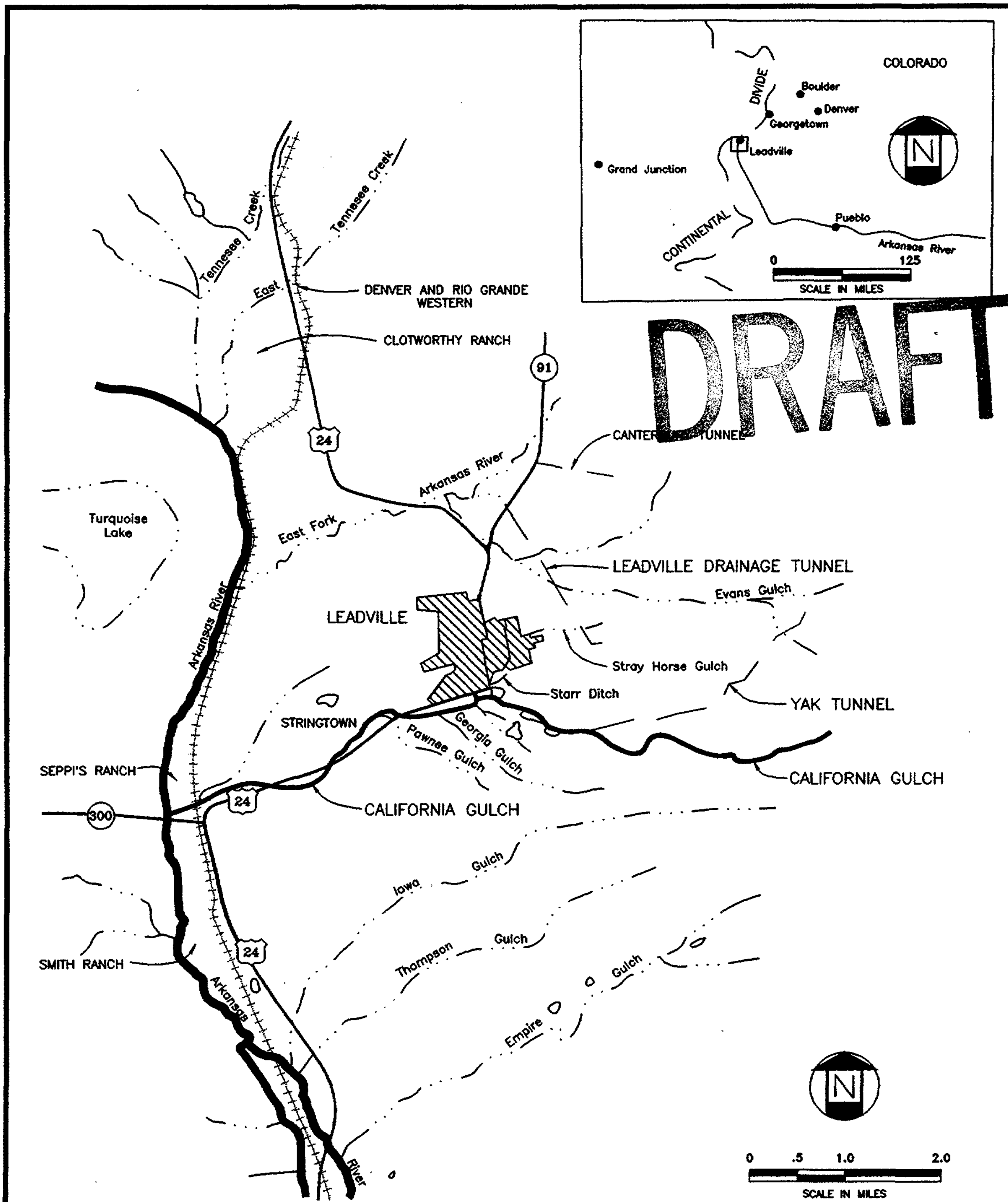
- recommend a removal/remedial action.

The objectives allow for selection of the most appropriate action for the mine waste piles located within the Leadville community.

This EE/CA examined the 38 mine waste piles located in the populated area of Eastern Leadville as identified in the WAMP. These piles were visually evaluated for mineralogy as part of the reconnaissance of mine waste piles in the populated areas in the Mine Waste Remedial Investigation (RI) Report (Asarco, 1994c). In the RI, eight of the piles were found to be stockpiles of construction materials or to contain no minerals of concern (lead, arsenic, cadmium or zinc). One pile representing this mineral group with no minerals of concern was evaluated with the remaining 30 piles to be certain that these piles pose no threat to human health or the environment. A total of 31 piles were investigated.

1.2 Report Organization

This report is written in accordance with EPA OSWER Directive 9360.0-32, Guidance on Conducting Non-Time Critical Removal Actions under CERCLA, August 2, 1993 (EPA, 1993) and contains the following components outlined therein. Section 2 characterizes the site by describing the setting, history of Leadville, climate, geology, hydrogeology, and hydrology. Also discussed in Section 2 are summaries of past investigations conducted on the mine waste piles. Section 3 presents an overview of the analytical results from the Mine Waste EE/CA sampling events. Sections 4 and 5 identify the removal action objectives and alternatives, respectively. Section 6 presents a screening of the potential removal actions. Section 7 presents the selected removal alternatives including detailed descriptions. Section 8 provides a comparative evaluation of the retained alternatives. Section 9 discusses the recommended removal action. Section 10 provides the Schedule of Work. The references are found in Section 11.



Golder Associates Denver, Colorado

TITLE

GENERAL SITE LOCATION MAP

DRAWN	RB	DATE	DEC 1995	JOB NO.	943-2819
CHECKED	BES	SCALE	AS SHOWN	DWG NO./REV. NO.	
REVIEWED	CAD	FILE NO.	2819A045	FIGURE NO.	1-1

CLIENT/PROJECT

ASARCO
MINE WASTE EE/CA

2.0 SITE CHARACTERIZATION

This section describes the site, provides a review of the data collected, and discusses the site conditions which justify a removal/remedial action. The site description information is based on the information from the Mine Waste Piles Remedial Investigation Report, California Gulch Site (WCC, 1994c).

2.1 Site Description

This section briefly describes the general site conditions which includes; site setting, history, climate, geology, hydrogeology and hydrology.

2.1.1 Site Setting

The California Gulch Site is located in Lake County, Colorado in the upper Arkansas River watershed, approximately 100 miles southwest of Denver, Colorado (Figure 1-1). The site encompasses approximately 16.5 square miles and includes the towns of Leadville and Stringtown, and the confluence of the Arkansas River and California Gulch. Elevations at the site range from 9,570 feet above Mean Sea Level (MSL) at the confluence to 12,250 feet above MSL.

The California Gulch Site is located in a highly mineralized area of the Colorado Rocky Mountains. Mining, mineral processing, and smelting activities have produced gold, silver, lead, and zinc for more than 130 years.

Over 2,000 mine waste rock piles have been identified at the site. Thirty-eight mine waste piles are located within the residential area in Leadville. Seven major tailing impoundments exist, as well as fluvial tailings deposited directly into California Gulch and Malta Gulch. Forty-four smelters formerly operated in the area (Res-ASARCO, 1987). Three major slag piles and several smaller piles remain. The primary point source of California Gulch surface water metals loading is the Yak Tunnel, which was built between 1895 and 1923 to drain water from established mines and facilitate exploration. Remediation of the Yak Tunnel Operable Unit (OU1) has occurred. The Yak Tunnel Water Treatment Plant (WTP) became operational in February 1992 and is currently treating the Yak Tunnel discharge.

2.1.2 History of the Leadville Mining District

Mining in the Leadville area began in 1859, when gold was discovered at the mouth of California Gulch by prospectors working the channels of Arkansas River tributaries. Initial activities consisted only of small-scale placer mining until 1868. Large-scale mining began in 1868 when the first gold ore veins were discovered along California Gulch. By 1872, however, problems with water transportation, and labor made ore removal so difficult that most miners had left the area.

In 1874, W.H. Stevens and A.B. Wood investigated the composition of a "heavy sand" that interfered with the recovery of gold in placer sluice boxes. The material proved to be a silver-bearing lead carbonate. Mining in the Leadville district boomed as news of this discovery spread and sources of carbonate ore were discovered.

As the search for ore became widespread, extensive replacement deposits of lead and silver and, later on, rich gold ores associated with fissure veins were found. Copper, usually associated with the gold ore, assumed minor importance. Zinc and manganese minerals occurred with the lead-silver ores; they were of little value in the early days, but were later mined extensively.

As surface veins diminished, miners tunneled deeper into the mountains. Underground mines were developed east and southeast of Leadville. During the development of mines, waste rock was excavated along with the ore. The waste rock was placed near the mine entrance, and the ore was transported to a mill.

At the mill ores were crushed and separated into metallic concentrates and waste products by physical processes. The metallic concentrates were then shipped elsewhere or further processed at a smelter in the area. The waste products (mill tailings) were generally placed near the mill in a tailings pond.

In the smelters, the high-grade ores were refined and concentrated into higher-grade products. Waste products from the smelters included slag, dust and off-gases. Forty-four known smelters operated in the district (Res-ASARCO, 1987).

Groundwater, which began flooding into the mines, had to be pumped out continuously. As a result, mining costs became prohibitive. In 1889, the Yak Tunnel was constructed as an extension of the Silver Cord Tunnel to drain the Iron Hill area (Luke, 1978). With the portal at an elevation of 10,330 feet above MSL, the Yak Tunnel was driven to penetrate the Iron-Mikado fault system. The venture proved so successful that the tunnel was extended at various times, successively penetrating the Breece Hill, Ibex, and Resurrection areas. In 1912, the tunnel was advanced to the Resurrection No. 2 Mine (Luke, 1978).

A surge of mining activity in the early 1920s in the Carbonate Hill and Iron Hill areas sparked new interest in using the Yak Tunnel for dewatering purposes. In May 1923, the Yak Tunnel was again extended to a total length of more than 3.5 miles. By that time, the tunnel drained a complex area of massive sulfide and carbonate mines through a maze of underground mine workings.

With the onset of World War II operating properties in the district increased production as a result of the federal support-premium price plan for copper, lead, and zinc. During the war, the major portion of the recorded production came from processing old dumps by the Ore and Chemical Company and John Hamm Milling Company. Production increases were recorded from the Resurrection No. 2, Fortune, Eclipse, and Hellena shafts as well. Ore output virtually stopped after 1957 when the Irene shaft was closed due to low metal prices.

2.1.3 Climate

The climate in the California Gulch area is typical of mountainous areas of central Colorado. The severe local topographic features strongly influence local climatic variations in Lake County. The elevation of the City of Leadville approximately 10,000 feet above MSL. Weather conditions are recorded at the National Weather Service's Leadville airport station located two miles southwest of Leadville.

The normal temperature extremes range from 86°F to -30°F, with the average minimum temperature being 21.9°F (Topielec et al., 1977). The average frost-free season is 79 days. The wind is predominantly from the northwest and ranges from calm to 30 miles per hour (Gilgulin, 1985).

Average annual precipitation is 18 inches. July and August record the most precipitation, while December and January record the least precipitation (USDA, SCS 1965). Summertime precipitation is usually associated with convective showers (Topielec et al., 1977). Annual snowfall depths for mountains in the area are between 200 and 300 inches. During winter months, the depth of snow on the ground in Leadville is commonly 6 inches (Gilgulin, 1985). The annual peak snowmelt usually occurs in June.

The Final Air Monitoring Report (ASARCO, 1992a) evaluates meteorological data from the California Gulch Site.

2.1.4 Geologic Setting

Bedrock in the California Gulch area consists of Precambrian granite and metamorphic rocks and is overlain by Paleozoic sedimentary beds of dolostone, limestone, sandstone, siltstone, and shale. The sedimentary formations, in order of oldest to youngest, are the Sawatch Quartzite, Peerless Formation, Manitou Dolomite, Chaffee Formation (containing the Parting Quartzite and Dyer Dolomite members), Leadville Dolomite, Belden Formation, and Minturn Formation

(Tweto, 1968). The total thickness of sedimentary rocks exposed in the area ranges from 0 to 1,600 feet (Emmons et al., 1927).

The Precambrian and Paleozoic rocks were intruded by porphyritic igneous rocks during the late Cretaceous and Tertiary periods. The porphyritic rocks form sheets several feet thick (sills) between sedimentary beds and a large deep-rooted irregularly shaped mass (the Breece Hill stock). Ore-forming fluids have chemically altered the porphyry throughout most of the area. Vertical pipe-like masses of rhyolite agglomerate breccia intruded into the porphyry, cross-cutting all other rock types. Bedrock is generally exposed east of the town of Leadville, including the upper California Gulch area.

The western portion of the study area, including the town of Leadville and the areas west and south of Leadville, is underlain by thick deposits of unconsolidated glacial outwash materials of Pleistocene age. These unconsolidated materials are derived from various types of lithologies in the Mosquito Range east of Leadville and include several varieties of porphyry, rhyolite, granite, and other igneous rocks, quartzite, dolomite, limestone, and sandstone. These materials were transported and redeposited by glacial and fluvial processes and are poorly sorted, loose, and porous. The Arkansas River valley, in the extreme western portion of the study area, is composed of Holocene stream terrace, stream channel, and floodplain deposits.

Terrace deposits are located parallel and adjacent to active stream channels in Evans Gulch, California Gulch and along the Arkansas River. Floodplain deposits, low terrace remnants, marshy areas, and active stream channel deposits are located throughout the study area.

A complex system of major and minor faults causes significant displacement and fracturing of the bedrock units. Major faults in the bedrock are generally high-angle, northerly-striking fracture zones, with displacements ranging from about 100 to more than 1,000 feet. Major faults separate the strata into a stair-step arrangement of fault blocks with decreasing elevations toward the west. Fracture zones associated with the major faults range from several tens to several hundreds of feet wide. Relatively impermeable layers of clay-rich fault gouge commonly exist within the fracture zones. Blocks of bedrock between major faults are commonly broken by numerous minor faults and fissures (Emmons et al., 1927). The Pendery Fault marks the boundary between upper and lower California Gulch. Upstream (east) from the Pendery Fault, California Gulch is incised into bedrock; just west of the fault, the unconsolidated sediments are more than 250 feet thick and increase in thickness toward the Arkansas River (EPA, 1989).

The majority of economic mineral deposits in the Leadville district occur east of Leadville and in the form of tabular dolostone or limestone replacement deposits with horizontal dimensions of hundreds to several thousands of feet thick. Mineral veins hosted in minor faults and fissures are also locally important sources of ore. Major mineralized areas include Iron Hill, White Cap-Cord, Ibex-Irene, and Resurrection-Diamond. Ore minerals in unoxidized areas are primarily sulfides and carbonates of iron, lead, and zinc, which contain small amounts of silver, gold, and other trace metals. Sulfide minerals in near-surface ore bodies have been naturally oxidized to carbonate, sulfate, silicate, and oxide minerals. Depths to unoxidized ore range from 100 to 800 feet below the ground surface (Emmons et al., 1927).

2.1.5 Hydrogeologic Setting

Groundwater in California Gulch, Evans Gulch, and the smaller tributary gulches occurs in both bedrock and alluvial aquifers. In the upper portions of California Gulch, particularly above the Pendery Fault, groundwater occurs primarily in the various fractured bedrock formations. Evans Gulch is a glaciated valley containing abundant glacial outwash deposits. Alluvial groundwater occurs throughout much of the length of the gulch.

Groundwater movement within the bedrock is facilitated by permeable highly-fractured zones adjacent to the major faults and by numerous interconnecting minor faults and fractures within the blocks. Before the bedrock system was disturbed by mining, the low-permeability gouge zones along the major faults apparently restricted flow between the fault blocks (Emmons et al., 1927).

The bedrock aquifer has three types of porosity that contribute to storage and flow: primary (intergranular rock porosity); secondary (faults, fractures, and karst); and mine workings. The primary porosity of most of the rock types in the area is low; thus the primary porosity is generally insignificant compared to secondary porosity and to the influence of mine workings.

The effects of mining and mine drainage have changed the natural hydrogeologic system. Mine workings in the area consist of a network of interconnected shafts, winzes, drifts, and stopes. The stopes (ore body excavations) commonly extend hundreds to thousands of feet in horizontal dimensions and are generally tens of feet high (Res-ASARCO, 1990a; Emmons et al., 1927). Stopes are generally filled with broken waste rock and/or rubble from roof collapse. These mine workings enhance groundwater flow toward the topographically lower Yak Tunnel and Leadville Drainage Tunnel. Connected mine workings distant from the Yak Tunnel appear to capture groundwater from neighboring drainage basins, such as Evans Gulch. The Yak Tunnel and the associated network of mine workings perforate fault gouge zones, connecting previously isolated groundwater-bearing fault blocks. Natural permeability within the aquifers is short-circuited by the free-flowing mine workings. New fractures caused by mine subsidence may further increase bedrock permeability.

Karst (cave formation) dissolution and collapse features occur locally in the Leadville and Dyer Dolomite units. Karst breccias commonly host ore deposits in the Leadville mining district and surrounding area (DeVoto, 1982; Johansing, 1982), and an open fissure of probable karst origin was encountered in the Leadville Tunnel (Salsbury, 1976). Karst features probably have local influences on groundwater flow due to having greater secondary porosity and permeability than the primary porosity and permeability of the surrounding rock.

Groundwater in the unconsolidated (alluvial) aquifer is contained in lake bed, glacial deposits, and alluvial deposits. Very little is known about the thickness and hydraulic characteristics of the lake bed deposits in California Gulch. Geologic interpretation from Emmons et al. (1927) and EPA (1987a) suggests that the lake bed deposits generally occur at depths greater than 200 feet below ground surface (bgs) in lower California Gulch.

The remainder of the unconsolidated deposits, composed of glacial till and outwash, and recent alluvial deposits, are currently being characterized. EPA considered groundwater in the alluvial formations to contain two distinctly separate aquifers based on aquifer pump testing, observed hydraulic gradients, and water quality (EPA, 1987a). Although some of the pump test data may suggest the existence of two distinct aquifers, lithologic information from geologic drill logs does not support this hypothesis.

Recharge to the bedrock and alluvial aquifers in the California Gulch area results from direct infiltration of precipitation and surface water, including snowmelt. Local bedrock recharge may also occur where mine workings constructed below stream channels intercept some of the surface water (EPA, 1987b). Observed fluctuations in the water table indicate that recharge occurs principally during the snowmelt and that short-duration summer thunderstorms are of little consequence (Turk and Taylor, 1979).

The nature of groundwater and surface water interaction in the top 10 feet of the alluvial aquifer was explored by EPA by installing 40 temporary shallow piezometers (EPA, 1987a). The results indicated that upper California Gulch, in general, is gaining from the bedrock aquifer and the lower gulch is losing to the alluvial aquifer (EPA, 1987a). The distribution and extent of infiltration from the gaining or losing zones appeared to vary over time, and surface streams appeared to act as a recharge source to the aquifer during spring snowmelt when surface water levels are high (EPA, 1989). The groundwater/surface water interaction is discussed in the Hydrogeologic Remedial Investigation Report.

2.1.6 Hydrologic Setting

California Gulch drains approximately 11.5 square miles and discharges into the Arkansas River. The Arkansas River is formed by the merging of Tennessee Creek and the East Fork of the Arkansas River northwest of Leadville. The mainstream of California Gulch receives water from several ephemeral drainages, including Stray Horse Gulch, upper California Gulch, Oregon Gulch, Georgia Gulch, Pawnee Gulch, Airport Gulch, and Malta Gulch. It also receives discharges from the Yak Tunnel Water Treatment Plant (WTP) and the Leadville Sewage Treatment Plant.

During 1991, flow rates of California Gulch at the confluence with the Arkansas River ranged between 1.1 and 3.5 cubic feet per second (cfs) based on data from the Surface Water Program. Annual flooding usually occurs as a result of rapid snowmelt in May and June. Analysis of snowmelt and rainfall/runoff events indicates that lower frequency, larger floods occur during short duration, high-intensity thunderstorms during the summer months. Floods with a frequency of less than approximately 10 years are typically generated by snowmelt.

In the past, metals loading to California Gulch was generated primarily by Yak Tunnel discharge (EPA, 1988a). The Yak Tunnel WTP was constructed during 1991 and began treating all Yak Tunnel discharge on February 26, 1992.

Evans Gulch, an ephemeral drainage, drains the area to the north of California Gulch. The Leadville Mine Drainage Tunnel (LMDT), constructed to dewater mines in the Stray Horse Gulch area, discharges into the East Fork of the Arkansas River north of Leadville. Further characterization of the surface water regime in the California Gulch area is presented in the Surface Water Remedial Investigation Report.

2.2 Mine Waste Piles Site Background

The following sections provide summaries of relevant site background information obtained from previous studies performed which included investigations of the waste piles.

2.2.1 Colorado Department of Law (CDL) Field Investigation of California Gulch (1986)

A field investigation of the California Gulch site was conducted by the Colorado Department of Law (CDL, 1986). The field investigation included a mine waste characterization study. Twenty-six waste piles were selected for sampling based on the potential to effect surface water systems. Fifteen piles are located in Stray Horse Gulch and eleven are located in California Gulch. Surface and subsurface samples were collected from 0 to 6 inches and 12 to 24 inches below the surface, respectively. Each sample was a composite of three subsamples collected within a 5-foot radius of the sample point at equal radial and angular distances. The samples were analyzed for arsenic, cadmium, copper, lead, manganese, nickel, and zinc. Acid extractable tests were also conducted on the samples to evaluate the potential for release of metals in the waste piles to surface water and groundwater. Analytical results showed that arsenic, cadmium, copper, lead, manganese, nickel, and zinc were detected in most of the waste piles. Acid extractable test results showed that most of the piles could potentially release metals including cadmium, copper, lead, manganese, nickel, or zinc to groundwater and surface waters. However, the exact protocol used for these tests is unknown. Additionally, these tests may not be appropriate to the site or represent the actual conditions present in a pyritic mining waste. Additional data showed that the waste piles are slightly acidic to highly acidic (CDL, 1986).

2.2.2 EPA Phase II RI of the California Gulch Site (1989)

Limited field investigations of the mine waste piles have been performed to date. The U.S. Environmental Protection Agency (EPA) conducted a Phase II RI of the California Gulch site from 1986 to 1988 (EPA, 1989). The Phase II RI included characterizing the mine waste and obtaining data on leachate production of different mine waste materials.

Screening of the approximately 2,000 mine waste piles within the site was conducted by the EPA in 1987 to identify piles larger than 100,000 cubic yards (yd^3) (EPA, 1989). This preliminary screening identified 203 piles in excess of 100,000 yd^3. Further screening was conducted based on proximity to populated areas, roadways, and surface water.

Screening was also conducted on the potential physical instability of the piles. Forty-five sites were selected for field inspection for evidence of potential instability. Fifteen of these sites were judged potentially unstable (EPA, 1989). The 45 sites selected for field inspection were selected for sampling based on access, size, waste type, stability, and proximity to residential areas and/or watercourses. Eleven of these sites are mine waste piles and the remainder are slag piles and tailing impoundments. Seven of the sampled mine waste piles are located in Stray Horse Gulch and four mine waste piles are located in California Gulch. Bulk and surface samples were collected from each mine waste pile and submitted to a contract laboratory program (CLP) laboratory for analysis of total aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, tin, vanadium, and zinc.

Samples collected from the mine waste piles were a composite of 20 subsamples collected from a grid across the pile. Each subsample point was analyzed by X-ray fluorescence (XRF) methods in the field for arsenic, cadmium, copper, iron, lead, and zinc. The surface samples were split into +80 and -80 mesh fractions for separate analyses by the lab. Bulk samples were analyzed for total metals, acid shake extractable metals, water shake extractable metals, and extraction procedures (EP) toxicity leaching characteristics.

2.2.3 Water, Waste, and Land Mine Waste Inventory (Resurrection Mining Company (RMC), 1990))

Approximately 100 mine waste piles were surveyed during the Mine Waste Inventory field work conducted by Water, Waste and Land (RMC, 1990). The field program consisted of located the waste pile on a map, photographing the pile and conducting a surface reconnaissance of each pile, to describe the material present, and assess possible hydrologic impacts.

The RMC 1990 report states that 32 of the surveyed mine waste piles appeared to have the potential to affect nearby surface water or groundwater or to pose hazards due to slope in stability. The conclusions were based on a visual inspection of the mine waste piles and proximity to water courses or residential areas. Mine waste piles supported by cribbing were judged to pose potential hazards due to pile instability. Chemical analyses were not performed to evaluate the effects on surface water or groundwater.

2.2.4 Asarco Mine Waste Piles RI Report (WCC, 1994c)

Remedial investigations of eleven mine waste piles located in the California Gulch site were conducted during the Fall of 1991. The purpose of the Asarco Mine Waste Piles RI Report was to characterize each pile's geochemistry, hydrology, hydrogeology, stability, and risk to human health. Surface and subsurface mine waste and foundation soil samples were collected at each site and analyzed for total metals, nutrients, Method 1312 leaching potential, and physical properties. Four monitoring wells were installed, developed, and sampled in the Stray Horse Gulch and Little Stray Horse Gulch drainages. Surface water samples were collected at the mouth of Stray Horse Gulch and in Starr Ditch during the Surface Water investigation. One pile evaluated in the Mine Waste RI, Pile 16, is included in this EE/CA. The other piles are outside Asarco's area of responsibility.

Geochemistry

Surficial mine waste material collected during the RI at each site was characterized by analysis of surface composite samples collected from the upper 2 inches of material. Each sample was a composite made from 10 subsamples. In addition to the surface samples, test borings drilled into each mine waste pile were sampled at intervals dependent on the conditions encountered at each site.

Table 2.1 presents a summary of the maximum concentrations of arsenic, cadmium, lead, and zinc for surface and subsurface samples collected at each mine waste pile.

The leaching characteristics of selected mine waste samples were evaluated for arsenic, cadmium, lead, and zinc using the Method 1312 leaching test.

TABLE 2.1

SUMMARY OF MAXIMUM METALS CONCENTRATIONS
MINE WASTE PILES

Mine Waste Pile #	Mineral Group	Sample Type	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Silver	Thallium	Zinc
16	4	SMC	--	255	64	--	135	--	236	14,000	6,180	0.79	--	--	2.3	16,900
		MW	--	94.7	49.2	--	248	--	87.6	9,850	50,200	1.0	--	--	--	57,100
79	2	SMC	--	--	168	--	32.9	4.1	17.5	937	4,520	1.1	11.0	10.2	1.9	16,900
		MW	--	246	302	--	18.5	3.6	11.6	10,600	3,280	1.5	6.8	--	10	5,680
103	3	SMC	--	117	82.8	--	59.5	3.5	332	13,700	2,970	0.88	--	74.5	--	11,100
		MW	--	261	--	--	--	--	--	26,700	--	--	--	--	--	32,000
120	5	SMC	--	290	192	--	25.5	--	58.8	15,100	4,240	4.5	--	--	--	4,040
		MW	--	67.0	200	--	13.8	13.2	84.9	2,080	1,220	0.81	--	--	1.3	2,000
141	4	SMC	--	73.4	417	--	69.2	4.8	116	8,950	17,800	1.4	--	43.3	1.5	9,740
		MW	--	283	154	--	57.8	--	117	66,400	1,730	0.62	--	--	--	9,350
150	4	SMC	--	139	--	--	15.4	--	--	5,410	--	--	--	--	--	2,810
		MW	--	71.3	30	--	230	--	280	6,200	8,890	0.64	--	13.2	--	25,800
151	4	SMC	--	--	--	--	52.4	--	--	1,440	--	--	--	--	--	10,300
		MW	--	500	76	--	187	13.2	827	16,100	4,790	0.36	--	65.7	--	7,810
156	5	SMC	--	89	--	--	47.1	--	--	6,310	--	--	--	--	--	6,940
		MW	--	3.2	90	--	5.1	6.5	8.8	84.6	259	--	7.6	--	--	998
172	2	SMC	--	72.4	736	--	51.5	5.4	36.1	4,010	10,400	1.7	--	14.5	1.3	11,700
		MW	--	65.9	198	--	48.7	5.6	12.1	7,270	3,480	1.0	--	--	--	7,800
196	4	SMC	--	147	--	--	6	--	--	7,250	--	--	--	--	--	870
		MW	--	141	242	--	116	20.6	22.5	2,130	1,360	0.9	--	--	3.7	11,500
Penrose	n/a	SMC	--	276	276	--	108	11.1	782	9,360	12,900	1.9	--	--	4.1	14,200
		MW	--	578	567	--	417	7.8	433	40,700	10,100	--	12.6	41.7	3.2	48,800

All units in mg/kg

SMC = Surface mine waste composite samples

MW = Subsurface mine waste samples

FS = Foundation soils samples

-- Not detected or not analyzed

Geotechnical

Geotechnical investigations included materials encountered during drilling, sampling and testing. Generally, four principal distinct mine waste material types were encountered during drilling:

- Tan to dark brown silty clay, sand, and gravel, subangular to angular containing interbedded quartz and/or iron oxide stained quartz and carbonate minerals from the ground surface to a depth of 55 feet.

- Orange, brown, and black poorly graded clayey and silty sand and angular gravel containing minor sulfides and carbonate minerals. This material type was found from near the ground surface to a depth of 15 feet.

- Orange to dark orange, brown, and grey sandy silt, clayey to silty sand and angular gravel containing mineralized and non-mineralized pyrite and sulfide minerals.

- Grey, fine- to coarse-grained sand and angular gravel containing large quantities of galena and other mineralized sulfides.

Hydrogeology

Groundwater flow within the alluvial aquifer in mine waste areas appeared to be influenced by drainage toward the Leadville Tunnel through both the alluvial and bedrock aquifers. Alluvial aquifer groundwater level contours exhibited subsurface drainage in the direction of the Leadville Drainage Tunnel. The estimated hydraulic gradient in the alluvial aquifer appeared to be greater in the vicinity of the Leadville Drainage Tunnel than in other monitored areas within the California Gulch site study area.

Groundwater quality in the mine waste monitoring wells appeared to have sustained only minor impacts from the mine waste piles. In the alluvial background well samples, the short list of heavy metals and major metals were not detected above reporting limits. The ranges of other water quality parameters for the four alluvial background wells sampled were: specific conductivity, 210 to 430 umhos/cm; sulfate, 8 to 47 mg/L; TDS, 130 to 220 mg/L; and pH, 7.4 to 7.9.

Groundwater quality data from well WMW1 are similar to groundwater quality data from alluvial aquifer background wells. The range of values for specific conductance, sulfate, TDS, and pH measured for samples from well WMW1 are within the range of similar values for alluvial aquifer background well water. Water quality values for the same parameters measured in samples from wells WMW2 and WMW4 (downgradient from well WMW1) are slightly higher than values from alluvial aquifer background wells. Manganese values in WMW1 and the downgradient wells were somewhat higher than values from alluvial background wells. Zinc also was detected in the wells downgradient from WMW1.

Water quality data from the downgradient wells may not accurately reflect aquifer water quality conditions because the wells downgradient from well WMW1 periodically go dry. Therefore, the possible effects of mining activities on groundwater quality in this area is not clear.

Surface Water

Intermittent surface water flow in the mine waste pile areas occurs only during periods of intense and/or extended precipitation and seasonal snowmelt. As a result, no surface water flow was present upgradient of any of the waste piles during the field sampling periods. Additionally, only limited surface water quality data were available downstream of the waste piles. Surface water samples were taken at two locations within Stray Horse Gulch.

Results of chemical analyses of surface water were described using parameters which include three groups of analytes: (1) dissolved heavy metals including arsenic, cadmium, lead, and zinc, (2) dissolved major metals including aluminum, iron, and manganese, and (3) other water quality parameters, including specific conductivity, dissolved sulfate, TDS, and pH.

The data available were not conclusive in identifying specific sources which may have contributed to some apparent acid mine drainage noted in the Remedial Investigation (WCC, 1994c).

Stability

Mine waste piles were analyzed for stability during this investigation. Construction of the piles influences the long term stability. The mine waste piles were probably developed by sequential dumping of waste rock materials with a steep angle of repose face. By definition, angle of repose slopes have a factor of safety of 1.0. As most of the mine waste piles were probably not subjected to shaking from the 1901 earthquake, the steep slope may still be at the original angle of repose. If so, the seismic factor of safety would be less than 1.0 and some slope movements and readjustments would be expected under earthquake loading conditions. The slope movements would be relatively minor. For deeper seated potential failure surfaces the factors of safety are generally slightly higher but still indicate that the piles are marginally stable under static loading conditions and possibly unstable under seismic loading conditions. Mine waste piles containing materials with some cohesion appear to be relatively stable.

3.0 ANALYTICAL REVIEW OF EE/CA MINE WASTE DATA

This section evaluates the analytical results from the mine waste piles included in the EE/CA Work Plan (Asarco, 1994b). Figure 3-1 shows the location of the 31 mine waste piles, highlighted according to total lead content.

3.1 Purpose and Objectives of the Engineering and Geochemical Evaluation

The engineering and geochemical evaluations of the mine waste piles were conducted to characterize the existing waste piles to facilitate development of removal/remedial alternatives. Geochemical analyses were performed to evaluate which piles would require removal/remedial actions. As identified in Asarco's WAMP (Asarco, 1994a) the characterization includes piles with a total lead content greater than 2000 parts per million (ppm) at the surface. The remaining piles, which have a total lead content less than 2000 ppm, require no action until the ROD is established. Figure 3-2 illustrates this process. Geotechnical evaluations were performed to aid in classification of the mine waste piles to allow evaluation of potential uses of the mine waste as construction material. Prior to initiation of this sampling program, access was obtained from the landowner(s).

3.2 Mine Waste Sample Collection and Geotechnical/Geochemical Characterization

Mine waste samples were collected during three sampling events conducted between August 31, 1994 and October 23, 1994. Mine waste pile sampling events were dependent upon receipt of access agreements. The first event was completed from August 31 to September 1, 1994, the second event was conducted from September 12 to September 13, 1994 and the last sampling event was completed on October 23, 1994. Sampling was conducted by Woodward-Clyde Consultants (WCC) and Golder Associates Inc. (Golder) field personnel. Mine waste composite sampling procedures, decontamination procedures, QA/QC sampling procedures, sample identification, and labeling/handling procedures, were followed in accordance with

Standard Operating Procedure (SOP) Number 2 of the Mine Waste EE/CA Work Plan for the California Gulch Site (WCC, 1994b).

3.2.1 Geotechnical Characterization

Grain size distributions were performed on 22 samples of near surface materials. The grain size distributions were used to aid in classification of the mine waste materials according to the Unified Soil Classification System (USCS). This information combined with data obtained from previous investigations were used to assess the potential uses of the mine waste piles.

3.2.2 Geochemical Characterization

A composite sample was collected from each mine waste pile. Each of the composite samples were initially analyzed for total lead content. Subsequent geochemical testing of the mine waste samples was contingent on the results of the total lead evaluation. Surficial samples (e.g. 0 to 2 inches) with reported total lead values exceeding 2000 ppm were used to identify piles requiring further characterization. The near surface samples (e.g. 2 to 24 inches) from mine waste piles were submitted for further characterization consisting of acid-base accounting (ABA) and EPA Method 1312 leachabilty testing. The analytical methods used to complete the geochemical testing are outlined on the Mine Waste EE/CA Work Plan (WCC, 1994b). The following paragraphs provide a brief discussion of ABA and Method 1312 testing.

The ABA procedure begins by measurement of total sulfur (in percent) within the sample and subsequent conversion to acid generation potential (AGP) (in tons $CaCO_3$/1000 tons waste material). The oxidation of pyrite (FeS_2) and the subsequent liberation and hydrolysis of iron is used to convert from percent total sulfur to AGP. Total sulfur has been used for this evaluation to provide a conservative estimate of the AGP for the mine waste piles. Based on the current understanding of the mineralogy of the mine wastes present at the site, weathering has resulted in the formation of non-acid producing minerals containing sulfur including jarosite and plumbojarosite. In the total sulfur analysis, this non reactive sulfur is reported and classified as acid producing. While this is not strictly correct, given the limitations of the ABA test in predicting potential geochemical behavior, this conservative approach is appropriate. In addition, many of the non-reactive weathering products are difficult to isolate and can result in matrix interferences.

The acid neutralization potential (ANP) is determined by the quantity of acid consumed by a finely ground sample of the waste material. The total acid consumed is then converted to $TCaCO_3/kT$ by stoichiometric conversion. The net neutralization potential (NNP) is then determined by the following equation:

$$NNP = ANP - AGP$$

A negative NNP value indicates that the material is potentially acid producing while a positive NNP value indicates an excess of neutralization potential (i.e. acid neutralizing). Because NNP is expressed in $CaCO_3$ equivalents, the value represents the amount of pure calcium carbonate (100% $CaCO_3$) that would be necessary to add to 1000 tons of waste material to neutralize all acidity produced. Kinetics (i.e. reaction rates) are not considered in the derivation of NNP because the ABA procedure only evaluates the mass balance of acid generating and acid neutralizing components.

The ratio of ANP to AGP is another method of evaluating ABA data. This simple ratio defines the relative proportion of acid neutralizing capacity to the acid generating potential for a particular material. The higher the proportion of neutralizing capacity the lower the potential for acid generation. Based on experience with laboratory tests and field data on a wide range of sulfur bearing rock types, there appears to be low potential for acid generation for waste rock samples with an ANP:AGP ratio greater than or equal to 3:1. Waste rock samples with a ratio of less than 1:1 have an increased potential to generate acid. Those waste rock samples with ANP:AGP ratios between 1:1 and 3:1 have an uncertain acid generation potential (Brodie et al, 1991; and Smith, 1992).

The criteria used to evaluate the ABA data in this report are summarized below:

Strong Acid Generation Potential:	NNP $<$-20 $TCaCO_3/kT$
Uncertain Acid Generation Potential	-20 $<=$ NNP $<=$ 20 $TCaCO_3/kT$
Strong Acid Neutralization Potential	NNP $=>$ 20 $TCaCO_3/kT$

In using the ABA test to estimate acid producing potential, it is assumed that all pyritic sulfur will weather and all iron produced will undergo hydrolysis to form $Fe(OH)_3$. This results in the maximum amount of acidity which can be formed from iron sulfide oxidation. At the California Gulch site, other sulfide minerals such as sphalerite (Zn sulfide) and galena (Pb sulfide) have also been found to occur in significant amounts. The rate of reaction and amount of acid production from the weathering of these minerals is most likely controlled by the presence and reactivity of pyrite.

Leachability testing of the mine waste piles was completed using EPA Method 1312 protocol. The objective of this test is to evaluate the potential of a particular material to leach metals into the receiving environment. The method consists of performing a batch test with a lixiviant composed of a dilute 60/40 mixture of nitric and sulfuric acids. Sample portions are combined with the lixiviant at a 20:1 ratio and agitated for approximately 18 hours. The leachate is subsequently decanted, filtered and analyzed for the parameters of interest. For the purposes of this characterization the leachates were analyzed for arsenic, cadmium, lead, and zinc.

3.2.3 Geotechnical Results

The results for the geotechnical testing are shown on the summary Table 3.1. The grain size distributions were used to estimate the USCS classifications for the waste materials and to provide a general soil description.

3.2.4 Geochemical Results

A summary of the geochemical testing results is presented on summary Table 3.2. Laboratory test data is presented as Appendix A.

Total Lead Concentrations

The total lead concentrations of the surficial samples (e.g. 0 - 2.0 inches) ranged from 349 ppm (waste pile No. 31) to approximately 27700 ppm (waste pile No. 109). The average total lead concentration for the surficial samples was 6272 ppm. Table 3.3 provides a summary of the total lead results for the mine waste samples. Of the 31 surficial samples tested, 8 piles were reported to have total lead concentrations below 2000 ppm. Four piles are classified as Mineral Group 2, three are classified as Mineral Group 3 and one pile is classified as Mineral Group 5. Twenty-three near surface samples were subsequently submitted for additional geochemical characterization consisting of ABA and EPA Method 1312 testing.

The total lead concentrations of the near surface samples (e.g. 2.0 to 24 inches) ranged from 192 ppm (waste pile No. 31) to 28600 ppm (waste pile No. 109). The average total lead concentration for the near surface samples was 6353 ppm and is consistent with the surficial sample results.

Acid Base Accounting

The results of the ABA testing performed on the twenty three mine waste pile samples are summarized on Table 3.4. Total sulfur values ranged from less than 0.01 percent to 1.74 percent. The average total sulfur value for the mine waste pile samples was approximately 0.38 percent. Acid generating potential values, based on total sulfur percentages, ranged from 0 $TCaCO_3$ to 54.4 $TCaCO_3$ with an average value of approximately 11.4. Acid neutralizing potential values ranged from 27 $TCaCO_3$ /kT to 616 $TCaCO_3$/kT with an average of approximately 293 $TCaCO_3$/kT.

Net acid neutralization potential values range from -0.6 $TCaCO_3/kT$ to 610 $TCaCO_3/kT$, with an average value of approximately 281 $TCaCO_3/kT$. With the exception of one sample (waste pile No. 19) the results suggest that all the mine waste piles sampled have a strong acid neutralization potential (e.g. NNP > 20 $TCaCO_3/kT$. This is supported by the ANP/AGP ratios which range from 1 (waste pile No. 19) to approximately 425. With the exception of waste pile No. 19, all samples were reported to have ANP:AGP ratios greater than 3 suggesting a strong acid neutralizing capacity.

Method 1312 Leachabilty Testing

The results of the Method 1312 testing are summarized on Table 3.5. In comparing the 1312 results to Toxicity Characteristic Leach Procedure (TCLP), each of the samples tested passed the TCLP criteria established for arsenic, cadmium and lead. No samples were reported to have detectable concentrations of arsenic. Three samples (waste piles Nos. 16, 17, and 109) had cadmium concentrations above the detection limit of 5 ug/L with values ranging from 6.2 to 95 ug/L. Lead and zinc were the most frequently detected metals. Lead was reported to be above detectable limits in eight samples, while zinc was present in 20 samples. Lead concentrations ranged from less than 20 ug/L to 68.7 ug/L. Zinc concentrations ranged from less than 10 ug/L to 2010 ug/L.

The Method 1312 results suggest that under aggressive, acidic conditions the metal leachability from the waste piles is limited with most observed concentrations below 50 ug/L for zinc and lead, respectively. In addition, all concentrations were well below the TCLP criteria.

3.3 Human Health Risk Assessment

A risk assessment was conducted for the Final Mine Waste Piles RI Report (WCC, 1994b). The approach used in the risk assessment followed EPA guidance for conducting human health risk assessments at Superfund sites (EPA, 1989; EPA, 1988c; EPA, 1991a, b; EPA, 1994). The EPA cautions that these documents are intended to provide guidance only and that considerable professional judgment must be exercised in applying the guidance to site-specific human health risk assessments. The risk assessment incorporated conservative assumptions, in addition to site-specific information, in evaluating potential exposures so that potential health risks would not be underestimated.

The results of the risk assessment indicated that exposure to mine waste metals show noncarcinogenic hazard indexes that do not exceed the EPA level of concern of 1.0. Estimated carcinogenic risks do not exceed the EPA acceptable risk level of 1×10^{-4} for any exposure pathway evaluated for all receptors (Table 3.6). It should be restated that the RME scenario in the risk assessment used a combination of site-specific data and conservative assumptions that represent the "high-end" exposure and more than likely overestimated the actual total cancer risk given the exposure and behavior patterns assumed for the assessment. It should also be noted that this risk assessment was conducted considering only the mine waste piles as sources of metals. A site wide risk assessment, considering multiple sources of metals, has not been conducted. A site wide risk assessment could show that incremental exposure from multiple sources of metals may result in unacceptable human health risks.

3.4 Conclusion

The results of the ABA testing suggest the material present in the upper 24 inches of the mine waste piles sampled have a very low potential to generate acid. The observed matrix interferences associated with the sulfur speciation are consistent with the highly weathered nature of the samples. Several of the weathering products identified in previous studies, such as plumbojarosite and jarosite, are stable under acidic conditions and remained recalcitrant to the acid digestion utilized in the sulfur speciation testing. In addition to the highly weathered state of the near surface mine waste material the acid neutralization capacity of the material was reported to be significant. This suggests that even if mild acid generation did occur, the neutralization potential of the waste materials exceeded the acid production potential by one to two orders of magnitude.

The Method 1312 test results suggest that the near surface waste materials have low metal leachability characteristics under acidic conditions. Zinc and lead were the most frequently detected metals found to be present in the leachate. The concentrations of these metals was reported to be low and were well below the TCLP criteria. The low metal leachabilty in combination with the inherent buffering capacity of the waste materials suggests that the near surface mine waste material of the piles tested is relatively inert.

TABLE 3.1

GEOTECHNICAL ANALYSES

Lab No.	Sample I.D.	Dry Sieve <0.075mm %	Dry Sieve .075-.125mm %	Dry Sieve .125-.250mm %	Dry Sieve .250-.500mm %	Dry Sieve .500-.707mm %	Dry Sieve .707-2.00mm %	Dry Sieve 2.00-4.00mm %	Dry Sieve 4.00-9.50mm %
L3984-01	W-014-C-01-940829sm	21.41	5.68	6.53	5.50	2.56	8.44	13.67	20.91
L3984-02	W-015-C-01-940829sm	28.22	5.89	7.34	5.88	2.61	9.26	15.37	18.45
L3984.03	W-016-C-01-940830sm	27.63	4.91	5.34	5.59	2.81	9.14	11.41	16.53
L3984-04	W-017-C-01-940829sm	26.68	5.40	7.15	7.57	3.30	9.06	10.32	17.13
L3984-05	W-018-C-01-940830sm	32.41	4.74	5.53	6.35	3.03	10.38	10.22	13.46
L3984-06	W-019-C-01-940829sm	29.59	4.78	5.58	5.21	2.32	9.25	10.47	14.77
L3984-07	W-022-C-01-940831sm	30.74	5.10	6.83	8.74	5.00	12.50	14.95	11.38
L3984-08	W-024-C-01-940901sm	41.62	4.58	5.75	8.55	5.27	16.93	8.80	8.50
L3984-09	W-026-C-01-940831sm	73.29	5.68	7.29	7.61	3.64	9.65	15.50	14.63
L3984-10	W-027-C-01-940912sm	28.80	6.55	6.88	7.65	2.11	10.46	11.98	14.26
L3984-11	W-028-C-01-940912sm	39.92	6.93	6.30	6.00	3.34	10.95	10.73	7.89
L3984-12	W-032-C-01-940830sm	31.25	6.17	5.77	5.85	2.73	9.48	9.83	14.32
L3984-13	W-033-C-01-940913sm	67.65	5.78	4.78	4.54	2.70	7.83	13.22	11.34
L3984-14	W-035-C-01-940912sm	54.19	6.44	6.68	6.43	3.43	9.83	11.77	15.13
L3984-15	W-110-C-01-940901sm	23.96	4.36	6.12	5.49	2.83	7.30	13.84	25.54
L3984-16	W-111-C-01-940901sm	22.65	4.82	4.65	3.70	2.15	8.93	13.77	16.76
L3984-17	W-140-C-01-940912sm	25.81	4.99	5.21	5.00	2.98	11.88	13.90	25.78
L3984-18	W-340-C-01-940912sm	29.10	8.70	8.98	8.00	4.13	13.50	12.76	12.51
L4349-01	G-013-C-01C-941025sm	21.48	6.67	9.50	8.59	2.86	8.79	11.24	17.04
L4349-02	G-108-C-01C-941025sm	22.65	6.23	5.71	4.05	2.10	8.81	9.17	17.62
L4349-03	G-109-C-01C-941025sm	18.63	4.62	5.81	4.57	2.12	7.83	10.59	16.69
L4349-04	G-207-C-01C-941025sm	21.38	6.51	9.14	8.78	3.13	8.57	6.53	17.66

TABLE 3.2
SUMMARY TABLE

Pile Number	Pile Name	Mineralogy Group Class.	Estimated Volume (cyds)	Soil Lead Content 0" to 2" (ppm)	Net Acid Neutralizing Potential (Tons/KT)	ANP/AGP Ratio	Method 1312 (Pass/Fail)	Assumed USCS Classification	Description
12	Corando/Northern	5	19,600	1540	n/a	n/a	n/a		
13	Estey	2	700	3150	320	n/a	PASS	SM	Sandy silt
14	Hibschle	2	5,600	22300	112.4	6.4	PASS	SM	Sandy silt
15	Hibschle	3	2,700	19400	201.8	10.5	PASS	SM	Sandy silt
16	Coronado	4	16,600	9240	235.6	5.3	PASS	SM	Sandy silt
17	Coronado/Northern	3	3,300	4200	414.8	25.1	PASS	SM	Sandy silt
18	Coronado	2	10,500	2370	126.4	20.3	PASS	SM	Sandy silt
19	Wolcott	2	8,800	20700	-0.6	1	PASS	SM	Sandy silt
20	Midas	2	28,500	2680	24.7	7.6	PASS		
22	Gray Eagle/Bison	2	12,000	5310	89.6	11.6	PASS	SM	Sandy silt
23	Kent/Cresent	3	500	1170	n/a	n/a	n/a		
24	Kent	3	300	4220	22.3	5.8	PASS	SM	Sandy silt
26	Pocahontas	2	5,800	14100	219.4	8.2	PASS	ML	Silt
27	Starr/Lazy Bill	2	9,200	3380	379.3	26.8	PASS	SM	Sandy silt
28	Starr	2	16,300	10700	610.1	103.7	PASS	SM	Sandy silt
31	Pocahontas/Pendery	3	200	349	n/a	n/a	n/a		
32	Pocahontas/Weldon #1	2	10,200	2120	526.2	188.1	PASS	SM	Sandy silt
33	Weldon/Weldon #2	2	39,900	2360	424.1	72.4	PASS	ML	Silt
34	Bohn	2	9,200	568	n/a	n/a	n/a		
35	Midland	1	8,350	3340	547.9	176.3	PASS	ML	Silt
36	Glass Pendery	2	2,600	1070	n/a	n/a	n/a		
108	Turbot	2	2,300	6220	410.6	120.4	PASS	SM	Sandy silt
109	Hope/Last Chip	2	6,800	27700	163.4	30	PASS	SM	Sandy silt
110	Luzerne	2	150	4800	132.7	425.6	PASS	SM	Sandy silt
111	Ypilanti	2	200	6270	485.4	46.7	PASS	SM	Sandy silt
140	Ypsilanti/Ypsilanti B	2	2,800	5700	301.8	43	PASS	SM	Sandy silt
207	Bohn	2	800	3210	163.1	174.9	PASS	SM	Sandy silt
329	Bon Air	2	33,300	1730	n/a	n/a	n/a		
331	Aetna	2	8,900	723	n/a	n/a	n/a		
339	P.O.S.	2	7,400	1560	n/a	n/a	n/a		
340	P.O.S.	2	12,200	2250	558.5	224.4	PASS	SM	Sandy silt

TABLE 3.3
SOIL LEAD SUMMARY TABLE

Pile Number	Sample Number	Soil Lead Content 0'-2" (ppm)	Sample Number	Soil Lead Content 2"-24" (ppm)
12	W012A1940913	1540	W012B1940913	2560
13	W1311A941025	3150	W1311B941025	2020
14	W14AC1940829	22300	W14BC1940829	25800
15	W15AC1940829	19400	W15BC1940829	17900
16	W16AC1940830	9240	W16BC1940830	8810
17	W17AC1940829	4200	W17BC1940829	4980
18	W18AC1940830	2370	W18BC1940830	2290
19	W19AC1940829	20700	W19BC1940829	22300
20	W020A1940913	2680	W020B1940913	4010
22	W022A1940831	5310	W022B1940831	6230
23	W023A1940901	1170	W023B1940901	196
24	W024A1940901	4220	W024B1940901	707
26	W026A1940831	14100	W026B1940831	8800
27	W027A1940912	3380	W027B1940912	4290
28	W028A1940912	10700	W028B1940912	5220
31	W31AC1940830	349	W31BC1940830	192
32	W32AC1940830	2120	W32BC1940830	1760
33	W033A1940913	2360	W033B1940913	2520
34	W034A1940913	568	W034B1940913	3130
35	W035A1940912	3340	W035B1940912	2890
36	W036A1940831	1070	W036B1940831	658
108	G1081A941025	6220	G1081B941025	8740
109	G1091A941025	27700	G1091B941025	28600
110	W110A1940901	4800	W110B1940901	11000
111	W111A1940901	6270	W111B1940901	4820
140	W140A1940912	5700	W140B1940912	3370
207	G2071A941025	3210	G2071B941025	3460
329	W329A1940912	1730	W329B1940912	2240
331	W331A1940912	723	W331B1940912	1070
339	W339A1940912	1560	W339B1940912	2380
340	W340A1940912	2250	W340B1940912	4020

TABLE 3.4
ACID-BASE ACCOUNTING SUMMARY TABLE

Sample Number	Pile Number	% Sulfur Total	% Sulfur Pyrite	% Sulfur Sulfate	AGP* (Tons/KT)	ANP (Tons/KT)	NNP (Tons/KT)	ANP/AGP
G013C01C941025	13	0.01 u	0.01 u	0.01 u	0	320	320	Div./0!
W014C01940829	14	0.66	1	0.14	20.6	133	112.4	6.4
W015C01940829	15	0.68	1	0.16	21.3	223	201.8	10.5
W016C01940830	16	1.74	1	0.99	54.4	290	235.6	5.3
W017C01940829	17	0.55	0	0.38	17.2	432	414.8	25.1
W018C01940830	18	0.21	0	0.13	6.6	133	126.4	20.3
W019C01940829	19	1.01	1	0.16	31.6	31	-0.6	1
W020C01940913	20	0.12	0.07	0.05	3.8	28.7	24.9	7.6
W022C01940831	22	0.27	0	0.08	8.4	98	89.6	11.6
W024C01940901	24	0.15	0	0.04	4.7	27	22.3	5.8
W026C01940831	26	0.98	1	0.12	30.6	250	219.4	8.2
W027C01940912	27	0.47	0	0.17	14.7	394	379.3	26.8
W028C01940912	28	0.19	0	0.03	5.9	616	610.1	103.7
W032C01940830	32	0.09	0	0.03	2.8	529	526.2	188.1
W033C01940913	33	0.19	0	0.07	5.9	430	424.1	72.4
W035C01940912	35	0.1	0	0.05	3.1	551	547.9	176.3
G108C01C941025	108	0.11	0.14	0.01 u	3.4	414	410.6	120.4
G109C01C941025	109	0.18	0.18	0.01 u	5.6	169	163.4	30
W110C01940901	110	0.01	0	0.01	0.3	133	132.7	425.6
W111C01940901	111	0.34	0	0.1	10.6	496	485.4	46.7
W140C01940912	140	0.23	0	0.12	7.2	309	301.8	43
G207C01C941025	207	0.03	0.07	0.01 u	0.9	164	163.1	174.9
W340C01940912C	340	0.08	0	0	2.5	561	558.5	224.4

* Total Sulfer values were used to determine the acid generation potential for each sample. Matrix interferences would not allow appropriate speciation of the total sulfur into pyrite and sulfate components. In some cases, the percent pyrite or percent sulfur obtained from the speciation tests indicated more sulfur than was determined for the totoal sulfur tests. This is indicative of the matrix interferences.

TABLE 3.5
EPA METHOD 1312 SUMMARY TABLE

Sample Number	Pile Number	Arsenic ug/L	Cadmium ug/L	Lead ug/L	Zinc ug/L
G13C1C941025	13	100 u	5 u	20 u	67.5
W014C1940829	14	100 u	5 u	32.5	12.3
W015C1940829	15	100 u	5 u	43.2	34.5
W016C1940830	16	100 u	95.4	52.7	2010
W017C1940829	17	100 u	38.6	20 u	785
W018C1940830	18	100 u	5 u	20 u	10 u
W019C1940829	19	100 u	5 u	21.6	42.8
W020C1940913	20	100 u	5 u	20 u	12.7
W022C1940831	22	100 u	5 u	20 u	10 u
W024C1940901	24	100 u	5 u	68.7	40.7
W026C1940831	26	100 u	5 u	32.4	40.9
W027C1940912	27	100 u	5 u	20 u	12.3
W028C1940912	28	100 u	5 u	30.8	75.8
W032C1940830	32	100 u	5 u	20 u	34.5
W033C1940913	33	100 u	5 u	20 u	16.8
W035C1940912	35	100 u	5 u	20 u	48.3
G1081C941025	108	100 u	5 u	20 u	25.4
G1091C941025	109	100 u	6.2	48.5	25.5
W110C1940901	110	100 u	5 u	20 u	48.5
W111C1940901	111	100 u	5 u	20 u	14.9
W140C1940912	140	100 u	5 u	20 u	14.9
G2071C941025	207	100 u	5 u	20 u	30.7
W340C1940912	340	100 u	5 u	20 u	21.3

TABLE 3.6

MINE WASTE CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDEXES (H.I.)

Receptor/Pathway	Average Exposure			Reasonable Maximum Exposure		
	Cancer Risk	Subchronic H.I.	Chronic H.I.	Cancer Risk	Subchronic H.I.	Chronic H.I.
Adult Visitor						
Ingestion of Mine Waste	1.93E-07	9.53E-03	1.02E-02	9.85E-06	6.12E-02	6.53E-02
Inhalation of Particulates	4.13E-11	8.56E-06	8.56E-06	1.47E-09	9.97E-05	9.97E-05
	1.93E-07	9.54E-03	1.02E-02	9.85E-06	6.13E-02	6.54E-02
Child Visitor						
Ingestion of Mine Waste	2.17E-06	5.36E-02	5.71E-02	1.34E-05	3.33E-01	3.55E-01
	2.17E-06	5.36E-02	5.71E-02	1.34E-05	3.33E-01	3.55E-01
Dirt Biker						
Ingestion of Mine Waste	7.24E-07	1.19E-02	1.27E-02	5.85E-06	9.68E-02	1.03E-01
Inhalation of Particulates	1.10E-10	2.28E-05	2.28E-05	5.21E-09	3.53E-04	3.53E-04
	7.24E-07	1.19E-02	1.27E-02	5.85E-06	9.72E-02	1.04E-01

From Asarco, 1994c

EPA REGION VIII
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID # 321328
PAGE #

IMAGERY COVER SHEET
UNSCANNABLE ITEM(S)

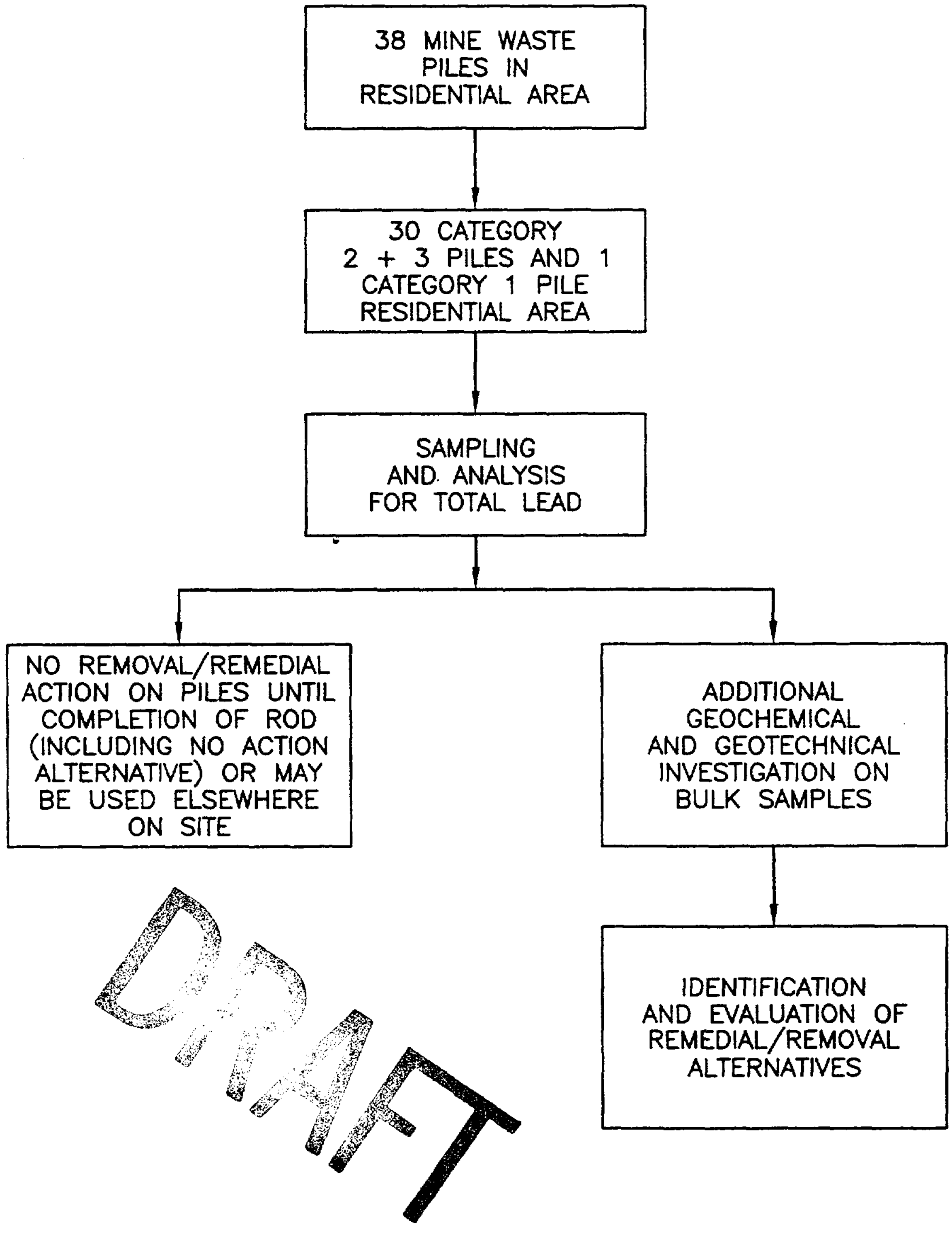
Contact the Superfund Records Center to view this (these) document(s).
(303-312-6473)

SITE NAME: CALIFORNIA GULCH

REPORT OR DOCUMENT TITLE: ASARCO
MINE WASTE PILE MAP

DATE OF DOCUMENT: DEC 1995

DESCRIPTION OF IMAGERY: FIGURE 3-1
MINE WASTE EE/CA



Golder Associates, Denver, Colorado	TITLE: **MINE WASTE EE/CA FLOW CHART**	
CLIENT/PROJECT: **ASARCO MINE WASTE EE/CA**	DRAWN: RB	DATE: DEC 1995	JOB NO. 943-2819.28
	CHECKED: ARG	SCALE: NTS	DWG NO./REV. NO. A147
	REVIEWED: CAD	FILE NO. 2819A147	FIGURE NO. **3-2**

4.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

The following removal/remedial action objectives have been established for the 38 mine waste piles within the populated area.

- Control wind and water erosion of the piles and thereby reduce potential for contamination of California Gulch by metals;
- Control leaching and migration of metals from the waste piles into the surface soil and rock, surface water, and groundwater;
- Prevent direct exposure to humans, particularly children, through contact with the mine waste materials which contain elevated metals levels; and,
- Stabilize the pile slopes to prevent failure and limit erosion.

4.1 Site Conditions that Justify a Removal Action

The mine waste piles have been determined to contain various levels of metals associated with mineral extraction in the area. These metals do not exceed the maximum contamination levels established by the EPA for mine waste piles. Generally, the piles do not appear to be acid generating. A final risk assessment addressing all media will be completed early in 1996.

The following site conditions justify the consideration of a removal/remedial action for the mine waste piles.

- The mine waste piles are in or near a populated area;
- Metals concentration in the piles exceeds background levels;
- The piles pose an attractive nuisance in the area which may increase exposure to elevated metals;

- Some piles are steep and may be unstable in their present condition; and,

- The piles are subject to erosion by wind and water which may spread contaminants.

The implementation of a removal/remedial action for the mine waste piles could alleviate the concerns indicated above.

4.2 Determination of Removal/Remediation Scope

The removal/remediation scope consists of meeting the objectives outlined above by effectively containing the mine waste piles or removing them from the populated area to a location for storage or long-term disposal. All piles with surface concentrations of total lead in excess of 2000 ppm, will be capped or removed to meet the project objectives. Section 5.0 of this report provides potential removal/remediation alternatives and Section 6.0 and 7.0 screens and analyzes the applicability of the various alternatives to achieve the project objectives. Section 8.0 provides a comparative analysis of the retained alternatives.

4.3 Compliance with ARARs

4.3.1 Definition of ARARs

Remedial actions must attain a general level of cleanup that assures protection of human health and the environment, is cost-effective, and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, SARA requires that any hazardous substance or pollutant remaining on site meet the level or standard of control: established by ARAR standards, requirements, criteria, or limitations; established under any federal environmental law; or any more stringent standards, requirements, criteria, or limitations promulgated in accordance with a state environmental statute.

A requirement may be either applicable or relevant and appropriate to remedial activities at a site, but not both. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site. In other words, they would be legally applicable notwithstanding CERCLA.

Although a requirement may not be applicable it may still be relevant and appropriate. The basic considerations for relevance and appropriateness are whether the requirement: (1) regulates or addresses problems or situations sufficiently similar to those encountered at the subject site (i.e., relevance), and (2) is appropriate to the circumstances of the release or threatened release, such that its use is well suited to the particular site. A requirement that is relevant but not appropriate for a specific site would not be an ARAR. Determining whether a requirement is relevant and appropriate is site-specific and must be based on best professional judgment. This judgment is based on a number of factors, including the characteristics of the remedial action, the hazardous substances present at the site, and the physical circumstances of the site and of the release. EPA maintains in its guidance that portions of a requirement may be relevant and appropriate (EPA, 1988c).

Compliance with all requirements found to be applicable or relevant and appropriate is required under SARA. Waivers of ARARs may be obtained under the provisions of SARA under certain circumstances (CERCLA Section 121(d)(4)). These waivers apply only to meeting ARARs with respect to remedial actions on-site. Other CERCLA statutory requirements, such as the requirement that remedies be protective of human health and the environment, cannot be waived.

CERCLA Section 121(d)(2)(A) specifically limits the scope of State ARARs to standards, requirements, criteria, or limitations under environmental or facility siting laws that are promulgated and more stringent than Federal requirements. The National Contingency Plan defines "promulgated" State requirements as State standards that are of general applicability and are legally enforceable.

"To be considered" items (TBCs) are nonpromulgated advisories, proposed rules, criteria, or guidance documents issued by federal or state governments that do not have the status of potential ARARs. However, these criteria and guidance are to be considered when determining protective cleanup levels where no ARAR exists, or where ARARs are not sufficiently protective of human health and the environment. In these circumstances, TBC values may be considered in establishing remedial objectives.

4.3.2 Chemical-Specific ARARs

Chemical-specific requirements are based on health or risk-based concentration limits or discharge limitations in environmental media (i.e., water, air) for specific hazardous chemicals. These requirements may be used to set cleanup levels for the chemicals of concern (in this case, metals) in the designated media, or to set a safe level of discharge (e.g., wastewater discharge, taking into account water quality standards) where a discharge occurs as part of the remedial activity.

Sources for potential target cleanup levels include selected standards, criteria, and guidelines that are typically considered as ARARs for remedial actions conducted under CERCLA. The chemical-specific ARARs and other criteria or guidelines to be considered are discussed below, as well as being presented on Tables 4.1 and 4.2. They are based on standards, guidelines, and criteria found in relevant literature, past discussions with appropriate State regulatory agency personnel, and prior project experience. A summary of these federal and State regulations, standards, and guidance is presented in Table 4.1. Table 4.2 contains the numeric standards associated with the federal Ambient Water Quality Criteria.

In addition to the federal and State standards and guidance presented in this section, studies are being conducted to evaluate the natural background levels for contaminants of concern in the soils, groundwater, and surface water. It may be appropriate to use these natural background levels in evaluating target cleanup levels.

4.3.2.1 Waste Classification

RCRA Subtitle C has not been identified as an ARAR for this site because mine waste rock is excluded from RCRA Subtitle C based on 40 CFR 261.4(b)(7).

4.3.2.2 Federal Ambient Water Quality Criteria

Federal Ambient Water Quality Criteria (AWQC) are nonenforceable guidelines developed under the Clean Water Act (CWA), Section 304, and are used by the State, in conjunction with a designated use for a stream segment, to establish water quality standards under the CWA, Section 303. CERCLA mandates compliance with AWQC where it is applicable or relevant and appropriate. AWQC are considered relevant and appropriate for freshwater aquatic organisms in streams designated for aquatic use.

Remedial activities at the site may impact Oregon Gulch, Stray Horse Gulch, and Malta Gulch, as well as other smaller gulches. These gulches hold intermittent streams that drain into California Gulch, which in turn drains into the Arkansas River. These intermittent streams and California Gulch have not been assigned aquatic life use designations and would not be subject to the AWQC for aquatic life. The AWQC may require further evaluation in regard to the quality and use classification of the Arkansas River. These criteria are outlined on Table 4.2.

4.3.2.3 National Ambient Air Quality Standards

The goal of the Clean Air Act is to protect and enhance the quality of the nation's air in order to protect public health and welfare. The National Ambient Air Quality Standards (NAAQS) were established for six criteria pollutants; suspended particulate matter less than 10 microns

(PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic carbon (VOC), nitrogen dioxide (NO_2), and lead (Pb). States establish source-specific emission limitations in State Implementation Plans to maintain NAAQS. Only major sources are subject to the requirements related to the attainment of NAAQS. In general, emissions from Superfund remedial actions are not expected to qualify as "major sources." However, complying with NAAQS during and following remedial action will have to be assessed when the remedial action has been determined.

4.3.3 Location-Specific ARARs

Location-specific ARARs are restrictions placed on the types of activities that may occur in particular locations. The location-specific ARARs for this site are presented in Table 4.3. The location of a site may be an important characteristic in determining its impact on human health and the environment, thus state standards often establish location-specific ARARs. These ARARs may restrict or preclude certain remedial actions or may apply only to certain portions of a site. Examples of location-specific ARARs include federal and state requirements for preservation of historic landmarks, endangered species and wetlands protection, and floodplain restrictions on management of hazardous waste.

4.3.3.1 Threatened/Endangered Species

As of the date of this report, no threatened or endangered (T/E) species have been found at the site (based on Draft TEE, Asarco, 1993). The Federal Endangered Species Act and the State Nongame, Endangered, or Threatened Species Act are both considered to have unknown applicability until the studies are completed. If T/E species are found to inhabit areas that will be impacted by remedial activities, these statutes will be applicable and coordination with federal and State agencies will need to be implemented to discuss mitigation measures or alternative remedial activities.

4.3.3.2 Species of Special Concern and Undetermined Status

No species of special concern or of undetermined status have been found to date at the site (based on Draft TEE, Asarco, 1993). These two wildlife categories are Colorado internal designations, and not authorized under statutory designations. Species of special concern are defined as a native species or sub-species which have been threatened or endangered or could become threatened or endangered due to low population levels. Species of undetermined status are species about which too little is known to accurately determine its status in the state. Colorado's Division of Wildlife maintains a list of species which have been determined to fit these categories. If species of special concern or of undetermined status are found at the site and remedial activities could potentially impact those species (or their habitats), the Division of Wildlife's Directive E-1, 1985 (modified), should be taken into consideration and coordination with the Division implemented.

4.3.3.3 Colorado Natural Areas Program

At this time, surveys currently being conducted at the site have not found any plant species of special concern. The Colorado Natural Areas Program maintains a list of Plant Species of Special Concern to the state of Colorado. It is not authorized by statute, and is considered a planning and management tool. If remedial activities impact plant species maintained on this list, the program should be taken into consideration and coordination with the Colorado Division of Parks and Outdoor Recreation implemented.

4.3.3.4 Cultural Resources

The potentially responsible parties (PRPs) for the site are required by EPA to implement an Identification and Evaluation Plan for Cultural resources at the site. The PRPs must be in compliance with the cultural resources management responsibilities specified in the Programmatic Agreement entered into between EPA, the State Historic Preservation Officer

(SHPO), and the Advisory Council on Historic Preservation (Council). These management responsibilities are required by the laws discussed below.

Section 110(f) of the National Historic Preservation Act (NHPA), which establishes procedures to minimize harm to National Historic Landmarks, is applicable since California Gulch lies within the Leadville National Historic Landmark District. Section 106 of the NHPA is also considered applicable at the site because EPA will have authority over actions that could impact the historically significant objects, buildings, or structures in the area. Archaeological surveys are currently being conducted on the site in accordance with the Programmatic Agreement, satisfying the requirements of the NHPA. The SHPO and the Council will have to be consulted prior to any drilling or remedial activity.

Executive Order 11593 on the Protection and Enhancement of the Cultural Environment is potentially applicable and requires consultation with the Council on the preservation and enhancement of historic resources if remedial activities threaten them. If historical and/or archeological data are impacted by remedial activities, the Historical and Archeological Data Preservation Act is considered applicable.

The Archaeological Resources Protection Act of 1979 provides for the protection of public or Indian lands, and would not be considered applicable. This statute may be relevant and appropriate, however, if remedial activities require the removal of archeological resources. Only substantive requirements would need to be met; no permit would be required.

The State Historical, Prehistorical, and Archeological Resources Act addresses the loaning of archeological resources on state-owned land to scientific or educational institutions. This statute is not considered applicable to the California Gulch Superfund site. However, should remedial activities endanger an archeological site that may necessitate removal of the resource, the procedures outlined by the Act could be designated "relevant and appropriate". Likewise, if remedial activities uncover any human remains that are of archeological interest, the procedures for excavation of said remains under the Act would also be "relevant and appropriate." Finally, the State's Register of Historic Places is potentially applicable if remedial activities may impact an area listed on the Register.

4.3.3.5 Wetlands and Floodplain Management

Federal regulations governing wetlands are considered applicable if remedial activities impact wetland areas at the Site. Approximately 3.4% of the study area (356 acres) is estimated to be wetlands (Asarco, 1992b). If applicable, coordination with the U.S. Fish and Wildlife Service would need to be initiated prior to any remedial activity. Wetlands have been surveyed at the Site, and no wetlands have been identified within OU-9. It is not currently known whether remedial activities at the site will impact to wetland areas as a result of mine waste pile remediation.

4.3.3.6 Clean Water Act (Section 404)

California Gulch, Oregon Gulch, Malta Gulch, and Stray Horse Gulch are the major gulches on the site. These gulches contain intermittent streams that could be considered "waters of the United States" (33 CFR 328.3(a)) and any remedial activity discharging fill materials into or changing the bottom elevation of these drainages (such as stream diversion ditches or construction of road crossings which impact the drainages) could make the dredge and fill substantive requirements of Section 404 of the Clean Water Act applicable. Several waste piles within these gulches are adjacent to drainages, and remediation of the waste piles could potentially discharge fill materials into the intermittent streams.

4.3.3.7 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act is considered applicable since remedial activities may affect or modify California Gulch, Oregon Gulch, Stray Horse Gulch, and Malta Gulch. Activities, such as stream flow modification and construction of reservoirs or surge ponds, as well as the activities mentioned in Section 4.3.3.6, could impact fish and wildlife resources in and along these drainages. EPA may need to coordinate with U.S. Fish and Wildlife Service and Colorado Department of Natural Resources to discuss mitigation measures to prevent loss or damage to these resources, if necessary.

4.3.3.8 State vs. Federal Waste Management Regulations

The Colorado Solid Waste Management Regulations are ARARs for management of non-hazardous waste, because they are more stringent than federal requirements.

4.3.4 Action-Specific ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements come into play. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative can be achieved.

Table 4.4 lists federal and state general action-specific ARARs. This table presents the regulations that may require action-specific ARARs for activities generally encountered in hazardous substance site remediation (e.g., generation, transportation, storage, on-site disposal, etc.). Regulations regarding worker health and safety (i.e., OSHA requirements) are not technically ARARs as they are not "environmental" requirements.

TABLE 4.1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCS CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, or Criteria	Description	Comment
Clean Water Act (33 USC Sect. 1351-1376)		
Ambient Water Quality Criteria (40 CFR Part 131; Quality Criteria for Water, 1976, 1980, 1986, 1987; Ambient Water Quality Criteria for Selenium, 1987)	Requires EPA and states to establish ambient water quality control criteria (AWQC) and standards, respectively, for surface water based on use classifications and the criteria stated under Sections 304(a) and 303 of the Clean Water Act.	Federal freshwater AWQCs may be "relevant and appropriate" if contaminants are released to site surface waters or if treated groundwater is discharged to a surface water. Colorado has its own state water quality standards which could be considered "applicable," where they are more stringent than the federal standards.
Clean Air Act (42 USC Sect. 7401-7642)		
National Ambient Air Quality Standards (40 CFR Part 50)	Establishes ambient air quality standards for certain "criteria pollutants" to protect public health and welfare.	Applicable if any criteria pollutant is emitted to the atmosphere during remedial action operations from a major source.
National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)	Establishes emission standards for certain industrial pollutants and sources.	Would only be an ARAR if the remedial action involves a specific industrial category for which NESHAPs has been established
Safe Drinking Water Act (42 U.S.C. 300)	Establishes regulations to protect human health from contaminants in drinking water and establishes national drinking water standards	
Underground Mining General Performance Standards (30 CFR Part 717)	Establishes minimum environmental protection performance standards for underground mining activities.	

Modified From EPA (1993)

TABLE 4.2

POTENTIAL CHEMICAL-SPECIFIC ARARs/TBCs
FEDERAL SURFACE WATER QUALITY STANDARDS (μg/ℓ)
CALIFORNIA GULCH SUPERFUND SITE

		CWA AWQC for Protection of Aquatic Life (a)		CWA AWQC for Protection of Human Health (a)	
Parameter	Type (1)	Acute Value	Chronic Value	Water and Fish Ingestion	Fish consumption Only
Sulfate	A				
pH	FP		6.5-9		
Temperature	FP	SS	SS		
Total Dissolved Solids	I	SS	SS	250,000	
Aluminum	M	750	87		
Antimony	M	9,000	1,600	146	45,000
Arsenic	M			0.0022	0.0175
Cadmium	M	3.9(2)	1.1(2)	10	
Chromium	M				
Chromium III	M	1,700(2)	210(2)	170,000	3,433,000
Chromium VI	M	16	11	50	
Copper	M	18(2)	12(2)		
Cyanide	M	22	5.2	200	
Iron	M		1,000	300	
Lead	M	82(2)	3.2(2)	50	100
Manganese	M			50	0.146
Mercury	M	2.4	0.012	0.144	100
Nickel	M	1,400(2)	160(2)	13.4	
Selenium	M	20(b)	5(b)	10	
Silver	M	4.1(2)	0.12	50	
Thallium	M	1,400(2)	40(2)	13	48
Zinc	M	120(2)	110(2)		

Explanation of Table
AWQC Ambient Water Quality Criteria
CWA Clean Water Act
SS Species Specific
μg/ℓ micrograms per liter
(1) Type abbreviations are: A = Anion; I = Indicator; FP = Field parameter; M = Metal
(2) Hardness dependent criteria; value set at hardness of 100 mg/L $CaCo_3$
(a) EPA, Quality Criteria for Protection of Aquatic Life, 1986
(b) EPA, National Ambient Water Quality Criteria for Selenium - 1987

From EPA 1993

TABLE 4.3
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARs
CALIFORNIA GULCH SUPERFUND SITE

Requirement	Potentially Applicable	Potentially Relevant and Appropriate	Comments
Location-Specific Laws/Requirements			
FEDERAL REGULATIONS			
E.O. 11988 Protection of Floodplains			
1. Limits activities in floodplains. Floodplain is defined as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of off-shore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." Federal agencies must evaluate the potential effects of actions taken in a floodplain and avoid adverse impacts from remedial activities [40 CFR 6.302 and Appendix A]	Yes	---	Portions of California Gulch lie within a 100-year floodplain. If remedial activities are conducted within the floodplain, this regulation will be applicable.
E.O. 11990 Protection of Wetlands			
2. Minimizes adverse impacts on areas designated as wetlands. [40 CFR 6.302(a) and Appendix A]	Yes	---	Wetlands are present along portions of California Gulch and the Arkansas River. Regulations are applicable only if remedial activities impact the wetlands areas.
Clean Water Act Section 404			
3. Regulates the discharge of dredged or fill material into waters of U.S. Consultation with the Regional Response Team required. [33 USC 1251, et seq; 40 CFR 230, 231; 33 CFR 320-330]	Yes	---	Dredge and fill substantive requirements will apply if Oregon Gulch, Stray Horse Gulch, Malta Gulch, California Gulch (if determined to be "waters of the United States") or the Arkansas River receive fill material from remedial activities.
4. Requires federal agencies to avoid, to the extent possible, adverse impacts associated with destruction or loss of wetlands	Yes	---	Wetlands occur along California Gulch and the Arkansas River; regulations would be applicable only if the remedial activities impact the wetlands areas.

TABLE 4.3
(Continued)

Requirement	Potentially Applicable	Potentially Relevant and Appropriate	Comments
Endangered Species Act			
5. Protects endangered species and threatened species and preserves their habitat. Requires coordination with federal agencies for mitigation of impacts. [16 USC 1531 et sequence; 50 CFR 200, 50 CFR 402]	Unknown	---	If there are T/E species or critical habitats within the areas impacted by the remedial activities, this regulation would be applicable.
Fish and Wildlife Coordination Act			
6. Requires coordination with federal and state agencies on activities affecting/modifying streams or rivers if the activity has a negative impact on fish or wildlife. [16 USC 661 et seq.; 40 CFR 6.302(g)]	Yes	---	If California Gulch or the Arkansas River and adjoining streams will be impacted by remedial activities, this regulation would be applicable.
Rivers and Harbors Act of 1899; Section 10			
7. Section 10 permit required for structures or work in or affecting navigable waters. [33 USC 403, 33 CFR 320-330]	No	---	Arkansas River not considered a "navigable river."
National Historic Preservation Act (NHPA)			
8. Requires the preservation of historic properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks. [16 USC 470 et seq.; 40 CFR 6.301(b); 36 CFR Part 63, Part 65, Part 800]	Yes	---	This Act is applicable as California Gulch lies within the Leadville National Historic Landmark District. A Programmatic Agreement has been entered into between the EPA, the Advisory Council on Historic Preservation, and the Colorado State Historic Preservation Officer in accordance with Section 106 and 110(f) of NHPA.
The Historic and Archeological Data Preservation Act of 1974			
9. Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity program. [16 USC 469; 40 CFR 6.301(c)]	Yes	---	Remedial activities may affect historical and/or archeological data at the Superfund site. A cultural resources survey was performed to identify and evaluate all historic properties which may be affected by remedial activities on the mine waste piles in OU-9.
E.O. 11593 Protection and Enhancement of the Cultural Environment			
10. Federal agencies directed to institute procedures to ensure programs contribute to the preservation and enhancement of non-federally owned historic resources. Consultation with the Advisory Council on Historic Preservation required. [16 USC 470]	Yes	---	See #8 above.

Modified From EPA 1993

TABLE 4.3
(Continued)

Requirement	Potentially Applicable	Potentially Relevant and Appropriate	Comments
The Archeological Resources Protection Act of 1979			
11. Requires a permit for any excavation or removal or archeological resources from public lands or Indian lands. [16 USC 470aa-470ll]	No	Yes	May be relevant and appropriate if any remedial activity involves removal or archeological resources; substantive requirements need to be met.
The Historic Sites Act of 1935			
12. Enables the National Park Service to preserve historic resources for public use. [16 USC 461-467]	No	No	May be "to be considered" if remedial activities impact areas eligible for inclusion in the National Register of Historic Places.
Wilderness Act			
13. Limits activities within areas designed as wilderness areas or National Wildlife Refuge Systems. [16 USC 1311, 16 USC 668; 50 CFR 53, 50 CFR 27]	No	No	The site is not within a federally-owned area designed as a wilderness area or a National Wildlife Refuge System.
Wild & Scenic Rivers Act			
14. Protects rivers that are designed as wild, scenic, or recreational. [16 USC 1271; 40 CFR 6.302(e)]	No	No	The Arkansas River is not listed as a Wild and Scenic River.
Resource Conservation and Recovery Act (RCRA), Subtitle D			
15. Facilities where treatment, storage, or disposal of solid waste will be conducted must meet certain location standards. These include location restrictions on proximity to airports, floodplains, wetlands, fault areas, seismic impact zones, and unstable areas [40 CFR 258.10-15].	No	Yes	Applicable if interim storage, treatment, and disposal is conducted as part of the California Gulch remedial action.
STATE REGULATIONS			
Colorado Historical, Prehistorical and Archeological Resources Act			
16. Establishes procedures and requires a permit for investigation, excavation, gathering, or removal from the natural state of any historical, prehistorical, or archeological resources on state lands for the benefit of recognized scientific or educational institutions. Also requires an excavation permit and notification if human remains are found on state land. [Colorado Revised Statutes, Title 24, Article 80, Sections 401-411]	No	Unknown	May be relevant and appropriate if archeological resources are removed or human remains discovered during remedial activities; coordination with state archeologist required, but no permit needed for Superfund site.
Register of Historic Places			
17. Establishes requirements for protecting properties of historical significance. [Colorado Revised Statutes, Title 24, Article 80, Sections 101-108]	Unknown	---	May be applicable if remedial actions impact any property listed on the Register of Historic Places.

Modified From EPA 1993

TABLE 4.3
(Continued

Requirement	Potentially Applicable	Potentially Relevant and Appropriate	Comments
Colorado Nongame, Endangered, or Threatened Species Act (CRS 33-2-103 through 108, 1984)			
18. Protects endangered and threatened species and preserves their habitats. Requires coordination with the Division of Wildlife if remedial activities impact on state-listed endangered/threatened species or their habitat. [Colorado Revised Statutes, Title 33, Article 2, Sections 101-108].	Unknown	---	If species on the State T/E list or their habitats are found in areas that will be impacted by remedial activities, the regulations will be applicable. A T/E survey of the California Gulch site was conducted, and concluded that there is no evidence that any listed species inhabit the site.
Colorado Species of Special Concern and Species of Undetermined Status			
19. Protects animals listed on the Colorado Division of Wildlife generated list. Coordination with the Division of Wildlife is strongly urged if animal species are to be impacted. [Colorado Div. of Wildlife Administrative Directive E-1, 1985, modified]	No	Unknown	If remedial activities impact animal species listed as special concern or of undetermined status, this directive would be "to be considered" and coordination with the Division of Wildlife recommended, even though there is no statutory authority. A survey of potential species of special concern was conducted as part of the TEE, and concluded that there is no evidence of animal species of special concern at the site.
Colorado Natural Areas			
20. The Colorado Natural Areas Program maintains a list of plant species of special concern for the State. Although not protected by State statute, coordination with Division of Parks and Outdoor Recreation is recommended if activities will impact listed species. [Colorado Revised Statutes, Title 33, Article 33, Section 104]	No	Unknown	If plants on the list of Plant Species of Special Concern are found in the areas impacted by remedial activities, this program would be "to be considered" and coordination with Colorado's Division of Parks and Outdoor Recreation would be necessary. A survey of potential plant species of special concern was conducted, and concluded that there is no evidence of plant species of special concern at the site.
State Solid Waste Disposal Sites and Facilities Act, Colorado Revised Statutes, Title 30, Article 20, Sections 101-118.			
21. Establishes regulations for solid waste management facilities, including location standards. [6 CCR 1007-2]	Yes	Yes	Applicable if remedial activities involve the disposal of solid waste materials. Permits are not required for onsite activities at a site listed on the NPL.

TABLE 4.3
(Concluded)

Requirement	Potentially Applicable	Potentially Relevant and Appropriate	Comments
Colorado Wildlife Act			
22. Establishes provisions governing the taking, possession, and use of wildlife and migratory birds. [Colorado Revised Statutes, Title 33, Article 1, Sections 101-120	No	No	Remedial actions being considered will not involve any taking, possession, or use of wildlife and migratory birds.

TABLE 4.4
POTENTIAL ACTION-SPECIFIC ARARs
CALIFORNIA GULCH SUPERFUND SITE

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
FEDERAL			
Clean Air Act	42 USC Sect. 7401-7642		
New Source Performance Standards	40 CFR 60	Establishes emission standards for certain categories of industrial stationary sources.	Only applicable if a remedial action creates air emissions regulated by these standards.
Solid Waste Disposal Act (SWDA as amended by the Resource Conservation and Recovery Act of 1976 (RCRA)	42 USC Sect. 6901-6987		
Hazardous Materials Transportation Act	49 USC Sect. 1801-1813		
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	Applicable if the remedial action involves off-site transportation of hazardous materials. The regulations affecting packaging, labeling, marking, placarding, using proper containers, and reporting discharges of hazardous materials would be potential ARARs.
Occupational Safety and Health Act	29 USC Sect. 651-678	Regulates worker health and safety.	Applicable for all remedial actions under the NCP.
Federal Mine Safety and Health Act	30 USC Sect. 800-962	Establishes requirements to protect worker health and safety.	Applicable for all remedial actions under the NCP conducted in and around mines.
STATE			
State Solid Waste Disposal Sites and Facilities Act CRS 30-20-101 to 118			
Colorado Solid Waste Management Regulations	6CCR 1007-2	Establishes policy for licensing, locating, constructing and operating of solid waste facilities.	Applicable if remedial activities involve disposal of solid waste materials. Permits are not required for on-site activities at a site listed on the NPL.

TABLE 4.4
(Concluded)

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Colorado Mined Land Reclamation Act	CRS 34-32-101 to 125		
Mineral Rules and Regulations	2CCR 407-1	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.	May be relevant and appropriate to remedial activities involving drilling, water control measures, and treatment and disposal of waste piles. Permit not required for CERCLA sites.
Colorado Air Quality Control Act	5CCR 1001-1, 3, 4, 5, 8, 10	Establishes emissions standards for PM 10 and lead.	Applicable if the remedial action creates emissions of regulated materials.
Colorado Noise Abatement Act	CRS 25-12-101 to 108	Establishes maximum permissible noise levels for particular time periods and land use zones.	Relevant and appropriate to remedial activities involving construction activities.
Miscellaneous			
Regulations on the Collection of Aquatic Life	2CCR 406-8, Ch. 13, Article III, Section 1316	Requirements government the collection of wildlife for scientific purposes.	Applicable if remedial activities trigger the need for biological monitoring.

Modified From EPA 1993

5.0 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

The following information was obtained from the Screening Feasibility Study (EPA, 1993b).

General response actions (GRAs) are broad classes of actions that may be implemented alone, or in combination, to satisfy the remedial action objectives. The general response actions identified as potentially applicable to the remediation of Site sources are presented in Table 5-1. The following are the six GRAs selected for the Mine Waste EE/CA:

- No Action leaves sources in their existing condition with no control or cleanup planned. This general response action serves as a baseline for comparison but may also be a selected remedial action for sources that pose no risk to human health or the environment.
- Institutional Controls are legal and physical restrictions applied to the source sites intended to control or prevent present and future use and access to source areas.
- Containment involves physical measures applied to the sources to control the release of contaminants or direct contact or exposure.
- Removal, Transport, and Disposal involves a complete or partial removal of source material followed by transportation to and disposal at a different location.
- Treatment involves physical or chemical measures applied to the source materials that reduce toxicity, mobility, and/or volume of the contaminants present.
- Resource Utilization involves use or reuse of the source material as a commercial product which, by the use or reuses, removes the source partially or totally from the site.

5.1 No Action

In accordance with the NCP, a no action general response action must be retained for consideration and to provide a baseline against which other technologies can be compared.

Implementation of the no action alternative dictates that no other alternatives or response be implemented at a source site and that the source remain in its existing condition with no plans for future control or for cleanup.

5.2 Institutional Controls

Institutional Controls are legal and physical restrictions applied to the source sites intended to control or prevent present and future use and access to source areas.

Land Use Controls

Zoning

Zoning would be implemented to control present and future land uses on or around a source area consistent with the potential hazards present, the nature of remedial measures implemented, and future land-use patterns. The objective of zoning would be to prevent public or private misuse of a source area that could jeopardize the effectiveness of remedial measures taken or pose an unacceptable potential for human exposure to the contaminants present in the source.

Deed Restrictions

Restrictions would be used to prevent the transfer of property without notification of limitations on the use of the property or requirements related to preservation and protection of the effectiveness of remedial measures that may have been taken. Both elements are intended to limit the potential for human exposure to source contamination.

Access Restrictions

Fencing and Posted Warning

Fencing and warnings would restrict access to a source site. Fencing would be installed around the perimeter of a source area to prevent human and animal access to the area. Posted warnings would identify the potential hazards present at the source site to deter trespass and misuse. Access restriction would prevent direct exposure to the contaminants present in the source and prevent disruption of any other remedial action taken on the source.

Community Awareness

Information and Education Programs

These programs could include a range of informational and educational programs designed to enhance community understanding and awareness of the potential hazards posed by the sources, the purpose and effectiveness of remedial actions taken, and the community's and the individual's responsibilities in the maintenance of the remedial actions.

5.3 Containment

Containment involves physical measures applied to the sources to control the release of contaminants.

Surface Water Controls

Diversion Ditches

Ditches would be constructed to divert upstream surface water flow around and away from the source area. Diversion ditches would limit the amount of water entering the source area to that which falls as precipitation directly on the source. They would also prevent direct contact of flowing water in streams or overland flows from coming in contact with the source material. Diversion ditch construction would reduce the potential for erosion and transport of solid source material away from the area.

Channelization

Channels would be constructed to divert existing or newly developed streams that flow through or are in direct contact with source material. New channels or improvements to existing channels may be required. The channelization would be designed to prevent erosion of the source material and control release of contaminants from the source.

Source Surface Controls

Grading

Grading of the source material surface would be performed to produce surface contours that enhance erosional stability, create non-erosive run-off of direct precipitation, or prevent the development of surface water ponds. The overall objective of grading is to create as stable a material surface as possible without the use of surface protection. The result of grading would be to reduce erosional transport of source material from the area through run-off or wind and control release of soluble contaminants due to leaching in run-off or through infiltration. Grading may include the establishment or construction of wind breaks to improve erosional stability.

Revegetation

A self-sustaining vegetative cover would be established directly on the source material surface to provide erosional stability (wind and water) and reduce infiltration. Direct revegetation would most likely be undertaken on graded source area surfaces to improve erosional stability.

Revegetation may require amendment of the source material with either organic matter, imported soil, or fertilizers, to provide an adequate growth medium to ensure successful establishment of vegetation. The vegetation cover would provide at least partial isolation of the source material thus reducing the potential for direct human contact and mitigating surface water processes.

Simple Covers

Source area surfaces, with or without prior grading, would be covered with imported soil or rock borrow, or suitable content materials from other site sources to develop an erosionally stable surface. In most cases, vegetation would be established on this cover depending on specific conditions of the source site and the type of cover material used. In most cases, the source surface would be graded prior to placement of the cover.

Multi-Layer Cover

Source area surfaces would be capped with more than one type of material in separate layers. The types of materials selected and the order in which they are to be placed would depend on the specific functions that the cover is designed to achieve. The multi-layer cover would be used to achieve a greater reduction in infiltration than would be possible from the installation of a simple cover. Either clay, clayey soil, or a synthetic membrane could be used as the lower layer of the cover which would be overlain with borrow material. Vegetation may or may not be established in multi-layer covers. In most cases where a multi-layer cover is to be constructed, grading of the source surface would occur prior to placement of the cover.

Barriers

Retaining Structures

Retaining walls, cribs, or rock or earthen buttresses and embankments would be constructed to stabilize source material surfaces or slopes against sliding and/or erosion. In most cases, retaining structures would be used only on selected portions of a source area to address special stability or erosion conditions.

Sediment Dams or Traps

Sediment dams or traps would most likely be constructed in conjunction with diversion ditches or channels to intercept and retain sediments produced from a source area. These sediment dams or traps could include sedimentation basins constructed within or outside of stream channels where sedimentation would occur.

Constructed Wetlands

Constructed wetlands are natural areas such as marshes, bogs, wet meadows, peat lands, and swamps. Such wetlands are known to naturally influence water quality. Wetland areas can be constructed specifically for use in water treatment. Such wetlands have been formed by installing an impervious membrane under the soil. Grass or other vegetation is then planted and allowed to proliferate. If the wetland is constructed with a gentle slope, the water is applied at the top of the wetland and allowed to slowly flow to the bottom, where it can be collected for final disposal. Otherwise, the wetland can be operated on a flood-and-drain basis. Such wetlands have been used for reducing concentrations of suspended solids.

5.4 Removal, Transport and Disposal

Removal

Mechanical Excavation/Dredging

Source materials would be excavated in the dry or in the wet using conventional earth-moving equipment such as a front end loader, excavator, or draglines with a clamshell.

Vacuum Dredging

Source materials would be dredged using water-jet cutters, suction pumps, piping, and associated equipment. Vacuum dredging would allow removal of wet materials without significant disturbance to a stream channel.

Demolition

Certain structures on site may require demolition due to structural decay and/or the degree of contamination. This would be accomplished using conventional equipment and demolition methods.

Decontamination

Decontamination consists of thorough cleaning of the interior and exterior of a contaminated structure. Industrial strength equipment and supplies, and professionally trained hazardous waste labor would be used.

Purchase/Replacement

This option consists of the purchase and/or replacement of contaminated land, residences, structures, and in-residence items (e.g., curtains, insulation).

Transport

Truck Hauling

Removed source material would be transported to a temporary stockpile or a disposal site in trucks.

Disposal

On-Site Repository

Materials removed from a source area would be disposed on site at a new repository. The repository would be designed and constructed to meet permitting and approval requirements.

On-Site Consolidation

Source materials removed from a source area would be disposed on site by relocation to another, existing source area. Such relocation would allow consolidation of source locations.

5.5 Treatment

Physical/Chemical

Soil Washing

Removed material would be washed with a formulated contaminant-specific washing solution to extract hazardous constituents. Oversized non-source materials and debris that cannot be treated would be screened from the materials prior to washing. The spent solution would be treated by conventional waste water methods to remove contaminants.

Physical Separation

Removed material would be milled by crushing, grinding, screening, magnetic separation, and/or decanting to separate heavy metals/minerals. Recovered metals or minerals would be either reprocessed or disposed.

Neutralization

Removed material would be screened to remove oversize materials and debris, then mixed mechanically with appropriate neutralizing agents such as lime or phosphate to raise the pH of the source material to reduce the mobility and toxicity of the contaminants present. The neutralized source materials would then be disposed of.

Stabilization

Removed material would be mixed mechanically with cement, lime, fly ash, asphalt, or pozzolanic stabilizing additives to reduce the mobility, solubility, and/or toxicity of the contaminants present. This stabilization could occur as a result of precipitation of new chemicals or mineral forms of the contaminants.

In Situ Stabilization

Stabilization agents would be mixed into source material (such as fly ash, cement, lime pozzolanic stabilizing additives, or asphalt). The addition of these chemical agents would be intended to convert the contaminants into less soluble, mobile, or toxic form, mitigating the potential for migration off site or mitigating the hazardousness of the contaminants. Deep mixing of the stabilizing agents with the source material could be accomplished using paddles or augers mounted on a drill rig. Shallow mixing could be accomplished by grading and disking to blend the surficial materials.

Reprocessing

Smelting

This process allows the economic removal of heavy metals from source materials. Source materials are removed from the source area and transported to a processing facility where crushing, grinding, and heating are used to remove metals from the materials. The flame reactor process is a variation of the smelting method that heats the materials with a very hot (greater than 2000°C) reducing gas, producing a non-leachable slag and recyclable oxides. Smelting would only be used on materials containing concentrations of metals high enough to allow economic processing.

5.6 Material Reuse

Material reuse involves utilizing materials for construction without further treatment. Sizing may be necessary for the implementation of this option. Examples of this option may include the use of materials for riprap, as railroad ballast, or other as constructional material. The full range of beneficial use is unknown at this time, although due consideration will be given to any associated limitations imposed by the nature of the contaminants within the material or other material properties.

TABLE 5.1

SITEWIDE GENERAL RESPONSE ACTIONS

General Response Action	Description
No Action	No control, or cleanup or source contamination. Serves as baseline for comparison.
Institutional Controls	Legal and physical restrictions applied to source sites intended to control or prevent present and future use and access to source.
Containment	Physical restrictions applied to the sources to control release of contaminants.
Removal/Transport/Disposal	Complete or partial removal of source material followed by transportation and disposal at a different location.
Treatment	Physical or chemical measures applied to the source material that reduce the toxicity, mobility, and/or volume of the contaminants present.
Material Reuse	Use or reuse of the source material as a commercial product which, by the use or reuses, removes the source partially or totally from the site.

From EPA 1993b

6.0 SCREENING OF REMOVAL ACTION ALTERNATIVES

Six response action alternatives have been defined in Section 5.0. These general response actions will be screened in this section with regard to effectiveness, implementability and cost, based on the results of the Screening Feasibility Study (EPA, 1993) and EE/CA guidance (EPA, 1993).

Effectiveness is defined as the potential effectiveness or degree of protection provided by the proposed removal action alternative. This screening factor also requires the consideration of the degree of long-term mitigation of threats to public health, welfare, and the environment and the reliability of the alternative to achieve the remedial action objectives. A rating system has been developed for the screening evaluation with rating factors ranging from 4 to 1. A rating of 4 is used to indicate complete effectiveness in protecting public health and the environment and 1 is used for no improvement over existing conditions.

Implementability considers the technical feasibility, administrative implementability, and length of time required to implement the technology. This factor includes both site specific and technology specific aspects. A rating system has been developed for this factor with ratings ranging from 4 to 1. A rating of 4 indicates the response action is easily implemented and a 1 rating indicates difficulty in implementation, either due to technical aspects greater than a year required for implementation, or difficulties in administrative implementation/ community concerns.

The cost factor considers the relative cost of each of removal action alternatives. Material reuse scored higher on this factor than removal/transport/disposal since the overall cost of the alternative may be reduced by the beneficial end use of the mine waste material, especially if intermediate stockpiling could be eliminated.

All six identified response actions have been evaluated based on the screening system described above. Table 6.1 presents a summary of the results of the screening analysis. Based on the results of the screening analysis, two of the six alternatives were eliminated since they contained one or more ratings of 1. The eliminated alternatives were treatment and removal and disposal. The removal and disposal option will be combined with the reuse alternative to yield a remove and reuse alternative. The no action and institutional control alternatives have been retained since they provide a baseline for cost comparisons and may be appropriate for some of the mine waste piles.

TABLE 6.1
SUMMARY OF ALTERNATIVES SCREENING ANALYSIS

Major Criteria	Sub-Criteria	No Action	Institutional Controls	Containment	Removal/Transport/ Disposal	Treatment	Material Reuse
Effectiveness	*Protectiveness of Public Health and the Environment*	1	2	4	4	4	3
	Ability to Achieve Remed. Objectives	1	2	3	3.5	2	4
Implementability	*Technical Feasibility*	4	4	3.5	3	1	3
	Availability	4	3	2	1	1	2
	Administrative Implementability	2.5	3	3	2	3	3
Cost	*Cost*	4	3	3	2	2	3
Totals		**16.5**	**17**	**17.5**	**15.5**	**13**	**19**
Ranking: Best (1) to Worst (6)		**4**	**3**	**2**	**5**	**6**	**1**
Alternative Retained		**Yes**	**Yes**	**Yes**	**No**	**No**	**Yes**

7.0 EVALUATION OF REMAINING REMOVAL ACTION ALTERNATIVES

Based on the results of the screening analysis presented in Section 6.0, site specific removal/remedial action alternatives have been developed. These alternatives will be defined and evaluated in detail in this section of the report in accordance with the EE/CA guidance. Criteria used for the evaluation are effectivness, implementability, and cost. Three alternatives incorporate various aspects of the alternatives evaluated in Section 6.0. Alternatives 1 and 2, presented below, have been developed for baseline comparisons to the remaining alternatives. Cross sections of piles located near houses and roadways were prepared to aid in alternative evaluations. Figures 7-1 through 7-18 present these cross sections. Cross section locations are illustrated on Figure 3-1.

7.1 Alternative 1 - No Action

7.1.1 Description

This alternative poses no action be taken on the mine waste piles. This action does not meet the objectives outlined for the project but is retained for comparison purposes.

7.1.2 Evaluation

Effectiveness

This alternative does not meet the project objectives and would likely not be considered acceptable by the public since it does not provide protection of public health or the environment.

Implementability

This alternative is technically feasible since no action or administration would be required.

Cost

There is no cost associated with this option. This option has been included on cost summary Table 7.1 for comparison purposes only.

7.2 Alternative 2 - Institutional Controls

7.2.1 Description

This alternative consists of constructing fencing and posting signs around mine waste piles with surface total lead levels in excess of 2000 ppm. Piles with surface total lead levels less than 2000 ppm will receive no action. In addition to fencing and posting of signs for the piles, efforts will be made to alter the deeds for the properties and to secure zoning restrictions for limiting future uses of the properties to limit potential exposure to metals.

7.2.2 Evaluation

Effectiveness

This alternative does not meet the project objectives and would likely not be considered acceptable by the public since this alternative does not eliminate the source of potential metals exposure. Metals migration into the environment by infiltration of water and erosion by wind and water would still be possible. The institutional controls would, however, limit access to the areas of highest metals concentrations and would reduce the risk of direct human exposure. Future land use restrictions would also aid in limiting direct exposure.

Implementability

This alternative is technically feasible and can be readily implemented in a short time frame with minimal administrative requirements.

Cost

This alternative has a relatively low cost which incorporates a present worth calculation for operation and maintenance of the fencing and signs. The operation and maintenance period was selected at 30 years to comply with Colorado solid waste post-closure requirements. A 7% discount rate was used for performing the present worth analysis. Variation of the assumed discount rate had only a minor affect on the total project cost estimate for this option. Table 7.1 presents as summary of the cost estimate for this option.

7.3 Alternative 3 - Cap Piles In-Place

7.3.1 Description

This alternative consists of constructing a 12 inch thick soil cover over the mine waste piles with surficial total lead levels in excess of 2000 ppm. The cover soil would be obtained from mine waste piles with surficial total lead levels less than 2000 ppm. This alternative would reduce the risks to human health and the environment posed by the mine waste piles. The soil cover would be vegetated and maintained to minimize the impact of soil erosion by wind and water. The intact cover would effectively eliminate the migration of contaminated soil particles by wind and water. The mine waste piles would be regraded to slopes of 2.5H:1V or less to achieve stabilization and promote surface water runoff. The regrading and covering with soil would reduce infiltration of direct precipitation and limit the potential for contamination of surface and ground waters.

7.3.2 Evaluation

Effectiveness

This alternative would impact the residents near or adjacent to the mine waste piles due to the nature of the construction activities. The construction would increase noise levels and dust during operation periods. Dust control measure would be implemented to limit the amount of dust generated during the construction. The benefit of mitigation of the potential contamination should offset any difficulties experienced by the public during the construction.

This alternative would meet the project objectives and limit the risk to human health and the environment posed by the mine waste piles. The waste pile regrading may result in dusting, however, extensive dust control measures would be implemented to minimize this occurrence. Capping would decrease infiltration of surface water into the mine waste piles and would promote runoff. These efforts would result in decreased potential for surface and ground water contamination. The cap would also decrease the effects of wind and water erosion.

Implementability

This alternative is feasible using common construction equipment, procedures, and practices. Some construction difficulties may arise due to the presence of earthmoving activities within the residential areas. Dust control would be a significant concern during the regrading and capping activities. Some piles (piles 18, 27, and 28) would have to be relocated rather than be regraded and capped due to the limited space between the piles and neighboring houses and roadways. Because space is limited the piles could not be regraded to appropriately flat slopes which will provide adequate long-term stability. These piles would be relocated using the methods described for Alternative 3. The piles to be relocated would be moved to a suitable location at an existing pile which is planned to be capped and where sufficient lateral area exists for additional mine waste storage. Institutional controls such as zoning changes and deed restrictions would be implemented to ensure that future land use does not impede cap performance.

Cost

Table 7.1 provides a cost estimate for this alternative. The costs have been estimated based on the following assumptions:

- The piles will be regraded to slopes of 2.5H:1V or flatter to enhance stability and limit erosion potential;
- Some piles (18, 27, and 28) will be relocated to other waste pile location(s) since sufficient lateral area is not present to allow regrading of the piles;
- Piles requiring relocation will be handled as described in Alternative 3;
- Mine waste piles with surficial total lead levels in excess of 2000 ppm will be capped;
- Mine waste piles with surficial total lead levels less than 2000 ppm will be left in-place without capping or will be used for capping of piles with total lead in excess of 2000 ppm;
- 12 inches of cover soil will be used for capping;
- The capped piles will be revegetated and the vegetation will be maintained for a period of 3 years to ensure establishment;
- Annual maintenance of the caps has been estimated for a 30 year period;
- Dust control will be necessary during construction;
- Traffic control will be necessary during the hauling periods;
- Temporary surface water controls will be established at each construction area;
- A 20% of project cost factor was assumed for engineering design and construction management costs;

- A 2% of project cost factor was assumed for contractor mobilization/demobilization; and,

- A 10% contingency is assumed to account for variations in construction quantities.

The cost for this alternative is average with respect to the other alternatives, and the project objectives are met.

7.4 Alternative 4 - Relocate and Consolidate Piles in a Stockpile Area for Construction Uses

7.4.1 Description

This alternative consists of relocating all mine waste piles with surficial total lead levels in excess of 2000 ppm to a remote area for temporary stockpiling. For the purposes of this EE/CA, it is assumed that the removed material would be stockpiled in OU1 near the Yak Tunnel Water Treatment Plant. Mine waste piles with surface total lead levels less than 2000 ppm would be left in place and no action would be taken. Mine Waste Pile 12 would require regrading to stabilize the pile slopes. This pile is the only "no action" pile which would require regrading. All other no action piles are located away from roadways and houses.

This alternative allows for the use of the contaminated mine waste materials as potential construction materials for other reclamation activities. The geotechnical characteristics of the mine waste materials may be beneficial for construction uses.

7.4.2 Evaluation

Effectiveness

This alternative remediates the potential for impacts on human health and the environment and provides for reuse of the mine waste for construction materials. These factors should be highly acceptable to the public. However, the implementation of the removal action will impact the people who live adjacent to the piles and along the haul route. Construction noise levels may be found to be unacceptably high for some people. In addition, construction derived dust may be difficult to control completely. Overall, the benefits of removing the source of contamination will be beneficial and should result in acceptance by the public.

As previously stated, the relocation of the mine wastes to a stockpile area in OU1 may have air quality impacts. Dust control measures would be implemented to minimize this impact. The removal action would eliminate the source of metals in the populated area and provide a usable construction material for future use in other remedial actions.

Implementability

This alternative is feasible using common construction equipment, procedures and practices. Some aspects of the alternative would require care during the implementation of the removal action. The potential for wind blown contamination would exist during the excavation and haul stages. Dust suppression activities would be required to minimize the potential of contamination from this source. In addition, care must be exercised when removal activities occur adjacent to existing houses, roadways, and utilities. Some relocation of utilities may be required.

Additional geochemical testing would be performed to quantify the variation and extent of contamination throughout each mine waste pile such that selective stockpiling could be accomplished. The highest lead levels (i.e., >10,000 ppm) would be stockpiled separately from the remainder of the mine waste materials to allow for selective end uses.

Cost

Table 7.1 provides the cost estimate for this alternative. The costs for this alternative have been developed assuming the following:

- Excavation will be achieved using a Caterpillar (CAT) 966 loader (or equivalent);
- 10-wheel end dump trucks (10 to 12 cyd capacity) will be used for hauling (loads will likely have to be tarped to reduce the potential for blowing dust);
- CAT D-6 dozer will be used for site and stockpile grading;
- A water truck with spray capability will be used for dust suppression;
- Traffic control personnel will be required;
- Verification of complete mine waste removal will be accomplished using hand held XRF devices;
- Additional geochemical characterization will be necessary to quantify the variations of contamination within the mine waste piles to be relocated such that selective stockpiling can be performed;
- Temporary sediment control will be required around the stockpile and at each excavation site;
- Engineering and construction management will be approximately 20% of the project cost;
- Contractor mobilization costs will be approximately 2% of project costs; and,
- A 10% contingency factor is included to account for variations in quantities and costs associated with unforeseen factors.

The cost for this alternative is relatively high when compared to the other retained alternatives. However, much of this cost could be offset if the stockpiling were eliminated and the mine waste was hauled directly to the end use location.

7.5 Cultural Resource Findings

Leadville has been classified as a National Historic Landmark. Therefore, the identification and evaluation (ID&E) of the potential effects of remediation of historic properties was required for this EE/CA. The ID&E was performed in two phases: a reconnaissance-level examination in January 1995, and a detailed Class III survey in June 1995. The presence of intact, substantial, structural remains, as well as visual prominence/contribution the cultural landscape, determines the potential for a resource to be recommended as eligible for listing on the National Register of Historic Places (NRHP). Eligibility for listing can be a consideration in the selection of a remedial action. Each mine waste pile within Asarco's area of responsibility was examined. The results are summarized in Table 7-2. Appendix B contains correspondence from the State Historic Preservation Office (SHPO) which lists the final determination on each of the mine waste piles. For convenience, a brief description of the four piles which were determined to be significant to the EE/CA, based on eligibility either individually or as a contributing element of the Historic Landmark is provided below:

Mine Waste Piles Nos. 16, 17, and 18: Coronado

Features Observed: Three mine waste piles. Cribbing remains at MWP's 16 and 18. Equipment platform, hoist foundation, furnace/boiler foundation remains, furance slag dump, shaft remains at MWP 16. Historic materials found include glass, bottle fragments, cans, nails.

Visual Assessment: Moderate to high visual prominence; all three piles are large.

Historic Significance: The Coronado was probably one of the most significant of the Downtown District Mines in terms of production; also associated with the labor strike of 1896. Several important persons in Leadville mining history were associated with the Coronado.

Evaluation: Individually eligible, and contributing to the historic industrial landscape, as part of the Coronado Mine complex. Avoidance is recommended for MWP's 16 and 18, or if this is not possible, mitigation should be considered. MWP 17 is evaluated as non-contributing.

Mine Waste Pile No. 20: Midas

Features Observed: Moderately disturbed, with significant amounts of modern trash. No structures, depressions, or shaft remains observed. Historic materials noted include bottle fragments, ceramic fragments, miscellaneous metal fragments, charcoal, slag, and burned wood fragments.

Visual Assessment: High visual prominence; very large pile.

Historic Significance: The Midas conveys the importance and productivity of the Downtown Mining District. Associated with the Coronado and the Guggenheim empire.

Evaluation: Not individually eligible, but contributing to the historic district due to its high prominence and visibility. Impacts to the waste pile should be avoided if possible; otherwise mitigation options should be considered.

Mine Waste Pile No. 33: Weldon

Features Observed: Moderately disturbed, but in poor condition, including the presence of modern trash. No structures or shaft remains observed. There is a depression containing furnace slag and a large deteriorated pile of bricks, and a rubble pile (probably a foundation remains). Historic materials noted include miscellaneous metal and very small fragments of glass.

Visual Assessment: High visual prominence; large pile.

Historic Significance: The Weldon conveys the importance and productivity of the Downtown Mining District. May have been somewhat important for it's ability to pump water and assist in dewatering of other mines to the east and up Carbonate Hill.

Evaluation: Not individually eligible, but contributing to the historic district due to its high prominence and visibility. No archaeological potential was identified.

Mine Waste Pile No. 340: P.O.S.

Features Observed: No structures, features, or depressions were observed at this pile; probable shaft remains were found associated with MWP 339 (not part of this investigation). Sparse historic materials were found, including cans and glass and metal fragments.

Visual Assessment: High visual prominence; fairly large pile; not visually screened.

Historic Significance: No identified historic significance. Was under the control of the Guggenheim operations ca. 1901, and the Down Town Mines Company in the 1910's and 1920's.

Evaluation: Not individually eligible, but contributing to the historic district due to its high prominence and visibility.

TABLE 7.1
REMOVAL/REMEDIAL ACTION ALTERNATIVES

Alternative 1: No Action

No Action means leaving all piles as they currently are, without modification.

There is no cost associated with this alternative

Alternative 2: Institutional Controls

- Placing fencing around mine waste piles with signs posting "No Trespassing"
- Allow for operation and maintenance for 30 year period.
- Perform changing of deeds, titles to discourage future development of site
- Implement zoning restrictions to limit future uses of the land where mine waste piles are located.

Description	Quantity	Time	Unit Cost	Subtotal
Fence	15,000 LF	----	$17	$255,000
Operation & Maintenance (present worth; 7% discount rate* assumed)	22 piles	30 yrs	$1000	$12,400
Signs & Posts	44 each	----	$100	$4,400
			Total:	$272,000

*Discount Rate Sensitivity

Discount Rate	Annuity Factor	Present Worth	Project Total Cost
4%	17.3	$17,300	$276,900
7%	12.4	$12,400	$272,000
10%	9.4	$9,400	$269,000

TABLE 7.1
(Continued)

Alternative 3: Capping waste piles in place using piles with lead concentrations less than 2,000 ppm as capping material.

- Regrade waste piles to stable configurations
- Relocate piles that have insufficient room for slope flattening
- Construct diversion channels around stabilized piles
- Revegetate capped piles and maintain
- Contractor Mod/Demob
- Traffic Control (Flag persons)
- Dust Control
- Temporary Sediment Control
- Establish Site Access
- Engineering Design/Construction Management
- Additional Characterization of Piles >2,000 ppm
- Contingency
- Operation & Maintenance for Erosion Repair of Cover
- Implement zoning limitations on future development and make changes to deeds to prevent disturbance of the capped piles.

Description	Quantity	Time	Unit Cost	Subtotal
Regrading & Ditch Excavation	180,000 cyds	514 hrs	$78/hr	$40,000
Site Access	31 sites	2 hrs	$78/hr	$5,000
Excavate, Load, Haul, & Cap	18,000 cyds	----	$5.00/cyds	$90,000
Relocate Piles too Steep to Flatten in Place	36,000 cyds	----	$4.60/cyds	$166,000
Revegetate Capped Piles	15 acres	----	$500/acre	$7,500
Revegetation Maintenance	30% year 1		$2,250	
	15% year 2		$1,125	
	05% year 3		$ 375	
	Mob / Demob		$1,500	$5,000
Traffic Control (Flag People)	3 people	225 hrs	$50/hr	$11,000
Additional Waste Pile Geochemical Characterization (Method 1312, ABA)	18 samples	----	$55/sample	$1,000
Dust Control	1 water truck	740 hrs	$50/hr	$37,000
Temporary Sediment Control	31 locations	----	$1,000/loc.	$31,000
Contractor Mobilization / Demobilization	2% of project cost		$8,000	
Engineering Design / Construction Management	20% of project cost		$80,300	
Contingency	10% of project cost		$48,200	
Operation & Maintenance (Present worth: 7% discount rate* assumed) Annual O&M for erosion repair of cover ($9,000 /yr for 30 yrs)				$111,600
			Total:	$641,600

*Discount Rate Sensitivity

Discount Rate	Annuity Factor	Present Worth	Project Total Cost
4%	17.3	$155,700	$685,700
7%	12.4	$111,600	$641,600
10%	9.4	$84,600	$614,600

TABLE 7.1
(Continued)

Alternative 4: Removal/Reuse of Waste Piles (Stockpile at OU1)

- Excavate, haul, and stockpile mine waste
- Site access for individual piles
- Regrade site following excavation
- Revegetate site following clean up
- Contractor mob/demob
- Erosion control at stockpile

Description	Quantity	Time	Unit Cost	Subtotal
Excavate, Load, & Haul Cost	200,000 yds	----	$4.60 cyds	$920,000
Revegetation of Disturbed Areas	9.9 Acres	----	$500/acre	$5,000
Regrade Following Pile Removal	432,000 SF	----	$0.022/SF	$10,000
Silt Fence at Stock Pile	2,000 LF	----	$5.00/LF	$10,000
Site Access	22 piles	2 hrs/pile	$78.00/hr	$3,500
Additional Waste Characterization (Method 1312 and ABA)	30 samples	----	$55.00/each	$4,500
Revegetation Maintenance	30% year 1 15% year 2 5% year 3 Mob / Demob ($500/yr)		$1,500 $ 750 $ 250 $1,500	$2,500
Traffic Control (Flag People)	3 people	1333 hours	$50/hr	$67,000
Dust Control	1 truck	1333 hours	$50/hr	$67,000
Temporary Sediment Control	22 locations	----	$1,000/loc.	$22,000
Contractor Mobilization / Demobilization	2% of project cost		$22,400	
Engineering Design / Construction Management	20% of project cost		$228,800	
Contingency	10% of project cost		$137,300	
			Total:	$1,500,000

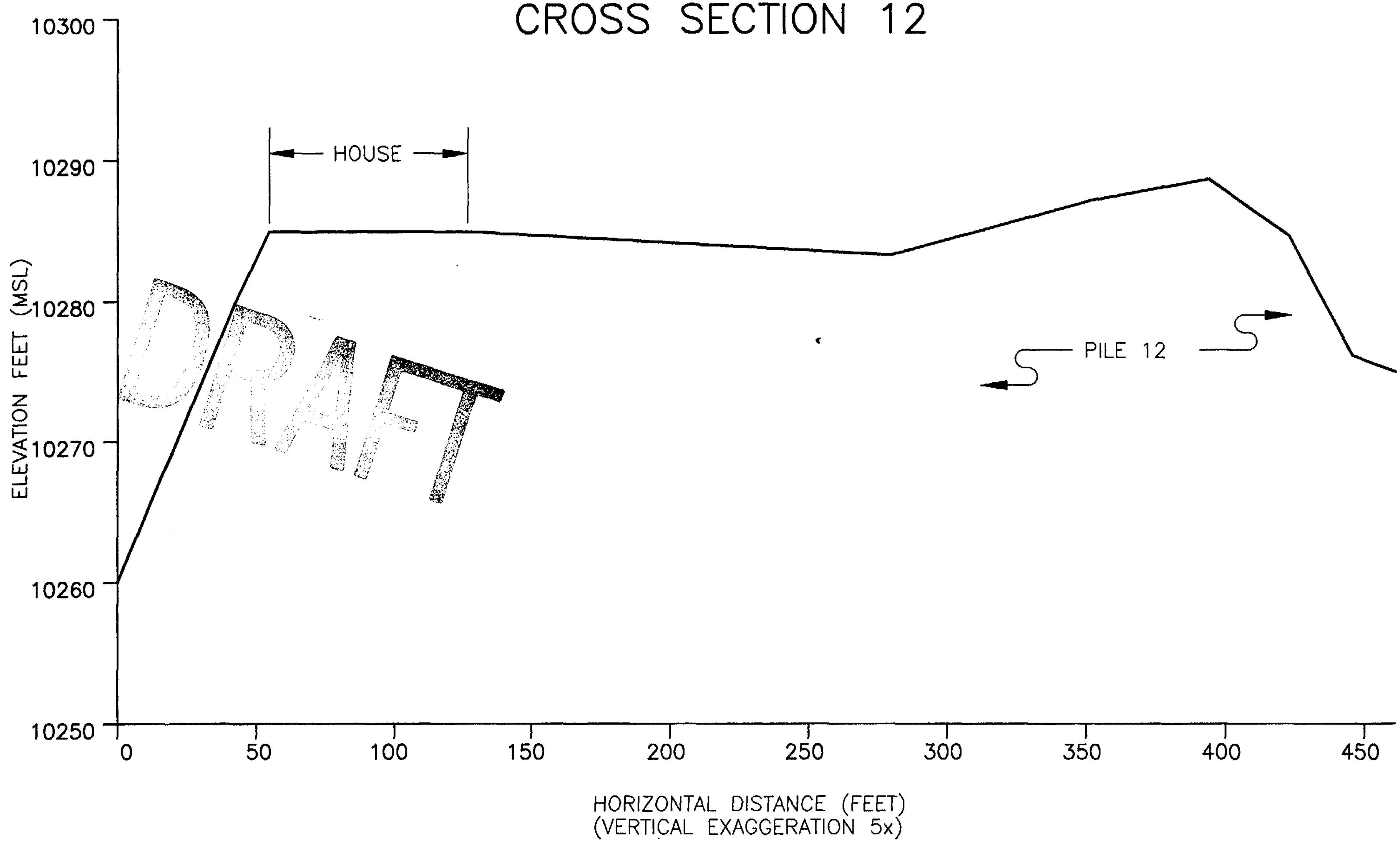
TABLE 7.2
CULTURAL RESOURCE MANAGEMENT SUMMARY

Pile No. - Name (Smithsonian Site Number)	Eligibility	District Status
MWP 13 - Estey (5LK867)	Not Eligible	Not Contributing
MWP 16, 17, 18 - Coronado (5LK868)	Eligible, both Individually and as a contributing element of the Leadville Historic District (5LK856)	Contributing
MWP 20 - Midas (5LK869)	Eligible only as a contributing element of the Leadville Historic District (5LK856)	Contributing
MWP 22 - Gray Eagle (5LK870)	Not Eligible	Not Contributing
MWP 24 - Kent (5LK871)	Not Eligible	Not Contributing
MWP 32 - Pocohontas (5LK872)	Not Eligible	Not Contributing
MWP 33 - Weldon (5LK873)	Eligible only as a contributing element of the Leadville Historic District (5LK856)	Contributing
MWP 35 - Midland (5LK874)	Not Eligible	Not Contributing
MWP 108 - Turbot (5LK875)	Not Eligible	Not Contributing
MWP 140 - Ypsilanti (5LK876)	Not Eligible	Not Contributing
MWP 340 - P.O.S. (5LK877)	Eligible only as a contributing element of the Leadville Historic District (5LK856)	Contributing

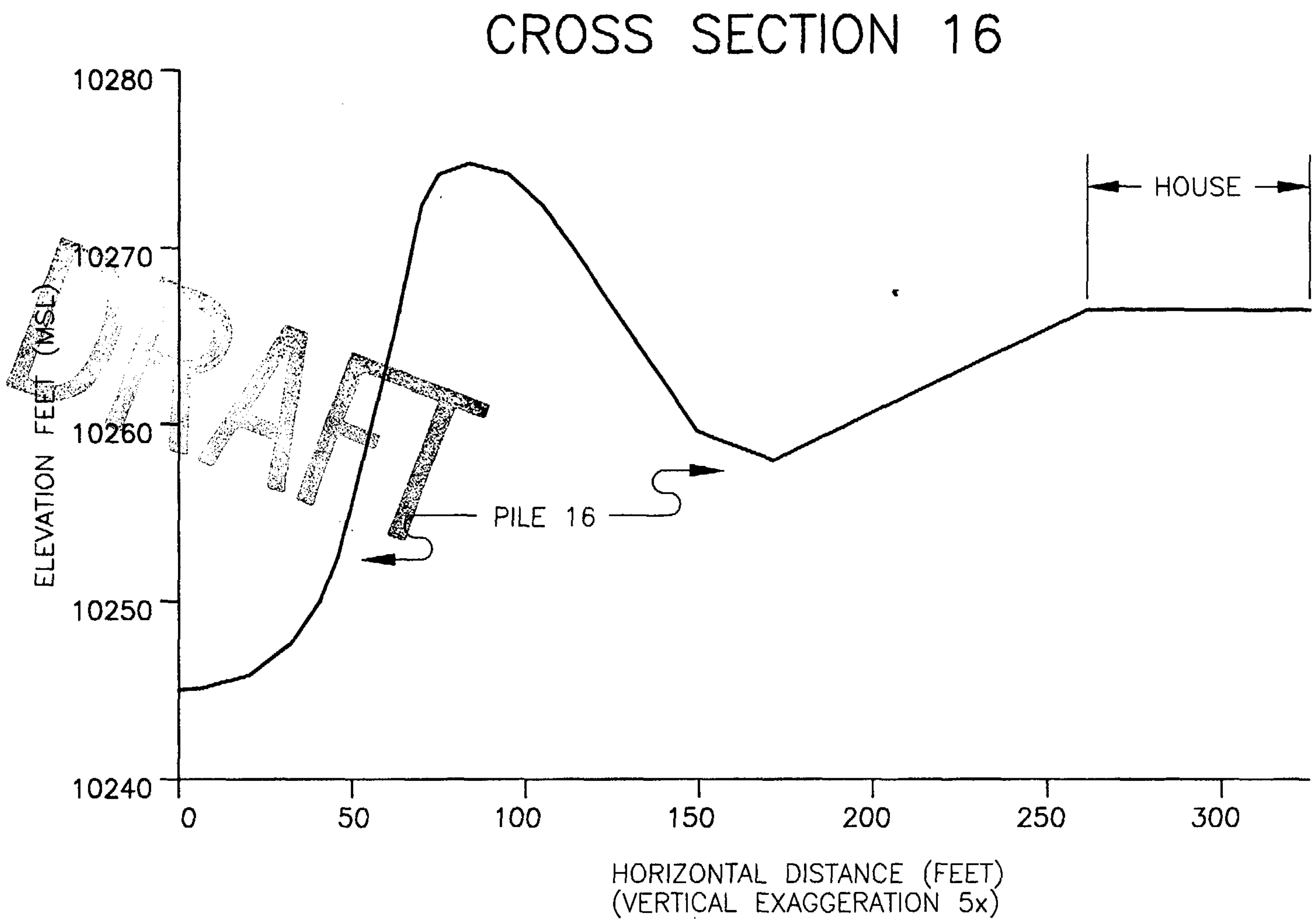
Note: The above table includes only "Sites", not "Isolated Finds." All isolated finds at the Mine Waste Piles surveyed were determined to be Not Eligible and Not Contributing

Source: FEC, 1995.

CROSS SECTION 12



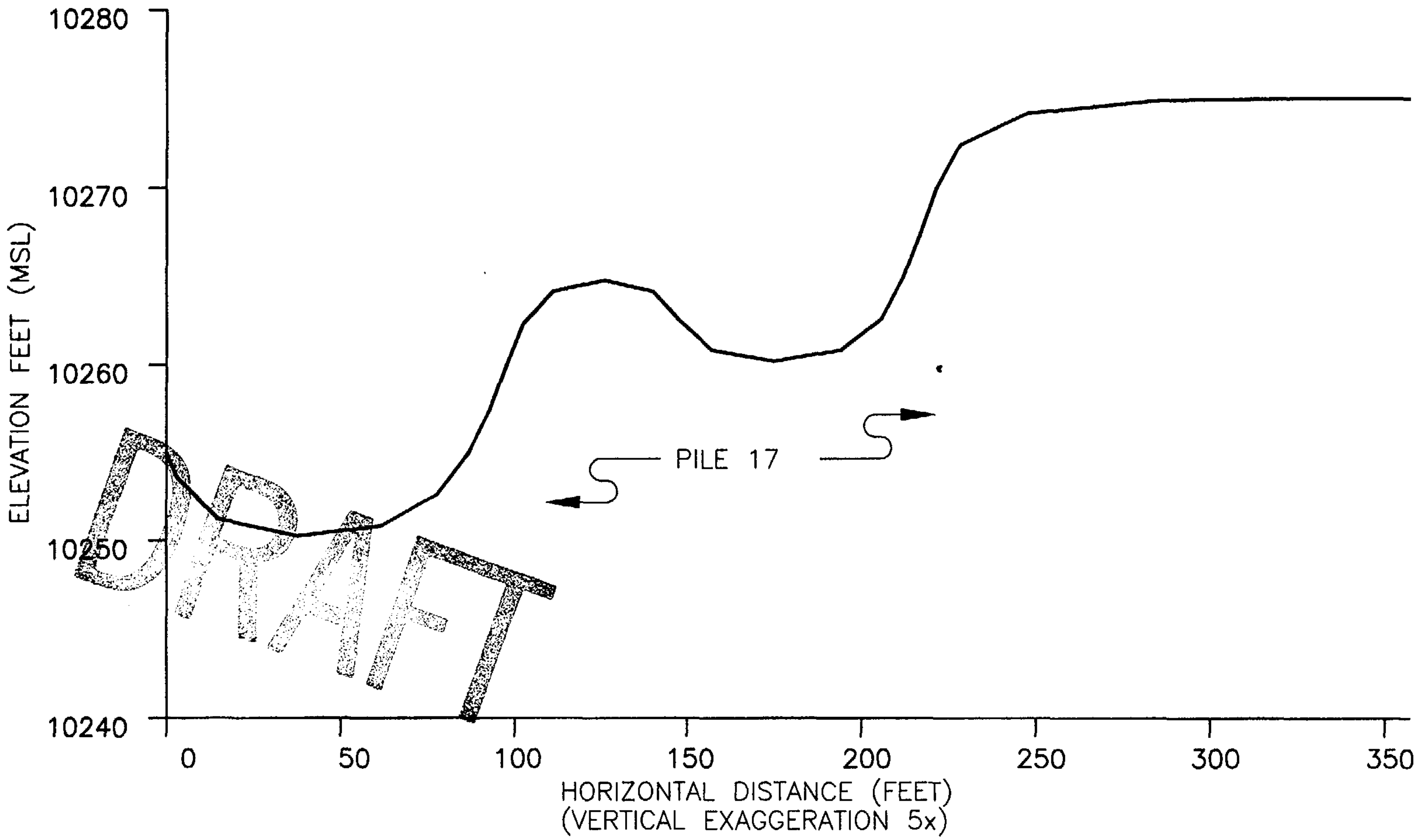
CLIENT/PROJECT									
ASARCO MINE WASTE EE/CA			Golder Associates, Denver, Colorado			TITLE: PILE 12 CROSS SECTION			
DRAWN RB	CHECKED BES	REVIEWED CAD	DATE JMJ	SCALE AS SHOWN	FILE NO. 2819A032	JOB NO. 943-2819	DWG NO./REV.NO.	FIGURE 7-1	



CLIENT/PROJECT **ASARCO** **MINE WASTE EE/CA**	Golder Associates **Denver, Colorado**	TITLE **PILE 16** **CROSS SECTION**

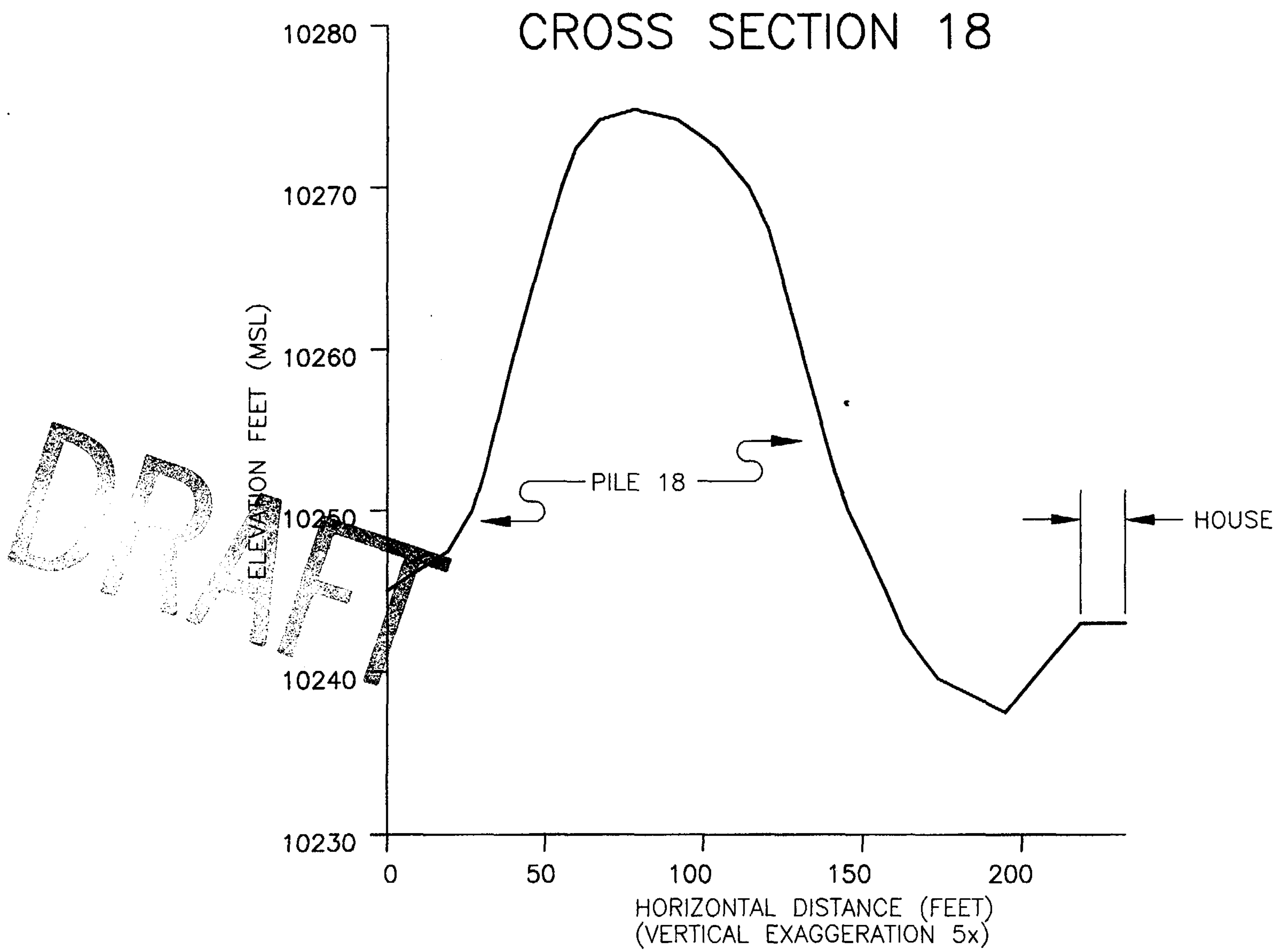
DRAWN	CHECKED	REVIEWED	DATE	SCALE	FILE NO.	JOB NO.	DWG NO./REV.NO.	FIGURE
RB	BES	CAD	JMJ	AS SHOWN	2819A040	943-2819		7-2

CROSS SECTION 17



CLIENT/PROJECT				TITLE
ASARCO MINE WASTE EE/CA		Golder Associates	Denver, Colorado	**PILE 17 CROSS SECTION**

DRAWN	CHECKED	REVIEWED	DATE	SCALE	FILE NO.	JOB NO.	DWG NO./REV.NO.	FIGURE
RB	BES	CAD	JMJ	AS SHOWN	2819A033	943-2819		7-3



CLIENT/PROJECT			Golder Associates	Denver, Colorado		TITLE		
ASARCO MINE WASTE EE/CA						**PILE 18 CROSS SECTION**		
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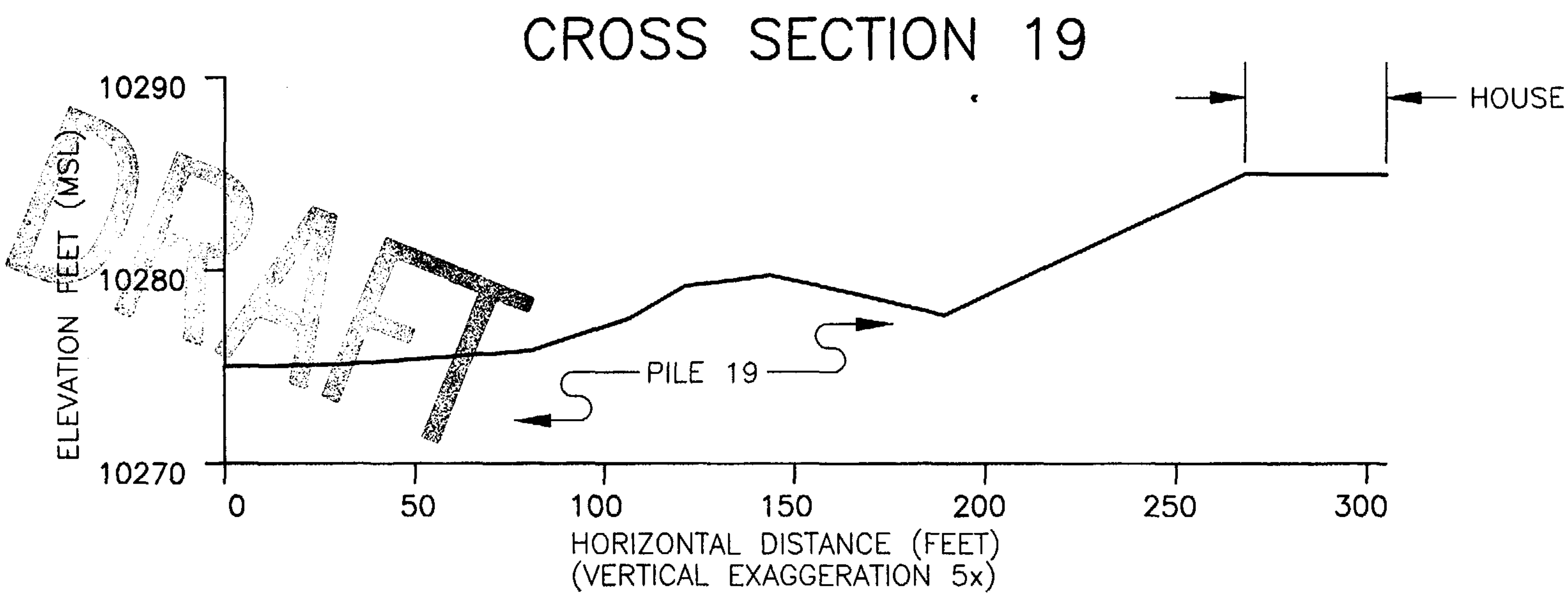

CLIENT/PROJECT ASARCO MINE WASTE EE/CA			Golder Associates Denver, Colorado			TITLE PILE 19 CROSS SECTION		
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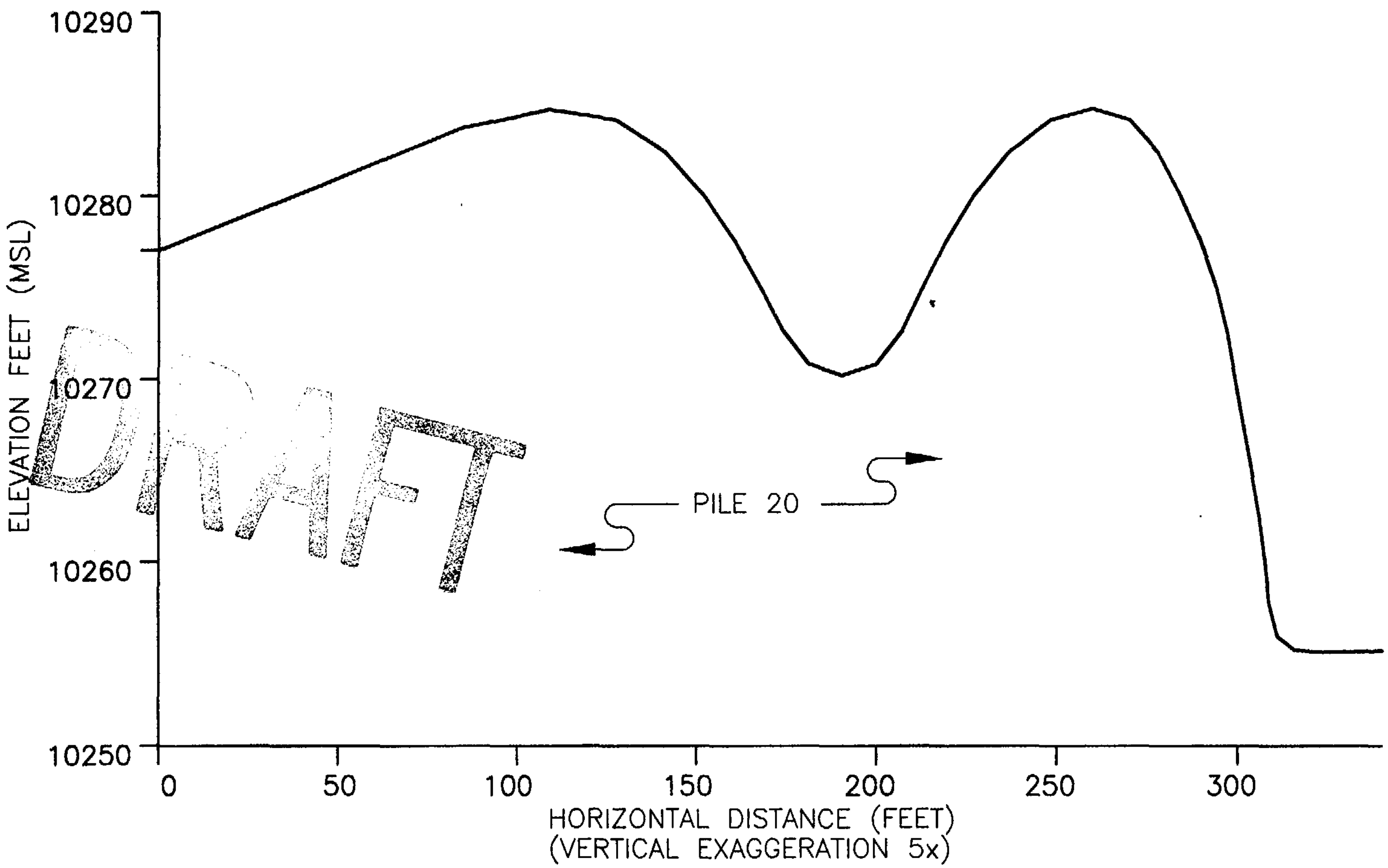
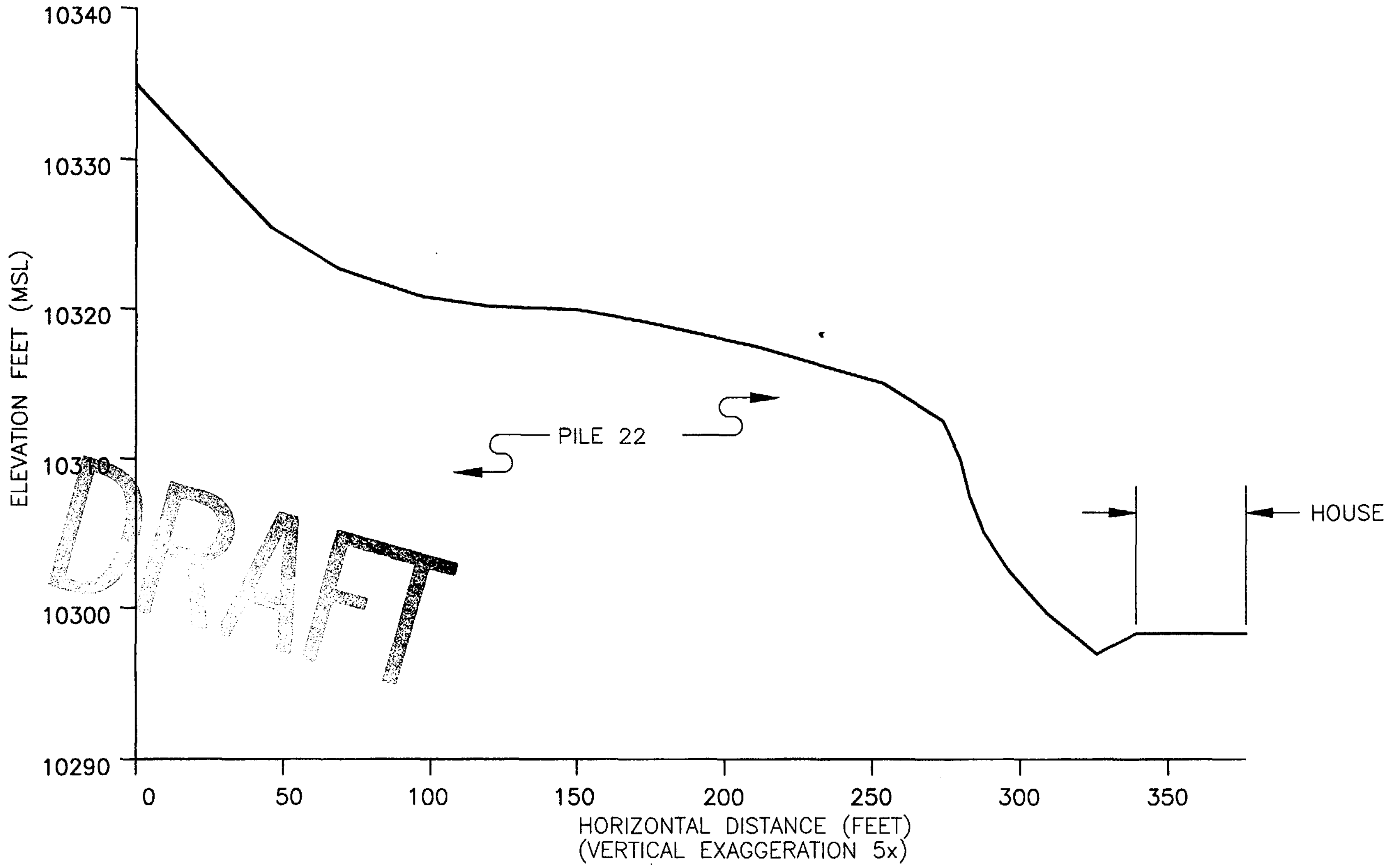
CROSS SECTION 20



CLIENT/PROJECT **ASARCO** **MINE WASTE EE/CA**	Golder Associates Denver, Colorado	TITLE **PILE 20** **CROSS SECTION**

DRAWN	CHECKED	REVIEWED	DATE	SCALE	FILE NO.	JOB NO.	DWG NO./REV.NO.	FIGURE
RB	BES	CAD	JMJ	AS SHOWN	2819A038	943-2819		7-6

CROSS SECTION 22



CLIENT/PROJECT **ASARCO MINE WASTE EE/CA**	Golder Associates Denver, Colorado	TITLE **PILE 22 CROSS SECTION**

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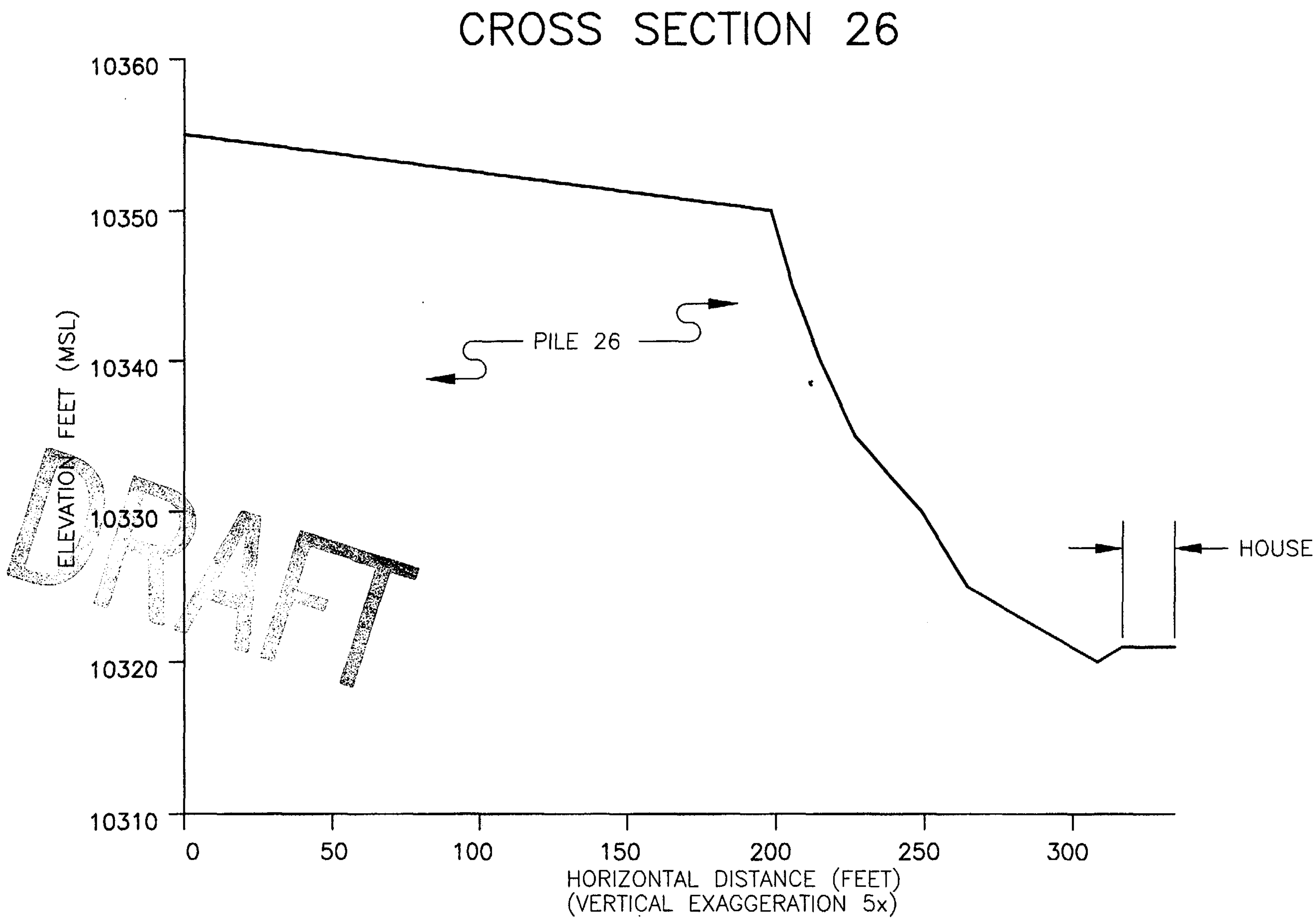
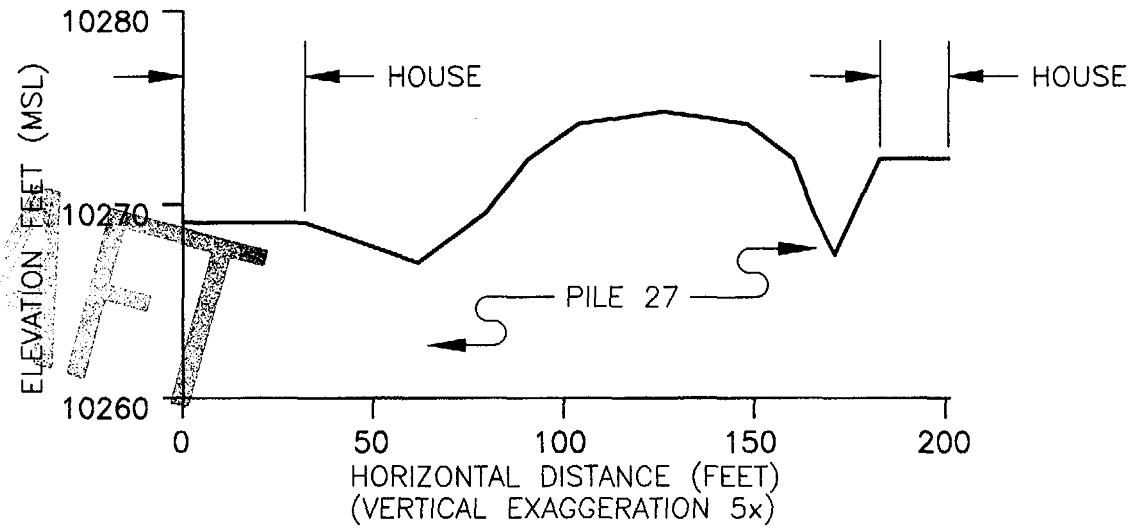


CLIENT/PROJECT						TITLE		
ASARCO MINE WASTE EE/CA			Golder Associates Denver, Colorado			PILE 26 CROSS SECTION		
DRAWN RB	CHECKED BES	REVIEWED CAD	DATE JMJ	SCALE AS SHOWN	FILE NO. 2819A034	JOB NO. 943-2819	DWG NO./REV.NO.	FIGURE 7-8

CROSS SECTION 27



CLIENT/PROJECT						TITLE		
ASARCO MINE WASTE EE/CA			Golder Associates, Denver, Colorado			**PILE 27 CROSS SECTION**		
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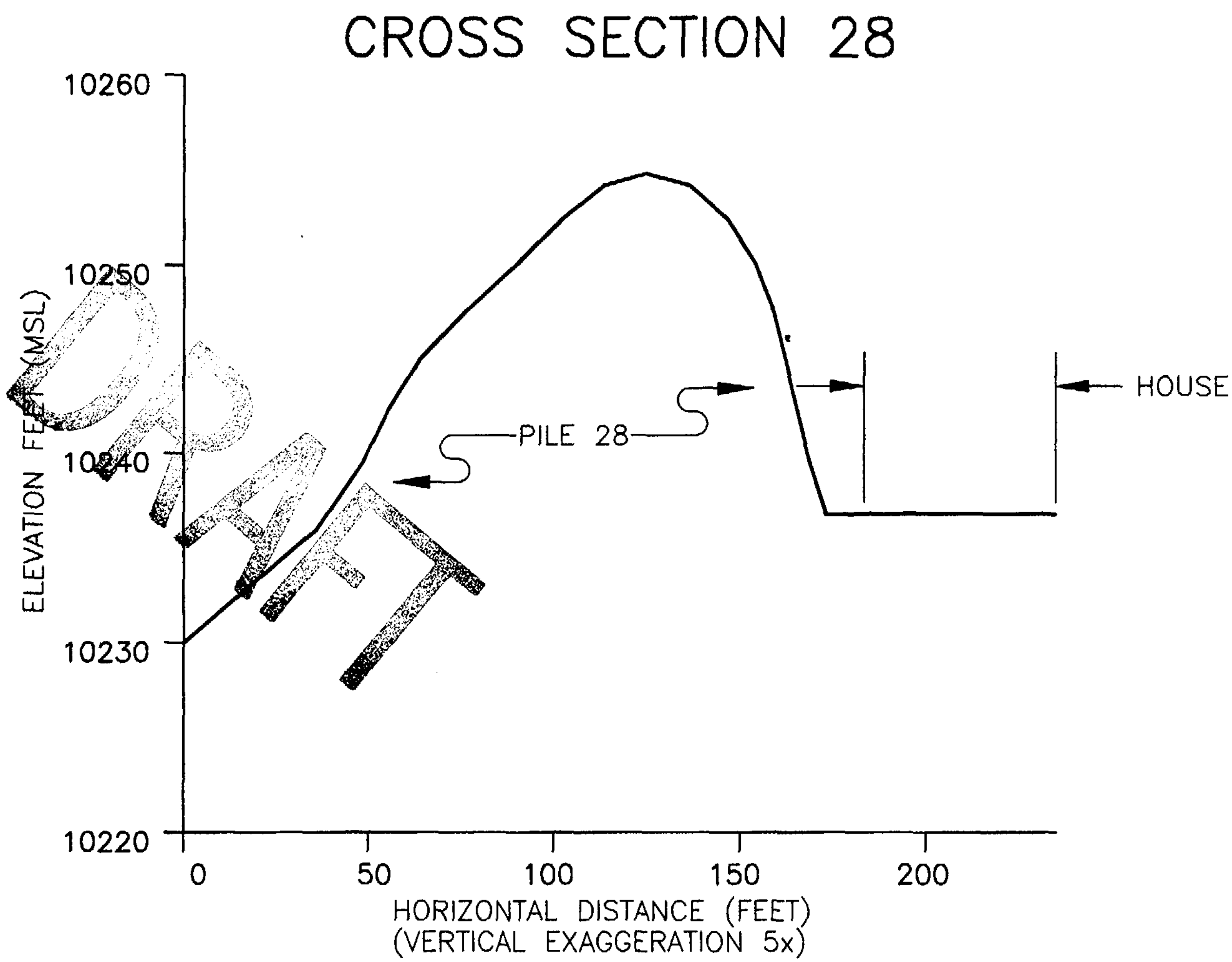

CLIENT/PROJECT			Golder Associates, Denver, Colorado			TITLE		
ASARCO MINE WASTE EE/CA						PILE 28 CROSS SECTION		
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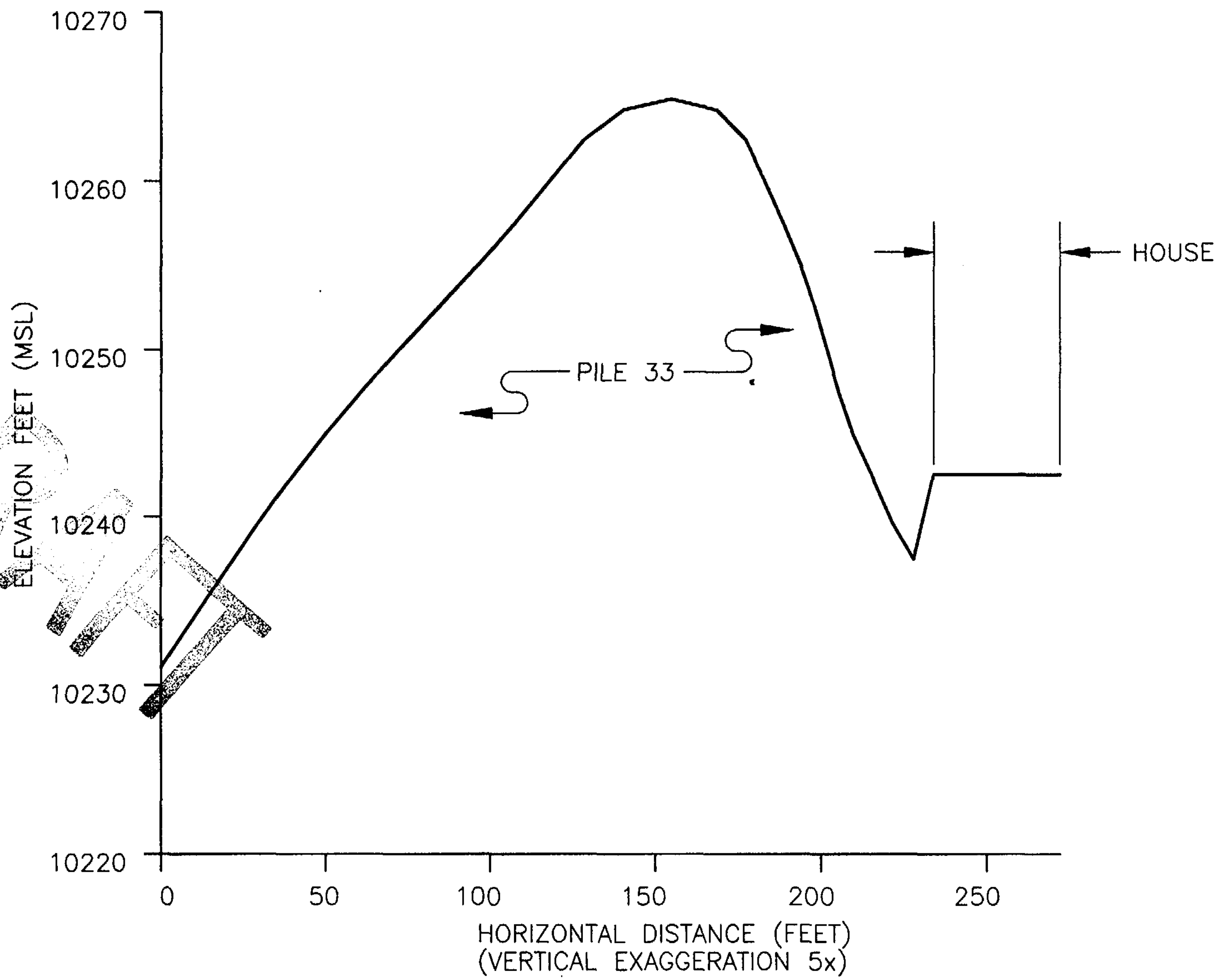
CROSS SECTION 33



CLIENT/PROJECT					TITLE		
ASARCO MINE WASTE EE/CA			Golder Associates Denver, Colorado		PILE 33 CROSS SECTION		
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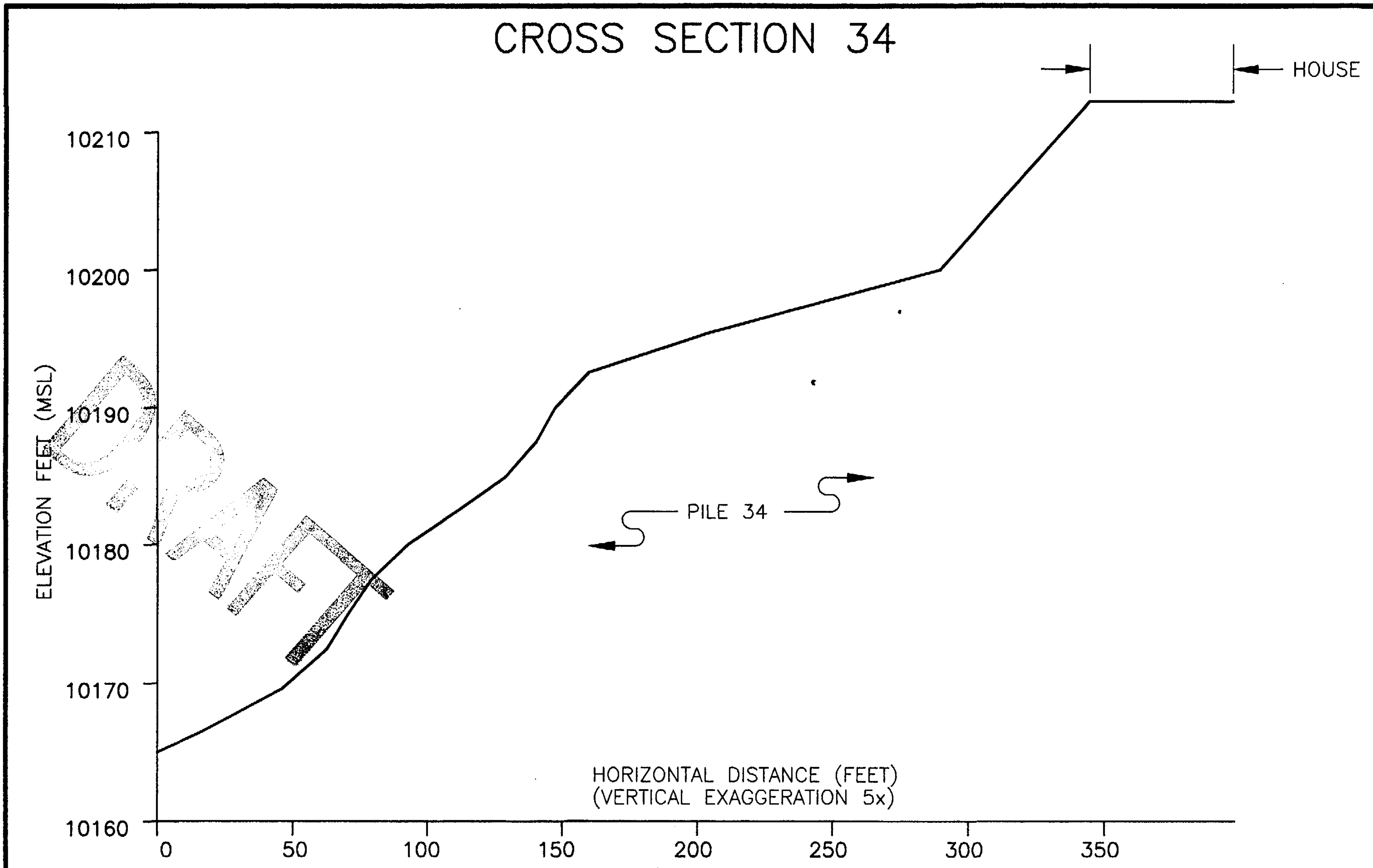

CLIENT/PROJECT				TITLE		
ASARCO MINE WASTE EE/CA			Golder Associates, Denver, Colorado	PILE 34 CROSS SECTION		
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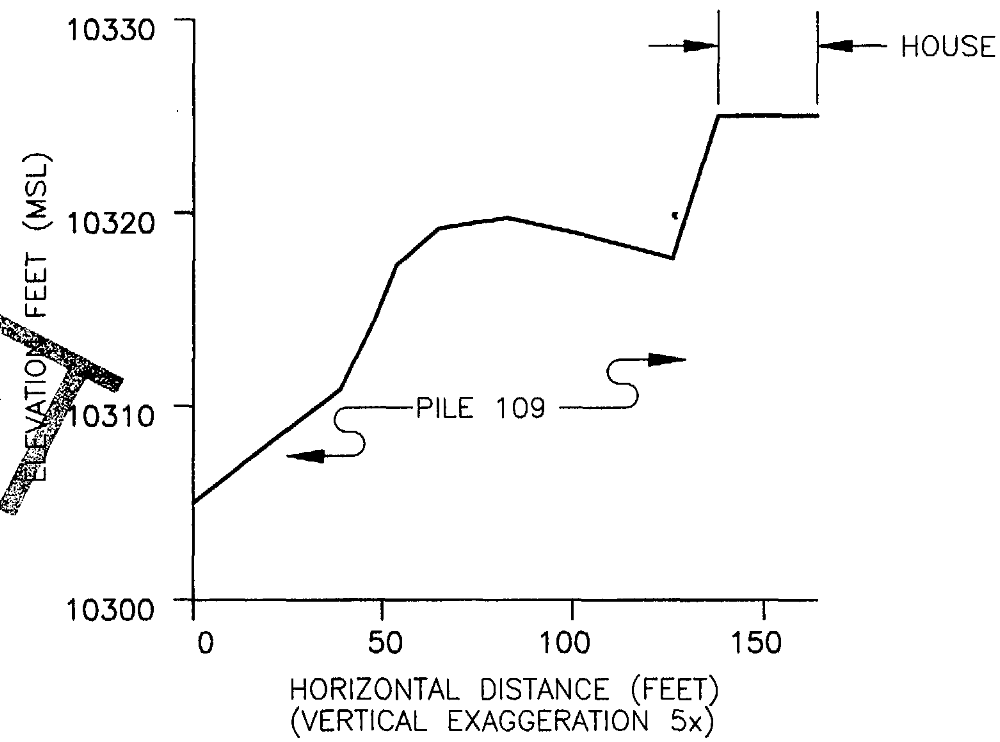
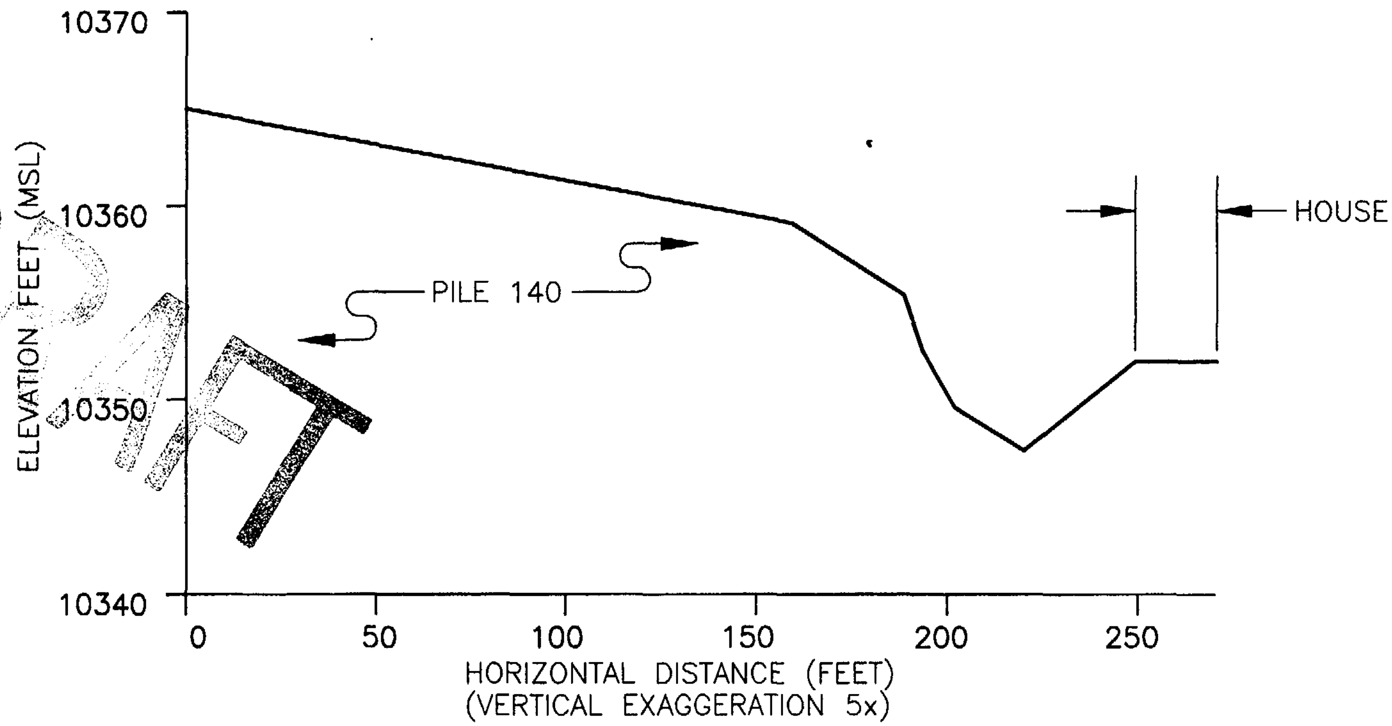
CROSS SECTION 109



CLIENT/PROJECT			Golder Associates Denver, Colorado			TITLE		
ASARCO MINE WASTE EE/CA						PILE 109 CROSS SECTION		
DRAWN RB	CHECKED BES	REVIEWED CAD	DATE JMJ	SCALE AS SHOWN	FILE NO. 2819A027	JOB NO. 943-2819	DWG NO./REV.NO.	FIGURE 7-13

CROSS SECTION 140



CLIENT/PROJECT						TITLE		
ASARCO MINE WASTE EE/CA			Golder Associates, Denver, Colorado			PILE 140 CROSS SECTION		
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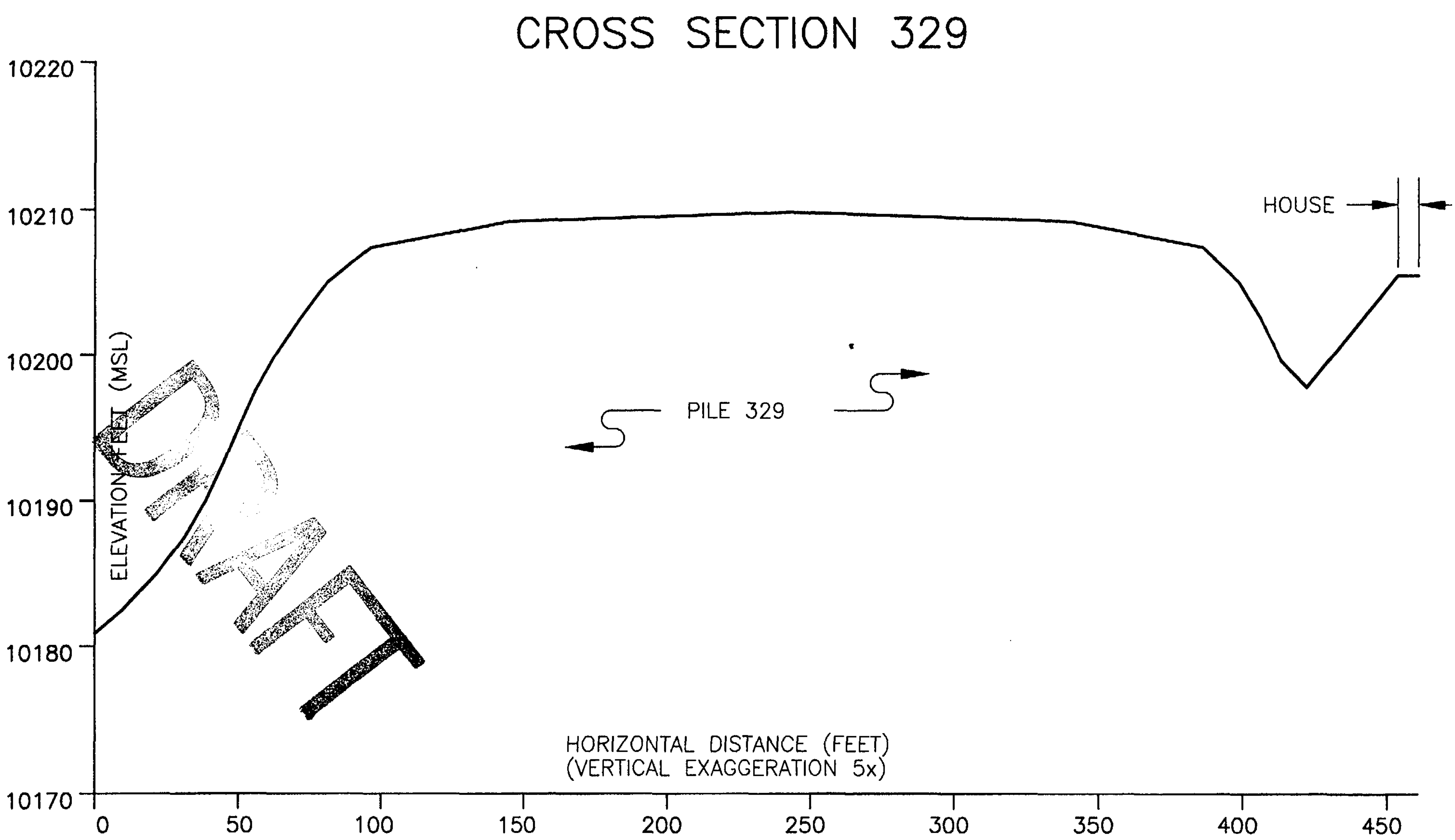

CLIENT/PROJECT			Golder Associates Denver, Colorado			TITLE		
ASARCO MINE WASTE EE/CA						PILE 329 CROSS SECTION		
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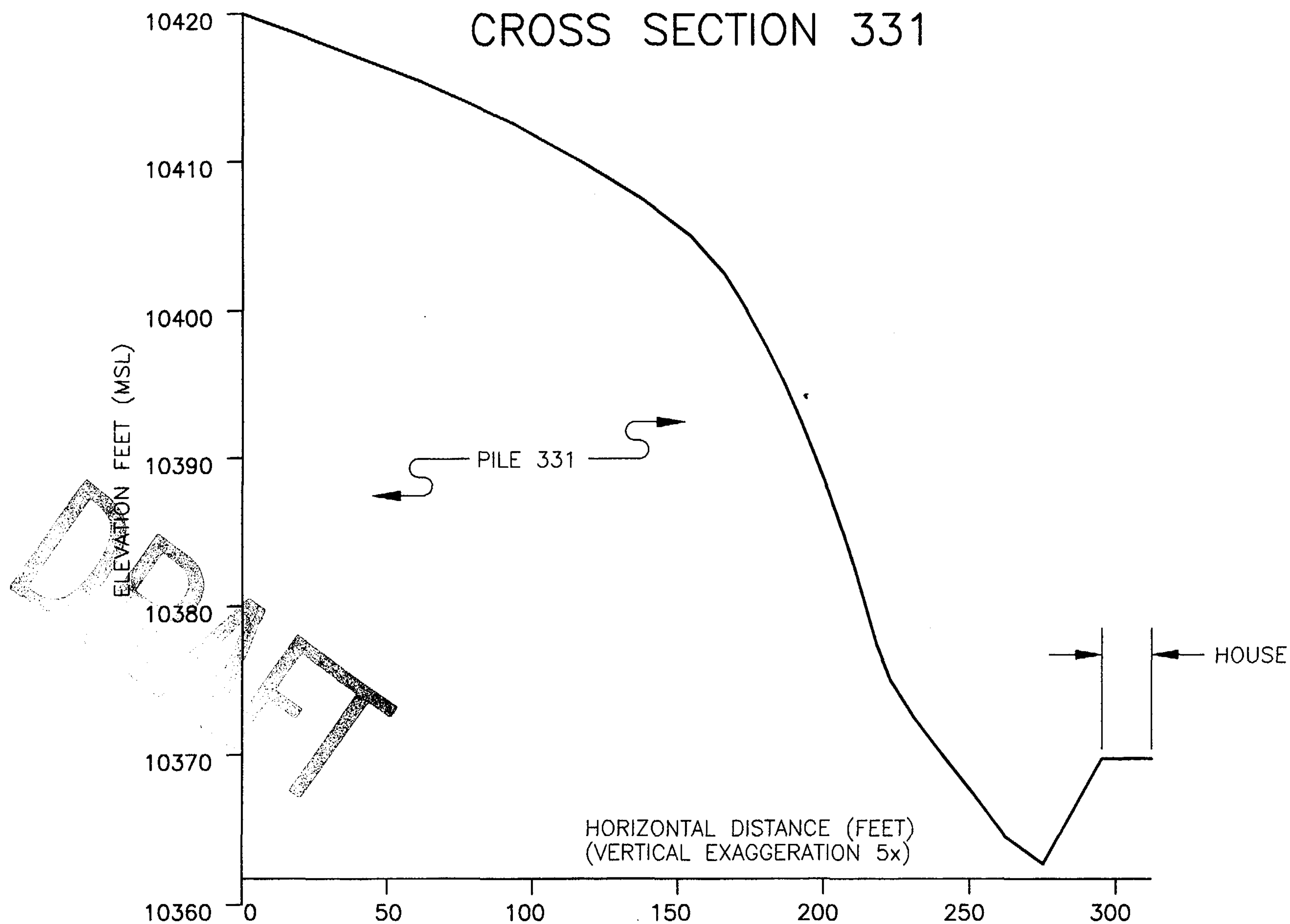
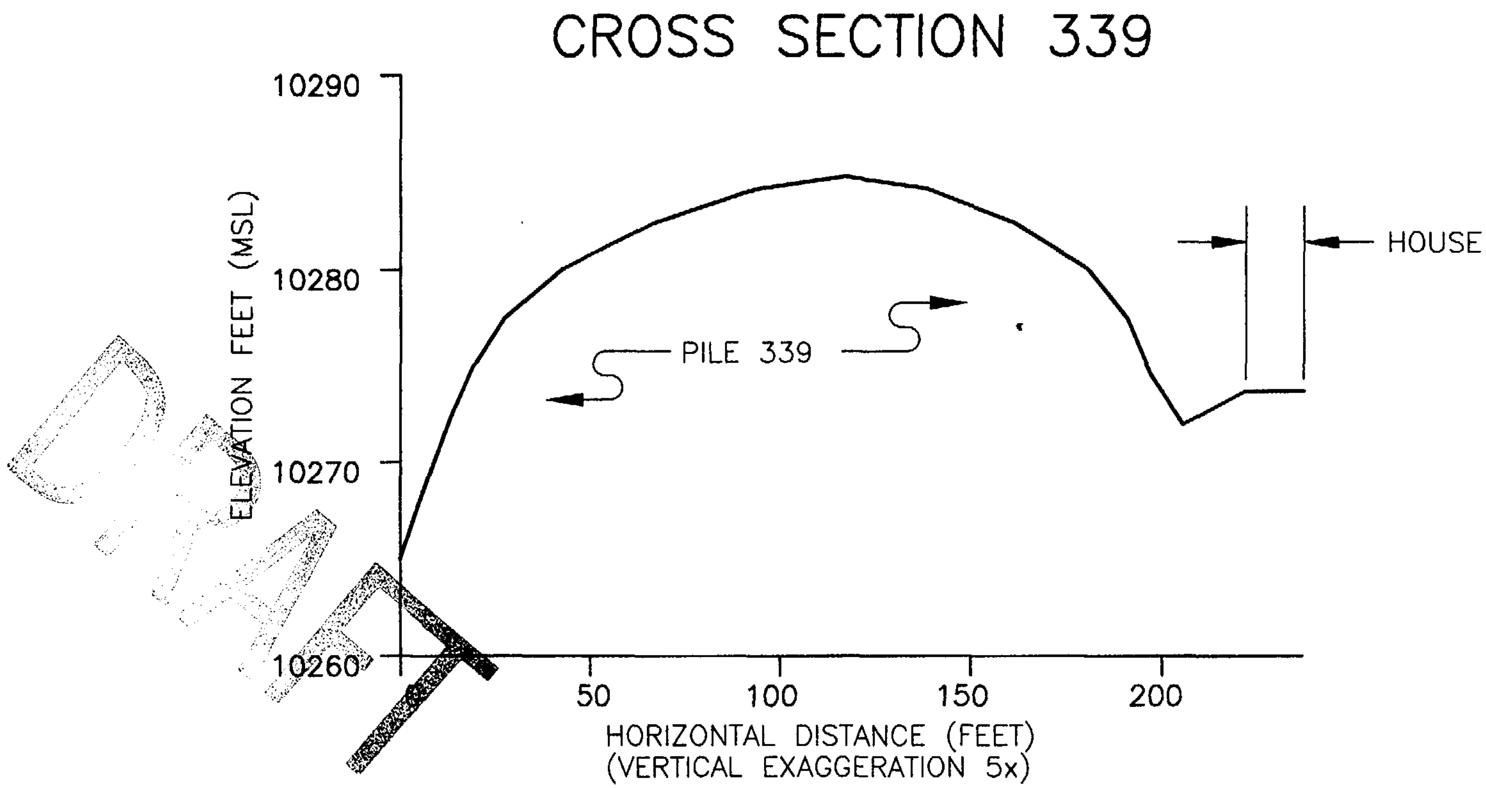


CLIENT/PROJECT		TITLE
ASARCO MINE WASTE EE/CA	Golder Associates Denver, Colorado	**PILE 331 CROSS SECTION**

DRAWN	CHECKED	REVIEWED	DATE	SCALE	FILE NO.	JOB NO.	DWG NO./REV.NO.	FIGURE
RB	BES	CAD	JMJ	AS SHOWN	2819A036	943-2819		7-16



CLIENT/PROJECT			Golder Associates Denver, Colorado			TITLE		
ASARCO MINE WASTE EE/CA						PILE 339 CROSS SECTION		
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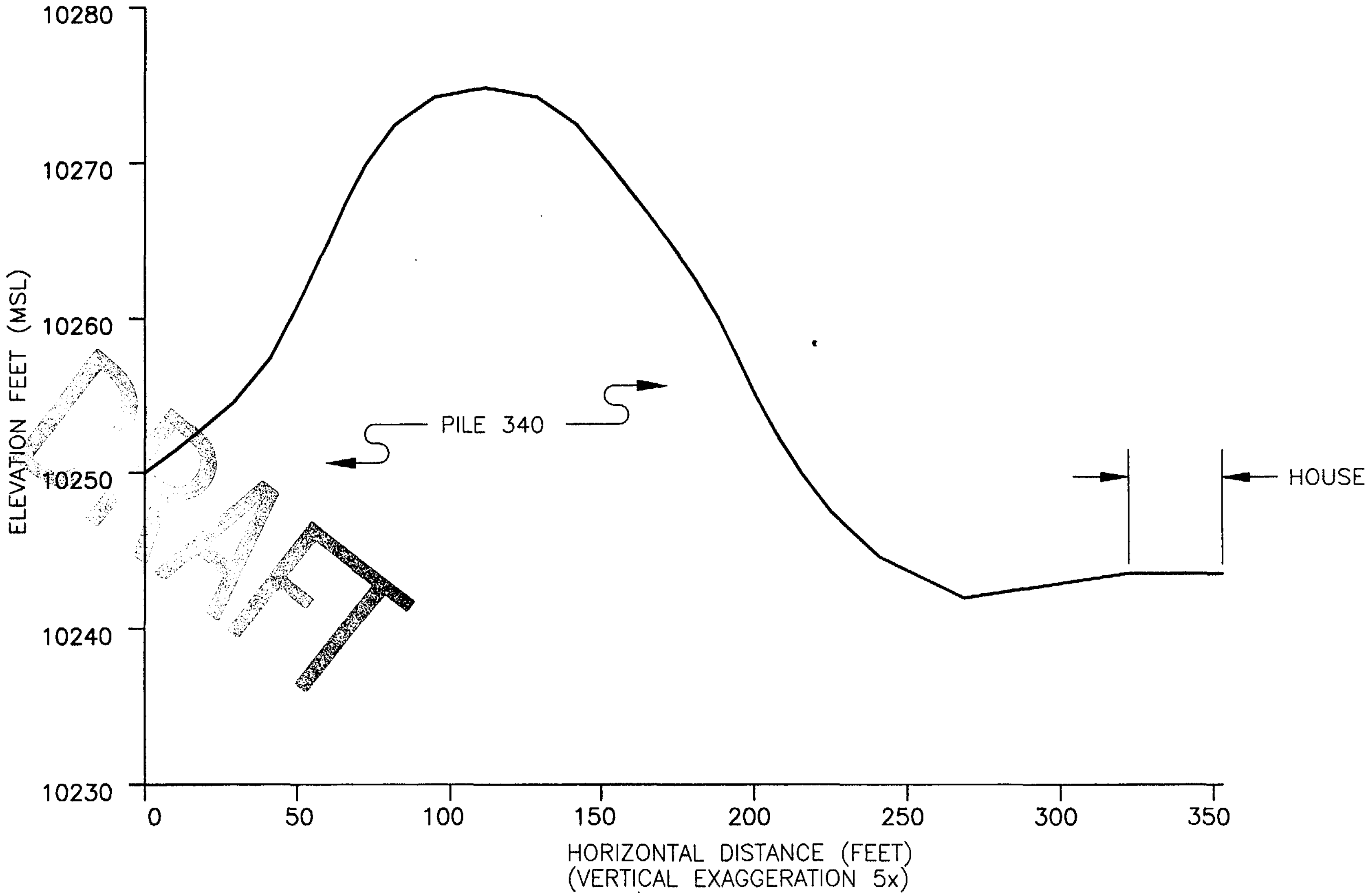
CROSS SECTION 340



CLIENT/PROJECT

ASARCO
MINE WASTE EE/CA

Golder Associates Denver, Colorado

TITLE

PILE 340
CROSS SECTION

DRAWN	CHECKED	REVIEWED	DATE	SCALE	FILE NO.	JOB NO.	DWG NO./REV.NO.	FIGURE
RB	BES	CAD	JMJ	AS SHOWN	2819A029	943-2819		7-18

8.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES (RANKING)

The four alternatives have been compared according to the following criteria:

- Effectiveness;
  - Protectiveness;
  - Ability to Achieve Removal Objectives;
- Implementability;
  - Technical Feasibility;
  - Availability;
  - Administrative Feasibility;
- Cost.

The comparisons were performed using a ranking system. The results of the comparison are presented on Table 8.1.

8.1 Alternative Ranking

A ranking system was developed to facilitate comparisons of the various retained removal/ remediation alternatives. The ranking system consisted of assigning a numerical value between 1 and 4 to each alternative in 3 major categories. The categories selected reflect the general criteria outlined above. The rankings for the general criteria were developed as follows:

Effectiveness

A ranking of 4 indicated long-term environmental impacts would be negligible and implementation of the technology would not impact the environment. A ranking of 1 indicated no improvement over current site conditions.

Implementability

A ranking of 4 indicated easily implementable technology with long effective life and excellent reliability. This ranking indicates that the technology is acceptable to the public and could be implemented safely. A ranking of 1 indicated difficult implementation of the technology with out long-term reliability. This technology would be unacceptable to the public and may not be safe to implement.

Cost

A ranking of 4 indicated low overall project cost and a ranking of 1 indicated high overall project cost.

8.2 Comparison of Alternatives Rankings

Only Alternatives 3 and 4 met the project objectives. Alternatives 4 and 3 ranked as first and second respectively. Alternative 4 provides for better overall environmental protection since the source of contamination would be completely removed. Alternative 3 would be less expensive to implement than Alternative 4 and would meet the project objectives. Alternative 4 would rank even higher if the reuse of the mine waste material as a construction material were considered and if the mine waste material was hauled directly to the reuse location and used concurrently. Alternative 3 appears to be a viable option compared to Alternative 4. Alternatives 1 and 2 do not meet project specifications and are not considered to be viable options.

Alternative 4 is not as attractive if the mine waste material is stockpiled without identified and approved reuse areas being previously designated. If reuse locations are not identified prior to initiation of the remedial activities, Alternative 3 may be selected for implementation or a combination of Alternatives 3 and 4 may be selected if only limited end uses are identified for the mine waste material.

TABLE 8.1
COMPARISON OF ALTERNATIVES

General Criteria	Specific Criteria		Comparison of Alternatives: Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Containment	Alternative 4 Material Reuse
Effectiveness	Protectiveness	Protective of Public Health and Community	1	2	3	4
		Protective of Workers During Implementation	4	3	2	2
		Protective of the Environment	1	2	3	4
		Complies with ARAR's	1	2	4	4
	Ability to Achieve Removal Objectives	Level of Treatment/Containment Expected	1	2	3	4
		No Residual Effect Concerns	1	2	3	4
		Will Maintain Control until Long-term Solution Implemented	1	2	3	4
Implementability	Technical Feasibility	Construction and Operational Considerations	4	3	3	3
		Demonstrated Performance/Useful Life	1	2	3	4
		Adaptable to Environmental Conditions	4	3	2	3
		Contributes to Remedial Performance	1	2	3	4
		Can be Implemented in 1 year	4	4	2	2
	Availability	Equipment	4	3	3	3
		Personnel and Services	4	3	3	3
		Outside Laboratory Testing Capacity	NA	NA	NA	NA
		Post-Removal Site Control	4	3	2	3
	Administrative Feasibility	Permits Required	4	3	2	2
		Easements or Right-of-Ways Required	4	3	2	2
		Impact on Adjoining Property	1	2	2	2
		Ability to Impose Institutional Control	1	2	3	4
		Likelihood of Obtaining Exemption from Statutory Limits (if needed)	1	1	3	3
Cost	Capital Cost		4	3	2	1
	PRSC Cost		2	3	2	3
	Present Worth Cost		4	3	2	2
TOTAL			57	58	60	70
RANKING			4	3	2	1

PRSC - Post-Removal Site Control

9.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

The removal/remediation scope consists of meeting the objectives outlined above by effectively containing the mine waste piles or removing them from the populated area to a location for storage or long-term disposal. All piles with surface concentrations of total lead in excess of 2000 ppm, will be capped or removed to meet the project objectives. Both Alternatives 3 and 4 would be acceptable options for the removal/remediation action. Alternative 4, the option to consolidate waste piles in a stockpile area for re-use, would provide the best overall environmental protection. This alternative is therefore recommended for implementation provided that materials can be re-used for other construction purposes. The implementation of Alternative 3, the option of capping the waste piles, would also be acceptable but this alternative does not remove the source of contamination. Alternative 4 includes beneficial end uses of the mine waste material and is considered the best option.

Alternative 4 could be improved if the mine waste material was hauled directly to the end use location. A potential end use would be to utilize the mine waste material for capping/stabilization of other contaminated areas on-site. Stockpiling of the mine waste at OU1 would result in double handling of the material and would yield increased costs. If the mine waste is transported directly to the end use area and concurrently placed as fill, the handling and material costs for that portion of the closure capping would be completely eliminated. However, direct placement of mine waste would cause a delay in mine waste remediation until the concurrent end use is prepared for construction. This proposed modification to Alternative 4 would result in a highly efficient and economical remediation action but would extend the schedule for remediation.

Figure 9-1 presents a summary of the proposed removal action for mine waste piles. Prior to initiation of the removal action, category 1 (mineral group 1) mine waste piles must be evaluated. Pile 35, sampled for preparation of this EE/CA, was used to represent these piles. Pile 35 was found to contain surface total lead levels in excess of 2000 ppm. The remaining category 1 piles (piles 11, 107, 332, and 334) will be sampled and tested in accordance with the work plan.

EPA REGION VIII
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID # 321328

IMAGERY COVER SHEET
UNSCANNABLE ITEM(S)

Contact the Superfund Records Center to view this (these) document(s).
(303-312-6473)

SITE NAME: CALIFORNIA GULCH

REPORT OR DOCUMENT TITLE: ASARCO
MINE WASTE EE/CA

DATE OF DOCUMENT: DEC 1995

DESCRIPTION: FIGURE 9-1
RECOMMENDED REMOVAL ACTION PLAN

10.0 SCHEDULE OF WORK

Alternative 4 could be completed within approximately 8 months assuming 40 hour work weeks. The project duration could be significantly reduced if longer work days and weeks were implemented. The 40 hour work week was assumed since it would minimize construction impact on the public. The project duration could also be reduced if additional equipment were mobilized to perform the removal. The additional equipment would increase the traffic on local roads. The assumed equipment spread consisted of one 966 CAT loader, one D-6 CAT dozer and five 10-wheel end dump haul trucks. If two spreads were used, the project duration would be reduced to 4 months. However, a total of 10 haul trucks would be continuously operating on the local roadways during construction hours.

Alternative 3 could be completed within 5 months assuming 40 hour weeks. The project duration could also be reduced by implementing similar methods as discussed for Alternative 4.

The mine waste removal schedule has been planned to be conducted during the summer of 1995. This schedule would be achievable for either alternative selected. However, if Alternative 4 is selected and the proposed modification of direct haul to the end use is preferred, the project could not occur during the summer of the 1996 since the end use has not been designed or approved. This modification to Alternative 4 is highly recommended and therefore, a delay in initiation of the removal/remediation action is recommended until the end use application is ready.

11.0 REFERENCES

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APPENDIX A

LABORATORY TEST DATA

APPENDIX A.1

DATA VALIDATION

ASARCO DATA VALIDATION
MINE WASTE SAMPLE CHARACTERIZATION
ACZ LABORATORY - SAMPLE DELIVERY GROUP REPORT AST215

SAMPLES COLLECTED:

G-013-C-01C-941025 G-108-C-01C-941025
G-109-C-01C-941025 G-207-C-01C-941025

SAMPLE DESCRIPTION:

The samples listed above are mine waste samples from ASARCO's Leadville unit.

ANALYSES REQUESTED:

The samples listed above were submitted for analysis of the following parameters:

Sulfur Forms - Pyritic, Organic, Sulfate, and Total Sulfur
Neutralization Potential as $CaCO_3$
Net Acid Neutralization Potential
Toxicity Characteristic Leaching Procedure (TCLP) analysis of Arsenic, Cadmium, Lead, and Zinc

CONTRACT LABORATORY PERFORMING ANALYSES:

ACZ Laboratory - Steamboat Springs, Colorado

SAMPLE COLLECTION AND ANALYSIS DATES - HOLDING TIME EVALUATION:

All of the samples listed above were collected on October 25, 1994. The required analyses were performed on the following dates:

Requested Analyses	Analysis Date
Sulfur Forms	01/20/95
Neutralization Potential	01/20/95
Net Acid Neutralization Potential	Calculated
TCLP	Extract 02/01/95, Analysis 02/14/95

The holding times for the TCLP metal analyses are six months. The analyses were performed within required holding times. Holding times are not specified for the sulfur forms and neutralization potential analyses.

ANALYSES REQUESTED COMPARED TO ANALYSES PERFORMED:

All analyses requested on the chain-of-custody forms were performed as requested for the samples reported in sample delivery group AST215. Chain-of-custody forms provided do not request the analyses for neutralization potential or sulfur forms. These analyses were requested by ASARCO by telephone.

SAMPLE CONDITION AND CHAIN-OF-CUSTODY CONSIDERATIONS:

ACZ laboratory recorded the following at the time of sample receipt: temperature, sample conditions, and custody seal integrity. All samples were received at a temperature of 10 degrees celsius. All chain-of-custody forms were correctly signed and dated, and all sample coolers had custody seals intact at the time of sample receipt. All sample integrity requirements are considered to be satisfied.

INTERNAL DATA CONSISTENCY:

No transcription errors are apparent in the final laboratory reports, with the following exceptions. The sample IDs listed on the cover page of the analytical report, and on the associated Form I's do not match the IDs listed on the chain-of-custody form. This appears to be a problem with the fact that the sample IDs listed on the chain-of-custody are too long to fit on the Form I's. This should be noted in any reference to these samples, but no action is taken.

INITIAL AND CONTINUING CALIBRATION RESULTS:

Neutralization Potential. Initial and continuing calibration results were provided for the neutralization potential analyses. Recoveries ranged from 103.6 to 106.1 percent, and were acceptable.

Sulfur Forms. Initial calibration results were provided for total sulfur. The calibration standard recovery was acceptable at 99.7 percent.

TCLP Metals. Initial and continuing calibration results were provided for the arsenic, cadmium, lead, and zinc analyses. These analyses were performed by ICP methodology after TCLP extraction. Recoveries ranged from 102 to 104 percent, and were acceptable. ICP CRDL check standard analyses were also performed, with recoveries ranging from 102 to 111 percent. No action was taken based on the CRDL check standard recoveries, as these are not applicable to analyses of TCLP extracts.

LABORATORY CONTROL SAMPLE ANALYSES:

Neutralization Potential. No laboratory control sample results were provided.

Sulfur Forms. One laboratory control sample analysis was performed. A true value for sulfur was not provided, but a recovery of 99 percent is indicated.

TCLP Metals. No laboratory control sample results were provided.

LABORATORY BLANK ANALYSES:

Neutralization Potential. Initial and continuing calibration blank sample analyses were performed. Neutralization potential was reported as non-detect in the blank analyses.

Sulfur Forms. Results from one preparation blank were provided for total sulfur and for organic and pyritic sulfur. No sulfur forms were detected in the preparation blank analyses.

TCLP Metals. Results from initial, continuing, and preparation blank analyses were provided for the metals analyzed. No metals were detected in any of the blanks at concentrations above the reporting limits provided, with one exception. Zinc was reported in the preparation blank at 15 ug/L. This concentration is above the IDL and below the CRDL. All zinc results reported for the associated samples are greater than the CRDL of 20 ug/L, and no action is taken.

ICP INTERFERENCE CHECK SAMPLES RESULTS:

ICP interference check sample results were provided for the TCLP metals analyses. Metals recoveries in the final solution ranged from 90 to 97.4 percent, and were within prescribed limits.

MATRIX SPIKE ANALYSIS RESULTS:

Neutralization Potential. Matrix spike analyses were not performed for the neutralization potential analyses.

Sulfur Forms. Matrix spike analyses were not performed for the sulfur forms analyses.

TCLP Metals. A matrix spike analysis was performed on mine waste sample G-207-C-01C-941025. All matrix spike recoveries were acceptable, ranging from 102 to 107 percent.

LABORATORY DUPLICATE ANALYSES:

Neutralization Potential. One duplicate analysis was performed for neutralization potential. Precision between the primary and duplicate analysis results was acceptable.

Sulfur Forms. One duplicate analysis was performed for the sulfur forms on waste pile sample G-207-C-01C-941025. Precision for the organic and pyritic forms was acceptable with an RPD of 0 %. The RPD for the total sulfur analysis is 50 %. However, the results for the two samples are within two total sulfur detection limit increments of each other, and no action is taken.

TCLP Metals. A laboratory duplicate analysis was performed on sample G-207-C-01C-941025. Arsenic, cadmium, and lead were each reported below detection limits in the primary and duplicate analyses. Zinc was detected at 30.7 ug/L in the primary analysis and at 22.2 ug/L in the duplicate analysis. The RPD is calculated at 32.1 percent. However, the data are not qualified because the control limit for the duplicate precision is 20 ug/L, and the two results agree within this control limit.

FIELD REPLICATE ANALYSES:

No field replicate samples were submitted with the samples associated with this sample delivery group.

SULFUR ANALYSIS PROBLEMS AND CONSIDERATIONS:

See the validation report for AST214 for a complete discussion of the sulfur forms analyses and data qualifications.

NEUTRALIZATION POTENTIAL ANALYSIS RESULTS:

The neutralization potential results are reported as percent $CaCO_3$. The net acid neutralization potential (NANP) is calculated as follows:

(neutralization potential x 10) - (total Sulfur x 31.25)

The results of the NANP analyses range from 163 to 411 tons $CaCO_3$/KT for the four samples submitted. NANP results greater than zero indicate that the sample has a neutralization potential that is capable of mitigating any acid formation due to the sulfur present in the sample.

VALIDATION SUMMARY

The analytical results provided by ACZ Laboratory (two reports for Sample Delivery Group AST215) for the mine waste samples listed on page one of this letter have been validated according to U.S. Environmental Protection Agency and Geraghty & Miller data validation criteria, as applicable. The validation results for the samples reviewed are presented in the table below.

Sample / Constituents	Validation Level	Reason(s)
TCLP metals - arsenic, cadmium, lead, and zinc (all samples)	Quantitative	All QC requirements are satisfied
Neutralization potential (all samples)	Quantitative	All QC requirements are satisfied
Total sulfur and sulfate sulfur (all samples)	Quantitative	All QC requirements are satisfied
Pyritic Sulfur - includes organic sulfur (all samples)	J/Estimated	Pyritic sulfur result includes organic sulfur. Matrix interferences precluded proper quantitation of the pyritic sulfur form.

Prepared By: [signature]
Project Scientist

3/16/95
Date

ASARCO DATA VALIDATION
MINE WASTE SAMPLE CHARACTERIZATION
ACZ LABORATORY - SAMPLE DELIVERY GROUP REPORT AST214

SAMPLES COLLECTED:

W-014C-01-940829	W-015C-01-940829	W-016C-01-940830
W-017C-01-940829	W-018C-01-940830	W-019C-01-940829
W-022C-01-940831	W-024C-01-940901	W-026C-01-940831
W-027C-01-940912	W-028C-01-940912	W-032C-01-940830
W-033C-01-940913	W-035C-01-940912	W-110C-01-940901
W-111C-01-940901	W-140C-01-940912	W-340C-01-940912

SAMPLE DESCRIPTION:

The samples listed above are mine waste samples from ASARCO's Leadville unit.

ANALYSES REQUESTED:

The samples listed above were submitted for analysis of the following parameters:

- Sulfur Forms - Pyritic, Organic, Sulfate, and Total Sulfur
- Neutralization Potential as $CaCO_3$
- Net Acid Neutralization Potential
- Toxicity Characteristic Leaching Procedure (TCLP) analysis of Arsenic, Cadmium, Lead, and Zinc

CONTRACT LABORATORY PERFORMING ANALYSES:

ACZ Laboratory - Steamboat Springs, Colorado

SAMPLE COLLECTION AND ANALYSIS DATES - HOLDING TIME EVALUATION:

All of the samples listed above were collected between August 29, 1994 and September 13, 1994. The required analyses were performed on the following dates:

Requested Analyses	Analysis Date
Sulfur Forms	01/03/95
Neutralization Potential	12/29/94
Net Acid Neutralization Potential	Calculated
TCLP	Extract 01/03/95, Analysis 01/19/95

The holding times for the TCLP metal analyses are six months. The analyses were performed within required holding times. Holding times are not specified for the sulfur forms and neutralization potential analyses.

ANALYSES REQUESTED COMPARED TO ANALYSES PERFORMED:

All analyses requested on the chain-of-custody forms were performed as requested for the samples reported in sample delivery group AST214. Chain-of-custody forms provided do not request the analyses for neutralization potential or sulfur forms. These analyses were requested by ASARCO by telephone.

SAMPLE CONDITION AND CHAIN-OF-CUSTODY CONSIDERATIONS:

ACZ laboratory recorded the following at the time of sample receipt: temperature, sample conditions, and custody seal integrity. All samples were received at temperatures between 2 and 4 degrees celsius. All chain-of-custody forms were correctly signed and dated, and all sample coolers had custody seals intact at the time of sample receipt. All sample integrity requirements are considered to be satisfied.

INTERNAL DATA CONSISTENCY:

No transcription errors are apparent in the final laboratory reports, with one exception. Two samples were submitted to ACZ with identical sample IDs. These were listed on the chain-of-custody with the identification W-032C-01-94830. This appears to be a sample labeling error by the sampling team. ACZ corrected the sample ID for the sample collected at 1700 hours to W-031C-01-940830.

INITIAL AND CONTINUING CALIBRATION RESULTS:

Neutralization Potential. Initial and continuing calibration results were provided for the neutralization potential analyses. Recoveries ranged from 99.6 to 103.3 percent, and were acceptable.

Sulfur Forms. No Form II calibration results were provided for the sulfur forms analyses.

TCLP Metals. Initial and continuing calibration results were provided for the arsenic, cadmium, lead, and zinc analyses. These analyses were performed by ICP methodology after TCLP extraction. Recoveries ranged from 98 to 103 percent, and were acceptable. ICP CRDL check standard analyses were also performed, with recoveries ranging from 100 to 116 percent. No action was taken based on the CRDL check standard recoveries, as these are not applicable to analyses of TCLP extracts.

LABORATORY CONTROL SAMPLE ANALYSES:

Neutralization Potential. No laboratory control sample results were provided.

Sulfur Forms. One laboratory control sample analysis was performed. A true value for sulfur was not provided.

TCLP Metals. No laboratory control sample results were provided.

LABORATORY BLANK ANALYSES:

Neutralization Potential. Initial and continuing calibration blank samples are listed in the spreadsheet runlogs for the neutralization potential analyses. However, no results are provided.

Sulfur Forms. Results from one preparation blank (sample weight of zero ?) were provided on a spreadsheet. Total sulfur from this analysis was zero.

TCLP Metals. Results from initial, continuing, and preparation blank analyses were provided for the metals analyzed. No metals were detected in any of the blanks at concentrations above the reporting limits provided.

ICP INTERFERENCE CHECK SAMPLES RESULTS:

ICP interference check sample results were provided for the TCLP metals analyses. Metals recoveries in the final solution ranged from 87 to 95.6 percent, and were within prescribed limits.

MATRIX SPIKE ANALYSIS RESULTS:

Neutralization Potential. Matrix spike analyses were not performed for the neutralization potential analyses.

Sulfur Forms. Matrix spike analyses were not performed for the sulfur analyses.

TCLP Metals. A matrix spike analysis was performed on mine waste sample W-140C-01-940912. All matrix spike recoveries were acceptable, ranging from 104 to 110 percent.

LABORATORY DUPLICATE ANALYSES:

Neutralization Potential. One duplicate analysis was performed for neutralization potential. Precision between the primary and duplicate analysis results was acceptable.

Sulfur Forms. A laboratory duplicate analysis was performed on another client's sample. The results are presented in units of mg/L. However, the results for the ASARCO samples are presented in units of percent. Precision for the results presented is poor. No action is taken as the results presented for the laboratory duplicate are not comparable in magnitude of the ASARCO sample results.

TCLP Metals. A laboratory duplicate analysis was performed on sample W-340C-01-940912. Arsenic, cadmium, and lead were each reported below detection limits in the primary and duplicate analyses. Zinc was detected at 21.3 ug/L in the primary analysis and at 12.3 ug/L in the duplicate analysis. The RPD is calculated at 53.6 percent. However, the data are not qualified because the control limit for the duplicate precision is 20 ug/L, and the two results agree within this control limit.

FIELD REPLICATE ANALYSES:

No field replicate samples were submitted with the samples associated with this sample delivery group.

SULFUR ANALYSIS PROBLEMS AND CONSIDERATIONS:

The methodologies used to perform the analyses for pyritic and organic sulfur forms were developed for evaluation of overburdens associated with coal mining. These methods do not perform well for the "hardrock" matrices of the mine waste samples submitted by ASARCO. Currently, there are no other approved methods that address this problem, though, according to ACZ, the problem is documented, and the USGS is working on methods for the sulfur forms that are more applicable to hardrock matrices. The following calculations were performed to determine the sulfur form results provided.

Total sulfur (percent) = $BaSO_4$ x 0.137 x 100

Samples are fused at 800 °C with sodium carbonate and manganese oxide. Sulfur is converted to $NaSO_4$ and leached with hot water. $BaCl_2$ is added to the leachate and $BaSO_4$ is formed. $BaSO_4$ is measured gravimetrically and total sulfur is calculated as shown above.

Pyritic sulfur = HCl extractable - HNO_3 extractable

The HCl extract residue contains both pyritic and organic sulfur, the HNO3 extract residue should contain only the organic sulfur. Therefore, the difference should be the pyritic sulfur fraction.

Sulfate = Total sulfur - HCl extractable

As noted in the analytical report narrative provided by ACZ, the hardrock matrix of the samples submitted prevented the correct quantitation of pyritic and organic sulfur forms. The residue from the nitric acid extraction of the samples should contain only the organic sulfur fraction. However, it appears that the pyritic form was not fully removed by the nitric acid. Additionally, some metals are apparently released during the nitric acid digestion that cause measurement interferences. Therefore, the results for the organic fraction residue also contain some of the pyritic fraction, and may be incorrectly biased high.

The HCl extraction should contain both the organic and pyritic sulfur forms. However, this extraction is less vigorous than the nitric acid extraction and the results were lower. Therefore, many of the pyritic sulfur form results calculated were negative values. For this reason, ACZ reported the pyritic sulfur from the HCl extract fraction (rather than from the calculation shown above). Due to the problems associated with the determination of the pyritic sulfur, all pyritic sulfur results are qualified as J/Estimated.

NEUTRALIZATION POTENTIAL ANALYSIS RESULTS:

The neutralization potential results are reported as percent CaCO3. The net acid neutralization potential (NANP) is calculated as follows:

(neutralization potential x 10) - (total Sulfur x 31.25)

The results of the NANP analyses range from 27 to 616 tons CaCO3/KT with an average of 308 and a standard deviation of 196. NANP results greater than zero indicate that the sample has a neutralization potential that is capable of mitigating any acid formation due to the sulfur present in the sample.

VALIDATION SUMMARY

The analytical results provided by ACZ Laboratory (two reports for Sample Delivery Group AST214) for the mine waste samples listed on page one of this letter have been validated according to U.S. Environmental Protection Agency and Geraghty & Miller data validation criteria, as applicable. The validation results for the samples reviewed are presented in the table below.

Sample / Constituents	Validation Level	Reason(s)
TCLP metals - arsenic, cadmium, lead, and zinc (all samples)	Quantitative	All QC requirements are satisfied
Neutralization potential (all samples)	Quantitative	All QC requirements are satisfied
Total sulfur and sulfate sulfur (all samples)	Quantitative	All QC requirements are satisfied
Pyritic Sulfur - includes organic sulfur (all samples)	J/Estimated	Pyritic sulfur result includes organic sulfur. Matrix interferences precluded proper quantitation of the pyritic sulfur form.

Prepared By: [signature]
Project Scientist

3/16/95
Date

APPENDIX A.2

LABORATORY TEST DATA

ACZ Laboratories, Inc.

DUPLICATE

ASARCO INC.
California Gulch CERCLA Site

FEB 15 1995

RECEIVED

CASE NARRATIVE
February 14, 1995

Client:	Asarco, Inc.
Project:	Inorganic Analyses of Soil Samples
SDG#:	AST214
Lab Nos.:	L3984-01 through L3984-18

Eighteen samples for this SDG were received on 08/31/94 - 09/16/94. The samples were received in good condition.

A matrix problem occurred during the forms of sulfur analysis. The HNO3 extractable sulfur which is suppose to remove pyritic sulfur had values greater than the sulfur total. The extractions had light green to dark green tint which is an indication of metallic precipitation which is a direct interference with the analysis. High organic sulfur concentrations are not typical of this type of mine waste. This leads us to believe that the HNO3 extraction did not fully remove the pyritic sulfur. The organic and pyritic sulfur are reported together in this data package. ABP, AGP, and ANP calculations were all based on the total sulfur data.

Susan K. Barkey

Susan K. Barkey, Project Manager

30400 Downhill Drive
Steamboat Springs, CO 80487-9400

Phone (800) 334-5493
FAX No. (303) 879-2216

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

Cover Page

Client:	Asarco, Inc.	Project:	Sediment
Matrix (Water/Soil):	SOIL	SDG No.:	AST214
Level (low/med):	LOW	Date Received:	12/02/94

Sample ID	Sample Date	Lab Number
W-014-C-01-940829	08/29/94	L3984-01
W-015-C-01-940829	08/29/94	L3984-02
W-016-C-01-940830	08/30/94	L3984-03
W-017-C-01-940829	08/29/94	L3984-04
W-018-C-01-940830	08/30/94	L3984-05
W-019-C-01-940829	08/29/94	L3984-06
W-022-C-01-940831	08/31/94	L3984-07
W-024-C-01-940901	09/01/94	L3984-08
W-026-C-01-940831	08/31/94	L3984-09
W-027-C-01-940912	09/12/94	L3984-10
W-028-C-01-940912	09/12/94	L3984-11
W-032-C-01-940830	08/30/94	L3984-12
W-033-C-01-940913	09/13/94	L3984-13
W-035-C-01-940912	09/12/94	L3984-14
W-110-C-01-940901	09/01/94	L3984-15
W-111-C-01-940901	09/01/94	L3984-16
W-140-C-01-940912	09/12/94	L3984-17
W-340-C-01-940912C	09/12/94	L3984-18

Parameters	Method No.	Detection Limit
Sulfur Forms	EPA 600/2-78-054 3.2,6.1	0.01 %
Neutralization Potential as CaCO3	EPA 600/2-78-054 3.2.3	0.1 %
Net Acid Neutralization Potential (NANP)	Calculation	1 Ton CaCO3/KT

Comments: Eighteen samples were analyzed for sulfur forms, neutralization potential and acid base potential.

000001

Project Manager: Susan K Barkey
Date: 02/14/95

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-014-C-01-940829

Client: Asarco, Inc.

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-01

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	1		%	
Sulfur, Sulfate	0.14		%	
Sulfur, Total	0.66		%	
Neut. Potential	13.3		$CaCO_3$ %	
NANP	112		Tons $CaCO_3$/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-015-C-01-940829

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-02

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	1		%	
Sulfur, Sulfate	0.16		%	
Sulfur, Total	0.68		%	
Neut. Potential	22.3		CaCO3 %	
NANP	202		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-016-C-01-940830

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-03

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	1		%	
Sulfur, Sulfate	0.99		%	
Sulfur, Total	1.74		%	
Neut. Potential	29.0		CaCO3 %	
NANP	236		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-017-C-01-940829

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-04

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.38		%	
Sulfur, Total	0.55		%	
Neut. Potential	43.2		CaCO3 %	
NANP	432		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-018-C-01-940830

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-05

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.13		%	
Sulfur, Total	0.21		%	
Neut. Potential	13.3		CaCO3 %	
NANP	133		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-019-C-01-940829

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-06

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	1		%	
Sulfur, Sulfate	0.16		%	
Sulfur, Total	1.01		%	
Neut. Potential	3.1		$CaCO_3$ %	
NANP	31		Tons $CaCO_3$/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-022-C-01-940831

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-07

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.08		%	
Sulfur, Total	0.27		%	
Neut. Potential	9.8		CaCO3 %	
NANP	98		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-024-C-01-940901

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-08

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.04		%	
Sulfur, Total	0.15		%	
Neut. Potential	2.7		CaCO3 %	
NANP	27		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-026-C-01-940831

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-09

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	1		%	
Sulfur, Sulfate	0.12		%	
Sulfur, Total	0.98		%	
Neut. Potential	25.0		CaCO3 %	
NANP	250		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-027-C-01-940912

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-10

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.17		%	
Sulfur, Total	0.47		%	
Neut. Potential	39.4		CaCO3 %	
NANP	394		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.
W-028-C-01-940912

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-11

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.03		%	
Sulfur, Total	0.19		%	
Neut. Potential	61.6		CaCO3 %	
NANP	616		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-032-C-01-940830

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-12

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.03		%	
Sulfur, Total	0.09		%	
Neut. Potential	52.9		CaCO3 %	
NANP	529		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-033-C-01-940913

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-13

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.07		%	
Sulfur, Total	0.19		%	
Neut. Potential	43.0		CaCO3 %	
NANP	430		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-035-C-01-940912

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-14

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.05		%	
Sulfur, Total	0.10		%	
Neut. Potential	55.1		CaCO3 %	
NANP	551		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-110-C-01-940901

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-15

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.01		%	
Sulfur, Total	0.01		%	
Neut. Potential	13.3		CaCO3 %	
NANP	133		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-111-C-01-940901

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-16

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.10		%	
Sulfur, Total	0.34		%	
Neut. Potential	49.6		CaCO3 %	
NANP	496		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

W-140-C-01-940912

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST214

Level (low/med): LOW

Lab Sample ID: L3984-17

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.12		%	
Sulfur, Total	0.23		%	
Neut. Potential	30.9		CaCO3 %	
NANP	309		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.
W-340-C-01-940912C

Client: Asarco, Inc.
Project:

Matrix (Water/Soil): Soil
SDG No.: AST214

Level (low/med): LOW
Lab Sample ID: L3984-18

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0		%	
Sulfur, Sulfate	0.00		%	
Sulfur, Total	0.08		%	
Neut. Potential	56.1		CaCO3 %	
NANP	561		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analyses Data Package

FORM 2A
Initial and Continuing Calibration Verification

Project: Asarco, Inc.
SDG No.: AST214
Matrix: SOIL

Report Date: 02/09/95
Date Received: 12/02/94
Lab Nos.: L3984-01 through 18

Analyte	Initial Calibration			Continuing Calibration	#1		#2		Method
	True	Found	R%	True	Found	R%	Found	R%	
Sulfur, Organic									NR
Sulfur, Pyritic									
Sulfur, Sulfate									NR
Sulfur, Total									NR
Sulfur, O. & P.									NR
Neut. Potential	100.0	99.6	99.6	100.0	103.3	103.3			
[illegible]d Base Potential									NR

ACZ LABORATORIES, INC.
Inorganic Analyses Data Package

FORM 6
Duplicate Sample

Project: Asarco, Inc.

SDG No.: AST214
Matrix: SOIL
Sample No.: LC30BX110829

Report Date: 02/09/95
Date Received: 12/02/94
Lab Nos.: L3984-01 through 18

Concentration Units: mg/L

Analyte		Control Limit	Sample Result	C	Duplicate Value	C	RPD %	Q	Method
Sulfur, Organic			0.09		0.31		110.0		
Sulfur, Pyritic			-0.01		-0.20		-181.0		
Sulfur, Sulfate			0.00		0.20		200.0		
Sulfur, Total			0.08		0.31		117.9		
Sulfur, O. & P.			0.08		0.11		31.6		
Neut. Potential			56.1		56.0		0.2		
Acid Base Potential									NR

ACZ LA[illegible]ATORIES, INC.
Sulfur, [illegible]l, Organic, Pyritic, Sulfate
M600/2-78-054 3.

WG5794.XLS 1/27/95 2:18 PM

Analyst: as
Dept: 5
Analysis Date: 1/3/95
Start Time: 9:10a
End Time:
Approved:
Approved:

023

Project:
SDG#:
SOP#: S-FORMS

Instrument:
Matrix Class: SOLID
List Type: I-S-FORMS
List Function: ANALYTICAL

#	Sample No.	Sample ID	Sample Weight (g)	Cruc. #	Cruc. Weight (g)	Cruc. & BaSO4 Wt. (g)	Sulfur (g)	% Sulfur Organic	% Sulfur Pyritic	% Sulfur Sulfate	% Sulfur Total
1	PBS		0.0000	1	24.5380	24.5381	0.0001	-0.01	0.00	0.01	0.00
2	LCSS	pcn 908	1.0000	2	23.4924	23.7227	0.2303	0.33	2.67	0.15	3.16
3	L3984-01	Samples	1.0000	3	22.9413	22.9892	0.0479	0.64	-0.12	0.14	0.66
4	L3984-02	Samples	1.0000	4	20.4172	20.4669	0.0497	0.61	-0.08	0.16	0.68
5	L3984-03	Samples	1.0000	5	22.2516	22.3788	0.1272	1.04	-0.29	0.99	1.74
6	L3984-04	Samples	1.0000	6	21.8321	21.8720	0.0399	0.26	-0.10	0.38	0.55
7	L3984-05	Samples	1.0000	7	21.2764	21.2920	0.0156	0.18	-0.09	0.13	0.21
8	L3984-06	Samples	1.0000	8	24.2306	24.3041	0.0735	1.02	-0.18	0.16	1.01
9	L3984-07	Samples	1.0000	9	22.9985	23.0180	0.0195	0.26	-0.07	0.08	0.27
10	L3984-08	Samples	1.0000	10	22.6853	22.6960	0.0107	0.14	-0.04	0.04	0.15
11	L3984-09	Samples	1.0000	11	23.4375	23.5088	0.0713	0.96	-0.10	0.12	0.98
12	L3984-10	Samples	1.0000	12	28.2496	28.2839	0.0343	0.35	-0.05	0.17	0.47
13	L3984-11	Samples	1.0000	13	22.2555	22.2693	0.0138	0.17	-0.01	0.03	0.19
14	L3984-12	Samples	1.0000	14	22.1979	22.2043	0.0064	0.06	0.00	0.03	0.09

#	Sample No.	Sample ID	Sample Wt(g)	HCl Residue (Org&Pyritic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc Wt.	Sulfur % O and P	HNO3 Residue (Organic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc. Wt.	Sulfur% Organic
1	PBS		0.0000	##	51	24.1720	24.1714	-0.01	12	72	25.0663	25.0658	-0.01
2	LCSS	pcn 908	1.0000		52	23.3300	23.5508	3.00		73	23.5474	23.5714	0.33
3	L3984-01	Samples	1.0000		53	23.0397	23.0779	0.52		74	25.8925	25.9393	0.64
4	L3984-02	Samples	1.0000		54	22.8596	22.8983	0.53		75	25.6208	25.6653	0.61
5	L3984-03	Samples	1.0000		55	23.7889	23.8442	0.75		76	24.3187	24.3949	1.04
6	L3984-04	Samples	1.0000		56	22.2986	22.3106	0.16		77	23.8896	23.9086	0.26
7	L3984-05	Samples	1.0000		57	25.3399	25.3463	0.09	18	78	22.3864	22.3994	0.18
8	L3984-06	Samples	1.0000		58	24.4326	24.4948	0.85		79	23.9515	24.0260	1.02
9	L3984-07	Samples	1.0000		59	24.9671	24.9808	0.19		80	23.4700	23.4888	0.26
10	L3984-08	Samples	1.0000		60	23.0366	23.0443	0.10		81	23.5024	23.5129	0.14
11	L3984-09	Samples	1.0000		61	24.5565	24.6196	0.86		82	25.8569	25.9271	0.96
12	L3984-10	Samples	1.0000		62	21.9425	21.9648	0.30		83	25.0265	25.0521	0.35
13	L3984-11	Samples	1.0000		63	22.9813	22.9931	0.16		84	23.6671	23.6794	0.17
14	L3984-12	Samples	1.0000	##	64	24.0987	24.1032	0.06	25	85	25.7596	25.7643	0.06

Comments:

ACZ LABO[illegible]ATORIES, INC.
Sulfur, T[illegible] Organic, Pyritic, Sulfate
M600/2-78-054 3.

WG5794.X[illegible] 1/27/95 2:18 PM

Analyst: [illegible]s
Dept: [illegible]
Analysis Date:
Start Time:
End Time:
Approved:
Approved:

Project:
SDG#:
SOP#: S-FORMS

Instrument:
Matrix Class: SOLID
List Type: I-S-FORMS
List Function: ANALYTICAL

[illegible]024

#	Sample No.	Sample ID	Sample Weight (g)			Cruc. #	Cruc. Weight (g)	Cruc. & BaSO4 Wt. (g)	Sulfur (g)	% Sulfur Organic	Pyritic	Sulfate	Total
15	L3984-13	Samples	1.0000			15	20.3217	20.3356	0.0139	0.17	-0.04	0.07	0.19
16	L3984-14	Samples	1.0000			16	21.3564	21.3635	0.0071	0.09	-0.04	0.05	0.10
17	L3984-15	Samples	1.0000			17	22.8742	22.8750	0.0008	0.01	-0.01	0.01	0.01
18	L3984-16	Samples	1.0000			18	25.0049	25.0296	0.0247	0.30	-0.06	0.10	0.34
19	L3984-17	Samples	1.0000			19	23.0414	23.0583	0.0169	0.24	-0.13	0.12	0.23
20	L3984-18	Samples	1.0000			20	22.1430	22.1492	0.0062	0.09	-0.01	0.00	0.08
21	DUP	3984-16	1.0000			21	26.3291	26.3520	0.0229	0.31	-0.20	0.20	0.31
											XXX	XXX	
											XXX	XXX	
											XXX	XXX	
											XXX	XXX	
											XXX	XXX	
											XXX	XXX	
											XXX	XXX	

#	Sample No.	Sample ID	Sample Wt(g)	HCl Residue (Org&Pyritic S)		Cruc. #	Cruc. Wt(g)	BaSO4& Cruc Wt.	Sulfur % O and P	HNO3 Residue (Organic S)	Cruc. #	Cruc. Wt(g)	BaSO4& Cruc. Wt.	Sulfur% Organic
15	L3984-13	Samples	1.0000			65	22.5578	22.5669	0.12	26	86	25.2766	25.2889	0.17
16	L3984-14	Samples	1.0000			66	24.2898	24.2936	0.05		87	24.1318	24.1384	0.09
17	L3984-15	Samples	1.0000			67	25.9365	25.9364	0.00		88	25.1462	25.1466	0.01
18	L3984-16	Samples	1.0000			68	24.6506	24.6681	0.24		89	23.5660	23.5881	0.30
19	L3984-17	Samples	1.0000			69	23.7168	23.7249	0.11		90	24.1618	24.1791	0.24
20	L3984-18	Samples	1.0000			70	23.8633	23.8694	0.08		91	22.2739	22.2804	0.09
21	DUP	3984-16	1.0000			71	24.9964	25.0046	0.11	32	92	23.3835	23.4060	0.31
														0.00
														0.00
														0.00
														0.00
														0.00
														0.00
														0.00

Comments:

ACZ LABORATORIES, INC.
Neutralization Potential
M600 2-78-054 3.

WG5793.XLS 12/29/94 5:50 PM

Analyst: as
Dept: 25
Analysis Date: 12/29/94
Start Time: 8;00
End Time: 6;00
Approved: mb
Approved: JW

Project: ASARCO
SDG#: AST214
SOP#: NEUT-POT

Instrument:
Matrix Class: SOLID
List Type: I-NEUT-POT
List Function: ANALYTICAL

Seq. #	ACZ Lab Sample No.	Client/QC Sample ID	Fizz Test (N,SL,MO or ST)	Sample Weight (g)	0.5 N HCl (ml)	0.5 N NaOH to pH 7.0 (ml)	CaCO3 %
1	ICB				30.0	28.0	
2	ICV	caco3		0.1	30.0	24.0	99.6
3	L3984-01	Samples		2.0	30.0	17.3	13.3
4	L3984-02	Samples		2.0	30.0	10.1	22.3
5	L3984-03	Samples		2.0	30.0	4.7	29.0
6	L3984-04	Samples		2.0	40.0	2.6	43.2
7	L3984-05	Samples		2.0	30.0	17.3	13.3
8	L3984-06	Samples		2.0	30.0	25.5	3.1
9	L3984-07	Samples		2.0	30.0	20.1	9.8
10	L3984-08	Samples		2.0	30.0	25.8	2.7
11	L3984-09	Samples		2.0	30.0	7.9	25.0
12	L3984-10	Samples		2.0	40.0	5.7	39.4
13	L3984-11	Samples		2.0	60.0	6.5	61.6
14	L3984-12	Samples		2.0	50.0	4.2	52.9
15	L3984-13	Samples		2.0	40.0	2.8	43.0
16	L3984-14	Samples		2.0	50.0	2.4	55.1
17	L3984-15	Samples		2.0	30.0	17.3	13.3
18	L3984-16	Samples		2.0	50.0	6.8	49.6
19	L3984-17	Samples		2.0	30.0	3.2	30.9
20	L3984-18	Samples		2.0	50.0	1.6	56.1
21	DUP	3984-18		2.0	50.0	1.7	56.0
22	CCB				30.0	27.7	
23	CCV	caco3		0.2	30.0	19.7	103.3

Na2CO3 g	Na2CO3 ml. (titration)	0.5N HCl ml.	HCL N
25.0	20.0	20.3	0.4647

HCl ml.	NaOH ml. (Blank)	HCl N	NaOH N
30.0	28.0	0.4647	0.4979

HCl SCN: 941228-1 NaOH SCN: 941227-1 Na2CO3 SCN: 940324-1

Comments:

NEUT-POT-1.qcfrm

Done

WORK GROUP REPORT (wk02)

Dec 22 1994, 04:01 pm

Work Group: WG5793 for Department: 25 Soil Analysis

Created: 22-DEC-94 Due: Operator: as

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L3984-01	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		25-FEB-95
L3984-02	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		25-FEB-95
L3984-03	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		26-FEB-95
L3984-04	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		25-FEB-95
L3984-05	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		26-FEB-95
L3984-06	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		25-FEB-95
L3984-07	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		27-FEB-95
L3984-08	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		28-FEB-95
L3984-09	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		27-FEB-95
L3984-10	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		11-MAR-95
L3984-11	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		11-MAR-95
L3984-12	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		26-FEB-95
L3984-13	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		12-MAR-95
L3984-14	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		11-MAR-95
L3984-15	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		28-FEB-95
L3984-16	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		28-FEB-95
L3984-17	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		11-MAR-95
L3984-18	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	14-DEC-94	D3		11-MAR-95

Comments:

L3984-01	Samples have been archived until 12/02/94.
L3984-02	Samples have been archived until 12/02/94.
L3984-03	Samples have been archived until 12/02/94.
L3984-04	Samples have been archived until 12/02/94.
-05	Samples have been archived until 12/02/94.
-06	Samples have been archived until 12/02/94.
L3984-07	Samples have been archived until 12/02/94.
L3984-08	Samples have been archived until 12/02/94.
L3984-09	Samples have been archived until 12/02/94.
L3984-10	Samples have been archived until 12/02/94.
L3984-11	Samples have been archived until 12/02/94.
L3984-12	Samples have been archived until 12/02/94.
L3984-13	Samples have been archived until 12/02/94.
L3984-14	Samples have been archived until 12/02/94.
L3984-15	Samples have been archived until 12/02/94.
L3984-16	Samples have been archived until 12/02/94.
L3984-17	Samples have been archived until 12/02/94.
L3984-18	Samples have been archived until 12/02/94.

cc 026

ACZ LABORATORIES, INC.
Acid Base Potential
M600

WG6751.XLS 1/27/95 2:25 PM

Analyst: as
Dept: 25
Analysis Date: 1-27-95
Start Time: 1:00
End Time: 3:00
Approved: AS
Approved: RVP 1/31/95

Project:
SDG#:
SOP#: 0.00

Instrument: 0.00
Matrix Class: SOLID
List Type: I-ABP
List Function: ANALYTICAL

#	Sample No.	Sample ID	Neut. Pot. %	Sulfur Total %	APP Tons/KT	ANP Tons/KT	NANP (ANP-APP) Tons/KT	ANP/APP
1	L3984-01	W-014-C-01-940829	13.3	0.7	20.6	133.0	112.4	6.4
2	L3984-02	W-015-C-01-940829	22.3	0.7	21.3	223.0	201.8	10.5
3	L3984-03	W-016-C-01-940830	29.0	1.7	54.4	290.0	235.6	5.3
4	L3984-04	W-017-C-01-940829	43.2	0.6	17.2	432.0	414.8	25.1
5	L3984-05	W-018-C-01-940830	13.3	0.2	6.6	133.0	126.4	20.3
6	L3984-06	W-019-C-01-940829	3.1	1.0	31.6	31.0	-0.6	1.0
7	L3984-07	W-022-C-01-940831	9.8	0.3	8.4	98.0	89.6	11.6
8	L3984-08	W-024-C-01-940901	2.7	0.2	4.7	27.0	22.3	5.8
9	L3984-09	W-026-C-01-940831	25.0	1.0	30.6	250.0	219.4	8.2
10	L3984-10	W-027-C-01-940912	39.4	0.5	14.7	394.0	379.3	26.8
11	L3984-11	W-028-C-01-940912	61.6	0.2	5.9	616.0	610.1	103.7
12	L3984-12	W-032-C-01-940830	52.9	0.1	2.8	529.0	526.2	188.1
13	L3984-13	W-033-C-01-940913	43.0	0.2	5.9	430.0	424.1	72.4
14	L3984-14	W-035-C-01-940912	55.1	0.1	3.1	551.0	547.9	176.3
15	L3984-15	W-110-C-01-940901	13.3	0.0	0.3	133.0	132.7	425.6
16	L3984-16	W-111-C-01-940901	49.6	0.3	10.6	496.0	485.4	46.7
17	L3984-17	W-140-C-01-940912	30.9	0.2	7.2	309.0	301.8	43.0
18	L3984-18	W-340-C-01-940912C	56.1	0.1	2.5	561.0	558.5	224.4

Comments:

0-1.qcfrm

027

ACZ LABORATORIES, INC.
Acid Base Potential
M600

WG6751.XLS 1/26/95 1:47 PM

Analyst: as
Dept: 25
Analysis Date: 1-27-95
Start Time: 1:00
End Time: 3:00
Approved: AS
Approved:

Instrument: 0.00
Matrix Class: SOLID
List Type: I-ABP
List Function: ANALYTICAL

Project:
SDG#:
SOP#: 0.00

AS 1-27-95

#	Sample No.	Sample ID	Neut. Pot. %	Sulfur Total %	~~APP~~ AGD Tons/KT	ANP Tons/KT	NANP (ANP-APP) Tons/KT	ANP/APP
1	L3984-01	W-014-C-01-940829	13.3	0.66	0.0	0.0	0.0	#DIV/0!
2	L3984-02	W-015-C-01-940829	22.3	0.68	0.0	0.0	0.0	#DIV/0!
3	L3984-03	W-016-C-01-940830	29.0	1.74	0.0	0.0	0.0	#DIV/0!
4	L3984-04	W-017-C-01-940829	43.2	0.55	0.0	0.0	0.0	#DIV/0!
5	L3984-05	W-018-C-01-940830	13.3	0.21	0.0	0.0	0.0	#DIV/0!
6	L3984-06	W-019-C-01-940829	3.1	1.01	0.0	0.0	0.0	#DIV/0!
7	L3984-07	W-022-C-01-940831	9.8	0.27	0.0	0.0	0.0	#DIV/0!
8	L3984-08	W-024-C-01-940901	2.7	0.15	0.0	0.0	0.0	#DIV/0!
9	L3984-09	W-026-C-01-940831	25.0	0.98	0.0	0.0	0.0	#DIV/0!
10	L3984-10	W-027-C-01-940912	39.4	0.47	0.0	0.0	0.0	#DIV/0!
11	L3984-11	W-028-C-01-940912	61.6	0.19	0.0	0.0	0.0	#DIV/0!
12	L3984-12	W-032-C-01-940830	52.9	0.09	0.0	0.0	0.0	#DIV/0!
13	L3984-13	W-033-C-01-940913	43.0	0.19	0.0	0.0	0.0	#DIV/0!
14	L3984-14	W-035-C-01-940912	55.1	0.10	0.0	0.0	0.0	#DIV/0!
15	L3984-15	W-110-C-01-940901	13.3	0.01	0.0	0.0	0.0	#DIV/0!
16	L3984-16	W-111-C-01-940901	49.6	0.34	0.0	0.0	0.0	#DIV/0!
17	L3984-17	W-140-C-01-940912	30.9	0.23	0.0	0.0	0.0	#DIV/0!
18	L3984-18	W-340-C-01-940912Cmp	56.1	0.08	0.0	0.0	0.0	#DIV/0!

Comments:

0-1.qcfrm

WORK GROUP REPORT (wk02)

Jan 26 1995, 01:31 pm

Work Group: WG6751   for Department: 25 Soil Analysis

Created: 26-JAN-95   Due: Operator: as

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L3984-01	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		25-FEB-95
L3984-02	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		25-FEB-95
L3984-03	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		26-FEB-95
L3984-04	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		25-FEB-95
L3984-05	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		26-FEB-95
L3984-06	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		25-FEB-95
L3984-07	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		27-FEB-95
L3984-08	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		28-FEB-95
L3984-09	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		27-FEB-95
L3984-10	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		11-MAR-95
L3984-11	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		11-MAR-95
L3984-12	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		26-FEB-95
L3984-13	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		12-MAR-95
L3984-14	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		11-MAR-95
L3984-15	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		28-FEB-95
L3984-16	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		28-FEB-95
L3984-17	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		11-MAR-95
L3984-18	Asarco, Inc.	S	ABP	Soil	WIP	U	14-DEC-94	03		11-MAR-95

Comments:

L3984-01 Samples have been archived until 12/02/94.
L3984-02 Samples have been archived until 12/02/94.
L3984-03 Samples have been archived until 12/02/94.
L3984-04 Samples have been archived until 12/02/94.
L3984-05 Samples have been archived until 12/02/94.
L3984-06 Samples have been archived until 12/02/94.
L3984-07 Samples have been archived until 12/02/94.
L3984-08 Samples have been archived until 12/02/94.
L3984-09 Samples have been archived until 12/02/94.
L3984-10 Samples have been archived until 12/02/94.
L3984-11 Samples have been archived until 12/02/94.
L3984-12 Samples have been archived until 12/02/94.
L3984-13 Samples have been archived until 12/02/94.
L3984-14 Samples have been archived until 12/02/94.
L3984-15 Samples have been archived until 12/02/94.
L3984-16 Samples have been archived until 12/02/94.
L3984-17 Samples have been archived until 12/02/94.
L3984-18 Samples have been archived until 12/02/94.

Soil Prep

ACZ LABORATORIES, INC.
ANALYSIS WORKLIST

BLANK.XLS

Analyst: JB
Date: 12-20-94
Start Time: 11:00a
End Time: 2:09p

Project: Asarco, Inc.
SDG#: AST 214
Instr:

Approved: JB
Approved: TM

No.	Lab No.	C/P	Sieve <60 mesh				
1	3984-1	DONE					
2	-2						
3	-3						
4	-4						
5	-5						
6	-6						
7	-7						
8	-8						
9	-9						
10	-10						
11	-11						
12	-12						
13	-13						
14	-14						
15	-15						
16	-16						
17	-17						
18	-18						
19							
20							

REMARKS:

Spike
Spike Sol. SCN =
Spike Sol. ml =
Sample ml =

PCN# =
PCN# = CC 030
SCN# =
SCN# =

APPENDIX A.3

LABORATORY TEST DATA

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE DUPLICATE

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: _____ SAS No.: ______ SDG No.:AST214

SOW No.: 3/90___

EPA Sample No.	Lab Sample ID
W014C1940829	L3984-01
W015C1940829	L3984-02
W016C1940830	L3984-03
W017C1940829	L3984-04
W018C1940830	L3984-05
W019C1940829	L3984-06
W022C1940831	L3984-07
W024C1940901	L3984-08
W026C1940831	L3984-09
W027C1940912	L3984-10
W028C1940912	L3984-11
W032C1940830	L3984-12
W033C1940913	L3984-13
W035C1940912	L3984-14
W110C1940901	L3984-15
W111C1940901	L3984-16
W140C1940912	L3984-17
W340C1940912	L3984-18

ASARCO INC.
California Gulch CERCLA Site
FEB 14 1995
RECEIVED

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:
____SOIL_SAMPLES_IN_THIS_SDG_WERE_DIGESTED_AND_ANALYZED_FOR_METALS_FROM______
____A_TCLP_EXTRACTION.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susan K Barkey / Ralph V. Poulsen Name: Susan K. Barkey / Ralph V. Poulsen

Date: 02/10/95 / 2/13/95 Title: Project Manager / Vice President

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W014C1940829

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO___

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-01

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	32.5	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	12.3	B		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W015C1940829

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-02

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	43.2	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	34.5			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W016C1940830

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-03

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	95.4			PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	52.7	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	2010			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W017C1940829

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-04

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_				NR
7440-38-2	Arsenic__	100	U		PM
7440-43-9	Cadmium__	38.6			PM
7440-70-2	Calcium__				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	785			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

FORM I - IN 7/88

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W018C1940830

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-05

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	10.0	U		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W019C1940829

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-06

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	21.6	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	42.8			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W022C1940831

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-07

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	10.0	U		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W024C1940901

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-08

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	68.7	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	40.7			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W026C1940831

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-09

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	32.4	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	40.9			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W027C1940912

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-10

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	12.3	B		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W028C1940912

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-11

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	30.8	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	75.8			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W032C1940830

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: _______ Case No.: _______ SAS No.: _______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-12

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	34.5			PM

Color Before: ________ Clarity Before: ______ Texture: ______

Color After: ________ Clarity After: ______ Artifacts: ______

Comments:

FORM I - IN 7/88

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W033C1940913

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-13

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	16.8	B		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W035C1940912

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-14

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	48.3			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
W110C1940901

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-15

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	48.5			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W111C1940901

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-16

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	14.9	B		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W140C1940912

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-17

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	14.9	B		PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

W340C1940912

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST214

Matrix (soil/water): WATER Lab Sample ID: L3984-18

Level (low/med): LOW__ Date Received: 12/02/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	21.3			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

FORM I - IN 7/88

DUPLICATE

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

ASARCO INC.
California Gulch CERCLA Site

FEB 27 1995

RECEIVED

Cover Page

Client:	Asarco, Inc.	Project:	Sediment
Matrix (Water/Soil):	SOIL	SDG No.:	AST215
Level (low/med):	LOW	Date Received:	01/13/95

Sample ID	**Sample Date**	**Lab Number**
G-013-C-01C-941025	10/25/94	L4349-01
G-108-C-01C-941025	10/25/94	L4349-02
G-109-C-01C-941025	10/25/94	L4349-03
G-207-C-01C-941025	10/25/94	L4349-04

Parameters	**Method No.**	**Detection Limit**
Sulfur Forms	EPA 600/2-78-054 3.2,6.1	0.01 %
Neutralization Potential as CaCO3	EPA 600/2-78-054 3.2.3	0.1 %
Net Acid Neutralization Potential (NANP)	Calculation	1 Ton CaCO3/KT

Comments: *Four samples were analyzed for sulfur forms, neutralization potential and acid base potential.*

Project Manager: Susan K Barbour / Ralph V. Poulsen
Date: 02/22/95 / 02/22/95

/000 01

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

G-013-C-01C-941025

Client: Asarco, Inc.

Matrix (Water/Soil): Soil

SDG No.: AST215

Level (low/med): LOW

Lab Sample ID: L4349-01

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0.01	U	%	
Sulfur, Sulfate	0.01	U	%	
Sulfur, Total	0.01	U	%	
Neut. Potential	32.0		CaCO3 %	
NANP	320		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

G-108-C-01C-941025

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST215

Level (low/med): LOW

Lab Sample ID: L4349-02

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0.14		%	
Sulfur, Sulfate	0.01	U	%	
Sulfur, Total	0.11		%	
Neut. Potential	41.4		$CaCO_3$ %	
NANP	411		Tons $CaCO_3$/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

G-109-C-01C-941025

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST215

Level (low/med): LOW

Lab Sample ID: L4349-03

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0.18		%	
Sulfur, Sulfate	0.01	U	%	
Sulfur, Total	0.18		%	
Neut. Potential	16.9		$CaCO_3$ %	
NANP	163		Tons $CaCO_3$/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analysis Data Package

FORM 1
Inorganic Analysis Data Sheet

SAMPLE NO.

G-207-C-01C-941025

Client: Asarco, Inc.

Project:

Matrix (Water/Soil): Soil

SDG No.: AST215

Level (low/med): LOW

Lab Sample ID: L4349-04

Date Received: 12/02/94

Analyte	Concentration	C	Units	M
Sulfur, Pyritic	0.07		%	
Sulfur, Sulfate	0.01	U	%	
Sulfur, Total	0.03		%	
Neut. Potential	16.4		CaCO3 %	
NANP	163		Tons CaCO3/KT	

Remarks: Reported pyritic sulfur values include organic sulfur. Matrix interferences prevented the separation of the two species.

ACZ LABORATORIES, INC.
Inorganic Analyses Data Package

FORM 2A
Initial and Continuing Calibration Verification

Project: Asarco, Inc.
Report Date: 02/20/95
Date Received: 01/13/95
SDG No.: AST215
Lab Nos.: L4349-01 through 04
Matrix: SOIL

	Initial Calibration			Continuing Calibration					
					#1		#2		
Analyte	True	Found	R%	True	Found	R%	Found	R%	Method
Sulfur, Total	3.13	3.12	99.7						NR
Sulfur, O. & P.	N/A								NR
Neut. Potential	100.0	106.1	106.1	100.0	103.6	103.6			

ACZ LABORATORIES, INC.
Inorganic Analyses Data Package

FORM 3
Calibration Blanks

Project:	Asarco, Inc.	Report Date:	02/20/95
		Date Received:	01/13/95
SDG No.:	AST215	Lab Nos.:	L4349-01 through 04

Analyte	Initial Calib. Blank	C	Continuing Calibration Blank #1	C	#2	C	Prep Blank	C	Method
Sulfur, Total							0.01	U	
Sulfur, O. & P.							0.01	U	
Neut. Potential	0.1	U	0.1	U					

ACZ LABORATORIES, INC.
Inorganic Analyses Data Package

FORM 6
Duplicate Sample

Project: Asarco, Inc.

Report Date: 02/20/95
Date Received: 01/13/95
Lab Nos.: L4349-01 through 04

SDG No.: AST215
Matrix: SOIL
Sample No.: G-207-C-01C-941025

Concentration Units: mg/L

Analyte		Control Limit	Sample Result	C	Duplicate Value	C	RPD %	Q	Method
Sulfur, Total			0.03		0.05		50.0		
Sulfur, O. & P.			0.02		0.02		0.0		
Neut. Potential			16.4		16.8		2.4		

ACZ LABORATORIES, INC.
Sulfur, Total, Organic, Pyritic, Sulfate
M600/2-78-054 3.

WG6575.XLS 1/25/95 3:12 PM

Analyst: mb
Dept: 25
Analysis Date: 1/20/95
Start Time: 3:15P
End Time: 3:15P 1-25-95
Approved: JB
Approved:

Project:
SDG#:
SOP#: S-FORMS

Instrument:
Matrix Class: SOLID
List Type: I-S-FORMS
List Function: ANALYTICAL

#	Sample No.	Sample ID	Sample Weight (g)		Cruc. #	Cruc. Weight (g)	Cruc. & BaSO4 Wt. (g)	Sulfur (g)	% Sulfur Organic	% Sulfur Pyritic	% Sulfur Sulfate	% Sulfur Total
1	PBS		0.0000		51	24.1714	24.1715	0.0001	0.00	0.00	0.00	0.00
2	LCSS		1.0000		52	23.3298	23.5576	0.2278	0.31	2.71	0.11	3.12
3	L4349-01	Previous	1.0000		53	23.0382	23.0382	0.0000	0.01	0.00 U	0.00	0.00
4	L4349-02	Previous	1.0000		54	22.8618	22.8696	0.0078	0.14	~~-0.06~~ .14	~~0.03~~ U	0.11
5	L4349-03	Previous	1.0000		55	23.7893	23.8028	0.0135	0.18	~~-0.03~~ .18	~~-0.03~~ U	0.18
6	L4349-04	Previous	1.0000		56	22.2983	22.3006	0.0023	0.03	~~-0.04~~ .01	~~-0.04~~ U	0.03
7	DUP	4349-4	1.0000		57	25.3399	25.3433	0.0034	0.05	-0.02	0.02	0.05
										XXX	XXX	
										XXX	XXX	
										XXX	XXX	
										XXX	XXX	
										XXX	XXX	
										XXX	XXX	
										XXX	XXX	

#	Sample No.	Sample ID	Sample Wt(g)	HCl Residue (Org&Pyritic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc Wt.	Sulfur % O and P	HNO3 Residue (Organic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc. Wt.	Sulfur% Organic
1	PBS		0.0000	11	61	24.5573	24.5574	0.00	1	76	24.3196	24.3196	0.00
2	LCSS		1.0000	12	62	21.9425	22.1623	3.02	2	77	23.8905	23.9130	0.31
3	L4349-01	Previous	1.0000	13	63	22.9812	22.9815	0.00	3	78	22.3868	22.3874	0.01
4	L4349-02	Previous	1.0000	14	64	24.0996	24.1053	0.08	4	79	23.9531	23.9632	0.14
5	L4349-03	Previous	1.0000	15	65	22.5580	22.5691	0.15	5	80	23.4713	23.4847	0.18
6	L4349-04	Previous	1.0000	16	66	24.2897	24.2951	0.07	6	81	23.5039	23.5064	0.03
7	DUP	4349-4	1.0000	17	67	25.9366	25.9382	0.02	7	82	25.8578	25.8612	0.05
													0.00
													0.00
													0.00
													0.00
													0.00
													0.00
													0.00

Comments:

ACZ LAB[illegible]ATORIES, INC.
Sulfur, T[illegible], Organic, Pyritic, Sulfate
M600/2-78-054 3.

WG6575.X[illegible]1/25/95 11:04 AM

Analyst: mb
Dept: 5
Analysis Date: [illegible]/20/95
Start Time: 3:15P
End Time:
Approved:
Approved:

10

Project:
SDG#:
SOP#: S-FORMS

Instrument:
Matrix Class: SOLID
List Type: I-S-FORMS
List Function: ANALYTICAL

#	Sample No.	Sample ID	Sample Weight (g)	Cruc. #	Cruc. Weight (g)	Cruc. & BaSO4 Wt. (g)	Sulfur (g)	% Sulfur Organic	Pyritic	Sulfate	Total	
1	PBS		0.0000	51	24.1714	24.1715	0.0001	0.00	0.00	0.00	0.00	
2	LCSS		1.0000	52	23.3298	23.5576	0.2278	0.00	3.02	0.11	3.12	
3	L4349-01	Previous	1.0000	53	23.0382	23.0382	0.0000	0.00	0.00	0.00	0.00	yellow liquid
4	L4349-02	Previous	1.0000	54	22.8618	22.8696	0.0078	0.00	0.08	0.03	0.11	Green liquid
5	L4349-03	Previous	1.0000	55	23.7893	23.8028	0.0135	0.00	0.15	0.03	0.18	yellow liquid
6	L4349-04	Previous	1.0000	56	22.2983	22.3006	0.0023	0.00	0.07	-0.04	0.03	yellow liquid
7	DUP	4349-4	1.0000	57	25.3399	25.3433	0.0034	0.00	0.02	0.02	0.05	yellow liquid
									XXX	XXX		
									XXX	XXX		
									XXX	XXX		
									XXX	XXX		
									XXX	XXX		
									XXX	XXX		
									XXX	XXX		

#	Sample No.	Sample ID	Sample Wt(g)	HCl Residue (Org&Pyritic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc Wt.	Sulfur % O and P	HNO3 Residue (Organic S) Cruc. #		Cruc. Wt(g)	BaSO4& Cruc. Wt.	Sulfur% Organic	
1	PBS		0.0000	11	61	24.5573	24.5574	0.00	1	76	24.3196	24.3196	0.00	
2	LCSS		1.0000	12	62	21.9425	22.1623	3.02	2	77	23.8905	23.9130	0.00	
3	L4349-01	Previous	1.0000	13	63	22.9812	22.9815	0.00	3	78	22.3868		0.00	
4	L4349-02	Previous	1.0000	14	64	24.0996	24.1053	0.08	4	79	23.9531		0.00	Brown Precip.
5	L4349-03	Previous	1.0000	15	65	22.5580	22.5691	0.15	5	80	23.4713		0.00	Lt. Brown Prec.
6	L4349-04	Previous	1.0000	16	66	24.2897	24.2951	0.07	6	81	23.5039		0.00	
7	DUP	4349-4	1.0000	17	67	25.9366	25.9382	0.02	7	82	25.8578		0.00	
													0.00	
													0.00	
													0.00	
													0.00	
													0.00	
													0.00	
													0.00	

Comments:

WORK GROUP REPORT (wk02)

Jan 20 1995, 10:10 am

Work Group: WG6575 for Department: 25 Soil Analysis

Created: 20-JAN-95 Due: Operator: mb

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L4349-01	Asarco, Inc.	S	S-FORMS	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-02	Asarco, Inc.	S	S-FORMS	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-03	Asarco, Inc.	S	S-FORMS	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-04	Asarco, Inc.	S	S-FORMS	Soil	WIP	U	25-JAN-95	03		23-APR-95

Comments:

L4349-01 Previously archived
L4349-02 Previously archived
L4349-03 Previously archived
L4349-04 Previously archived

ACZ LABORATORIES, INC.
Neutralization Potential
M600 2-78-054 3.

WG6405.XLS 1/20/95 2:49 PM

Analyst: mb
Dept: 25
Analysis Date: 1/20/95
Start Time: 9:30a
End Time: 2:45p
Approved: jb
Approved:

Instrument:
Project:
SDG#:
SOP#: NEUT-POT
Matrix Class: SOLID
List Type: I-NEUT-POT
List Function: ANALYTICAL

Seq. #	ACZ Lab Sample No.	Client/QC Sample ID	Fizz Test (N,SL,MO or ST)	Sample Weight (g)	0.5 N HCl (ml)	0.5 N NaOH to pH 7.0 (ml)	CaCO3 %
1	ICB			na	30.0	28.0	
2	ICV	CaCO3		0.1	30.0	23.8	106.1
3	L4349-01	Previous		2.0	30.0	2.7	32.0
4	L4349-02	Previous		2.0	40.0	4.6	41.4
5	L4349-03	Previous		2.0	30.0	14.6	16.9
6	L4349-04	Previous		2.0	30.0	15.0	16.4
7	DUP	4349-4		2.0	30.0	14.7	16.8
8	CCB			na	30.0	27.3	
9	CCV	CaCO3		0.2	30.0	19.8	103.6

>RPD = 2

Na2CO3 g	Na2CO3 ml. (titration)	0.5N HCl ml.	HCL N
25.0	20.0	20.0	0.4717

HCl ml.	NaOH ml. (Blank)	HCl N	NaOH N
30.0	28.0	0.4717	0.5054

HCl SCN: si 941228-1 NaOH SCN: si941227-1 Na2CO3 SCN: si 940324-1

Comments:

NEUT-POT-1.qcfrm

WORK GROUP REPORT (wk02)

Jan 18 1995, 09:30 am

Work Group: WG6405 for Department: 25 Soil Analysis

Created: 17-JAN-95 Due: Operator: mb

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L4349-01	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-02	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-03	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-04	Asarco, Inc.	S	NEUT-POT	Soil	WIP	U	25-JAN-95	03		23-APR-95

Comments:

L4349-01 Previously archived
L4349-02 Previously archived
L4349-03 Previously archived
L4349-04 Previously archived

ACZ LABORATORIES, INC.
ANALYSIS WORKLIST
NEUTRALIZATION POTENTIAL/CaCO3

NP_215.XLS

Analyst:
Date:
Start Time:
End Time:

Project: Asarco, Inc.
SDG#: AST215
Instr:

Approved:
Approved:

No.	Lab No.	Fizz Test (N,SL,MO, or ST)	SAMPLE WT. g	.5 N NaOH to pH 7.0 (ml)	TSS Cruc #	Cruc. + BaSO4 wt. g.	Sulfur wt. g	% Sulfur
1	BLANK							
2	LCS							
3	L4349-01							
4	L4349-01D							
5	L4349-02							
6	L4349-03							
7	L4349-04							
8	BLANK							
9	LCS							
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

REMARKS:

ACZ LABORATORIES, INC.
Acid Base Potential
M600

WG6674.XLS 2/20/95 10:42 AM

Analyst: as
Dept: 25
Analysis Date: 1/26/95
Start Time: 12 PM
End Time: 12:15
Approved: AS
Approved:

Project:
SDG#:
SOP#: 0.00

Instrument: 0.00
Matrix Class: SOLID
List Type: I-ABP
List Function: ANALYTICAL

#	Sample No.	Sample ID	Neut. Pot. %	Sulfur Total %	APP Tons/KT	ANP Tons/KT	NANP (ANP-APP) Tons/KT	ANP/APP
1	L4349-01	Previous	32.0	<0.01	0.0	320.0	320.0	#DIV/0!
2	L4349-02	Previous	41.4	0.1	3.4	414.0	410.6	120.4
3	L4349-03	Previous	16.9	0.2	5.6	169.0	163.4	30.0
4	L4349-04	Previous	16.4	0.0	0.9	164.0	163.1	174.9

Comments:

0-1.qcfrm

ACZ LABORATORIES, INC.
SOIL P AIRDRY
USDA No. 1, 1972

WG6433 01/17/95 10:30 AM

Analyst: jb
Dept: 0
Analysis Date: 1-17-95
Start Time: 10:30a
End Time: 4:30 1-19-95
Approved: JB
Approved: AS

RVD 1/23/95

Instrument: 0.00
Matrix Class: SOLID
List Type: I-SP-AIRDRY
List Function: PREP

Project:
SDG#:
SOP#:

Seq #	ACZ Lab Sample No.	Client/QC Sample ID	Air Dry								
1	L4349-01	Previous	1-17-95								
2	L4349-02	Previous									
3	L4349-03	Previous									
4	L4349-04	Previous									

Comments: upload 1-24-95 [illegible]

-1.qcfrm

21

WORK GROUP REPORT (wk02)

Jan 17 1995, 10:26 am

Work Group: WG6433 for Department: 20 Soil Preparation

Created: 17-JAN-95 Due: Operator: jb

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L4349-01	Asarco, Inc.	S	DRY-AIR	Soil	WIP	U	01-NOV-94	B3		01-NOV-94
L4349-02	Asarco, Inc.	S	DRY-AIR	Soil	WIP	U	01-NOV-94	D3		01-NOV-94
L4349-03	Asarco, Inc.	S	DRY-AIR	Soil	WIP	U	01-NOV-94	B3		01-NOV-94
L4349-04	Asarco, Inc.	S	DRY-AIR	Soil	WIP	U	01-NOV-94	D3		01-NOV-94

Comments:

L4349-01	Previously archived
L4349-02	Previously archived
L4349-03	Previously archived
L4349-04	Previously archived

17
SKB
2/22/95

ACZ LABORATORIES, INC.
SOIL PRE[illegible]RDRY
USDA No. [illegible]1972

WG6433.[illegible] [illegible]1/24/95 8:13 AM

Analyst: jb
Dept: 20
Analysis Date: 1/17/95
Start Time:
End Time:
Approved:
Approved:

Instrument: 0.00
Matrix Class: SOLID
List Type: I-SP-AIRDRY
List Function: PREP

Project:
SDG#:
SOP#:

Seq #	ACZ Lab Sample No.	Client/QC Sample ID	Air Dry								
1	L4349-01	Previous	17-Jan-95								
2	L4349-02	Previous	17-Jan-95								
3	L4349-03	Previous	17-Jan-95								
4	L4349-04	Previous	17-Jan-95								

Comments:

-1.qcfrm

000 18

ACZ LAPORATORIES, INC.
SOIL [-SIEVE60
ASA No.9 15-4.2.2

WG6554(_S 1/19/95 5:00 PM

Analyst: jb
Dept: 20
Analysis Date: 1/19/95
Start Time: 4:30p
End Time: 4:55p
Approved: JB
Approved: AS

RVP 1/23/95

19

Project:
SDG#:
SOP#:

Instrument: 0.00
Matrix Class: SOLID
List Type: I-SP-SIEVE60
List Function: PREP

#	ACZ Lab Sample No.	Client/QC Sample ID	Sieve 60								
1	L4349-01	Previous	19-Jan-95								
2	L4349-02	Previous									
3	L4349-03	Previous									
4	L4349-04	Previous									

Comments: upload 1-24-95 ... dr

-1.qcfrm

WORK GROUP REPORT (wk02)

Jan 19 1995, 04:17 pm

Work Group: WG6554 for Department: 20 Soil Preparation

Created: 19-JAN-95 Due: Operator: jb

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L4349-01	Asarco, Inc.	S	SIEVE-<60	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-02	Asarco, Inc.	S	SIEVE-<60	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-03	Asarco, Inc.	S	SIEVE-<60	Soil	WIP	U	25-JAN-95	03		23-APR-95
L4349-04	Asarco, Inc.	S	SIEVE-<60	Soil	WIP	U	25-JAN-95	03		23-APR-95

Comments:

L4349-01	Previously archived
L4349-02	Previously archived
L4349-03	Previously archived
L4349-04	Previously archived

ASARCO Incorporated — CHAIN OF CUSTODY — 13655 — No. 0517

California Gulch CERCLA Project
1019 Eighth Street, Suite 304, Golden, CO 80401
Phone: (303) 279-2645 FAX: (303) 279-7136

Attn: Sue Barkley
Project: 81347-485 Min Waste
Sampling Co.: Golder & Associates
Sampling Site: Leadville CO
Team Leader: Amy Golke

SAMPLE CONDITIONS

1. Packed by: ______ Seal # ______
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: ______
4. Sealed for Shipping by: G. SLIFKA
5. Initial Contents Temp.: 4 °C Seal # ______
6. Sampling Status: (Done) Continuing Until ______
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: ______ °C
9. Condition of Contents: ______

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
10-25-94	13:50	G-109-C-01C-941025	Soil	1	~~Ar~~ Method 1312	Archive
10-25-94	11:45	G-109-C-01A-941025	Soil	1	Total Pb	
10-25-94	13:50	G-109-C-01B-941025	SOIL	1	Total Pb	
10-25-94	0905	G-108-C-01A-941025	SOIL	1	Total Pb	
10-25-94	1050	G-108-C-01C-941025	SOIL	1	Method 1312	ARCHIVE
10-25-94	1050	G-108-C-01B-941025	SOIL	1	Total Pb	
10-25-94	1630	G-207-C-01C-941025	SOIL	1	Method 1312	Archive
10-25-94	1530	G-207-C-01A-941025	SOIL	1	Total Pb	
10-25-94	1630	G-207-C-01B-941025	SOIL	1	Total Pb	
10-25-94	1700	G-013-04-941025	WATER	1	Total Metals	Rinsate

Condition of Samples Upon Receipt
By ACZ Laboratories, Inc:
Temperature of Contents: 10 °C
Sample Containers: Intact
Custody Seals: NA

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Amy R. Golke	Gary A. Slifka	10-25-94	1900
2	Gary A. Slifka			0900
3				

SHIPPING DETAILS

Delivered to Shipper by: Hand
Method of Shipment: UPS – Red Airbill # 0424 9684 120
Received for Lab: B. Austin Signed: B. Austin Date/Time 10.27.94 1000
Lab Project No. AST213

AS..RCO Incorporated — **CHAIN OF CUSTODY** — No. (0518

California Gulch CERCLA Project
~~1010 Eighth Street, Suite 304, Golden, CO 80401~~ 748 County Rd 2A Leadville CO 80461
~~Phone: (303) 279-2645 FAX: (303) 279-7136~~

Attn: Sue Barkey

Project: 81347-485 - Mine Waste

Sampling Co.: Golder & Associates

Sampling Site: Leadville CO

Team Leader: Amy Colke

SAMPLE CONDITIONS

1. Packed by: ______ Seal # ______
2. Seal Intact Upon Receipt by Sampling Co.: Yes No
3. Condition of Contents: ______
4. Sealed for Shipping by: G. SLIFKA
5. Initial Contents Temp.: 4 °C Seal # ______
6. Sampling Status: (Done) Continuing Until ______
7. Seal Intact Upon Receipt by Laboratory: Yes No
8. Contents Temperature Upon Receipt by Lab: ______ °C
9. Condition of Contents: ______

Date	Time	Sample ID/Description	Sample Type	No. Containers	Analysis Parameters	Remarks
10-25-94	1755	G-013-C-01C-941025	SOIL	1	Method 1312	Archive
10-25-94	1700	G-013-C-01A-941025	SOIL	1	Total Pb	
10-25-94	1755	G-013-C-01B-941025	SOIL	1	Total Pb	
10-25-94	1755	G-013-C-02B-941025	SOIL	1	Total Pb	Duplicate
10-25-94	1755	G-013-C-02A-941025	SOIL	1	Total Pb	Duplicate
10-25-94	1755	G-013-C-MS-941025	SOIL	1		Matrix Spike

Condition of Samples Upon Receipt By ACZ Laboratories, Inc:
Temperature of Contents: 10 °C
Sample Containers: Intact
Custody Seals: NA

CUSTODY TRANSFERS PRIOR TO SHIPPING

	Relinquished by: (signed)	Received by: (signed)	Date	Time
1	Amy R. Colke	Gary A. Slifka	10/25/94	19:00
2	Gary A. Slifka		10/26/94	0900
3				

SHIPPING DETAILS

Delivered to Shipper by: Hand

Method of Shipment: UPS Red Airbill # 0424 9684 111

Received for Lab: B. Aurin Signed: B. Aurin Date/Time 102794 1000

Lab Project No. AST213

FORM 1
Inorganic Analysis Data Sheet
SIEVE ANALYSIS

Project: Asarco, Inc.
SDG #: AST214, AST215

Lab No.	Sample I.D.	Dry Sieve <0.075 mm %	Dry Sieve .075-.125mm %	Dry Sieve .125-.250mm %	Dry Sieve .250-.500mm %	Dry Sieve .500-.707mm %	Dry Sieve .707 - 2.00mm %	Dry Sieve 2.00-4.00mm %	Dry Sieve 4.00-9.50mm %
L3984-01	W-014-C-01-940829	21.41	5.68	6.53	5.50	2.56	8.44	13.67	20.91
L3984-02	W-015-C-01-940829	28.92	5.89	7.34	5.88	2.61	9.26	15.37	18.45
L3984-03	W-016-C-01-940830	27.63	4.91	5.34	5.59	2.81	9.14	11.41	16.53
L3984-04	W-017-C-01-940829	26.68	5.40	7.15	7.57	3.30	9.06	10.32	17.13
L3984-05	W-018-C-01-940830	32.41	4.74	5.53	6.35	3.03	10.38	10.22	13.46
L3984-06	W-019-C-01-940829	29.59	4.78	5.58	5.21	2.32	9.25	10.47	14.77
L3984-07	W-022-C-01-940831	30.74	5.10	6.83	8.74	5.00	12.50	14.95	11.38
L3984-08	W-024-C-01-940901	41.62	4.58	5.75	8.55	5.27	16.93	8.80	8.50
L3984-09	W-026-C-01-940831	73.29	5.68	7.29	7.61	3.64	9.65	15.50	14.63
L3984-10	W-027-C-01-940912	28.80	6.55	6.88	7.65	2.11	10.46	11.98	14.26
L3984-11	W-028-C-01-940912	39.92	6.93	6.30	6.00	3.34	10.95	10.73	7.89
L3984-12	W-032-C-01-940830	31.25	6.17	5.77	5.85	2.73	9.48	9.83	14.32
L3984-13	W-033-C-01-940913	67.65	5.78	4.78	4.54	2.70	7.83	13.22	11.34
L3984-14	W-035-C-01-940912	54.19	6.44	6.68	6.43	3.43	9.83	11.77	15.13
L3984-15	W-110-C-01-940901	23.96	4.36	6.12	5.49	2.83	7.30	13.84	25.54
L3984-16	W-111-C-01-940901	22.65	4.82	4.65	3.70	2.15	8.93	13.77	16.76
L3984-17	W-140-C-01-940912	25.81	4.99	5.21	5.00	2.98	11.88	13.90	25.78
L3984-18	W-340-C-01-940912C	29.10	8.70	8.98	8.00	4.13	13.50	12.76	12.51
L4349-01	G-013-C-01C-941025	21.48	6.67	9.50	8.59	2.86	8.79	11.24	17.04
L4349-02	G-108-C-01C-941025	22.65	6.23	5.71	4.05	2.10	8.81	9.17	17.62
L4349-03	G-109-C-01C-941025	18.63	4.62	5.81	4.57	2.12	7.83	10.59	16.69
L4349-04	G-207-C-01C-941025	21.38	6.51	9.14	8.78	3.13	8.57	6.53	17.66

Project Manager: [signature]
Date: 02/22/95

APPENDIX A.4

LABORATORY TEST DATA

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: _____ SAS No.: ______ SDG No.:AST215

SOW No.: 3/90___

EPA Sample No.	Lab Sample ID
G1081C941025	L4349-02
G1091C941025	L4349-03
G13C1C941025	L4349-01
G2071C941025	L4349-04

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before
application of background corrections ? Yes/No NO_

Comments:
____SAMPLES_IN_THIS_SDG_WERE_ANALYZED_FOR_1312_METALS.________

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susan K Barkey / Ralph V. Poulsen Name: Susan K. Barkey / Ralph V. Poulsen

Date: 02/22/95 / 02/22/95 Title: Project Manager / Vice Pres.

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

G1081C941025

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Matrix (soil/water): WATER Lab Sample ID: L4349-02

Level (low/med): LOW__ Date Received: 01/13/95

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	25.4			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

G1091C941025

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Matrix (soil/water): WATER Lab Sample ID: L4349-03

Level (low/med): LOW__ Date Received: 01/13/95

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	6.2			PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	48.5	B		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	25.5			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

FORM I - IN 7/88

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

G13C1C941025

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Matrix (soil/water): WATER Lab Sample ID: L4349-01

Level (low/med): LOW__ Date Received: 01/13/95

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	67.5			PM

Color Before: ______ Clarity Before: ______ Texture: ______

Color After: ______ Clarity After: ______ Artifacts: ______

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

G2071C941025

Lab Name: ACZ_LABORATORIES_INC._____ Contract: ASARCO_____

Lab Code: _______ Case No.: _______ SAS No.: _______ SDG No.: AST215

Matrix (soil/water): WATER Lab Sample ID: L4349-04

Level (low/med): LOW__ Date Received: 01/13/95

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-38-2	Arsenic	100	U		PM
7440-43-9	Cadmium	5.0	U		PM
7440-70-2	Calcium				NR
7439-89-6	Iron				NR
7439-92-1	Lead	20.0	U		PM
7439-95-4	Magnesium				NR
7440-66-6	Zinc	30.7			PM

Color Before: __________ Clarity Before: _______ Texture: _______

Color After: __________ Clarity After: _______ Artifacts: _______

Comments:

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Initial Calibration Source: II950116-3__

Continuing Calibration Source: II940126-3__

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	%R(1)	Continuing Calibration True	Continuing Calibration Found	%R(1)	Found	%R(1)	M
Aluminum									NR
Arsenic	1000.0	1020.00	102.0	5000.0	5100.00	102.0	5170.00	103.4	PM
Cadmium	1000.0	1040.00	104.0	2500.0	2550.00	102.0	2560.00	102.4	PM
Calcium									NR
‾ ‾on									NR
ad	1000.0	1040.00	104.0	5000.0	5100.00	102.0	5160.00	103.2	PM
Magnesium									NR
Zinc	1000.0	1040.00	104.0	2500.0	2550.00	102.0	2570.00	102.8	PM

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

U.S. EPA - CLP

2B

CRDL STANDARD FOR AA AND ICP

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

AA CRDL Standard Source: ____________

ICP CRDL Standard Source: II950209-1__

Concentration Units: ug/L

	CRDL Standard for AA			CRDL Standard for ICP				
					Initial		Final	
Analyte	True	Found	%R	True	Found	%R	Found	%R
Aluminum								
Arsenic				200.0	215.00	107.5	216.00	108.0
Cadmium				10.0	13.40	134.0	11.10	111.0
Calcium								
Iron								
Lead				40.0	48.30	120.7	41.10	102.7
Magnesium								
Zinc				40.0	43.50	108.7	43.60	109.0

U.S. EPA - CLP

3
BLANKS

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: _______ Case No.: _______ SAS No.: _______ SDG No.: AST215

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Preparation Blank	C	M
Aluminum											NR
Arsenic	100.0	U	100.0	U	100.0	U			100.000	U	PM
Cadmium	5.0	U	5.0	U	5.0	U			5.000	U	PM
Calcium											NR
Iron											NR
Lead	20.0	U	20.0	U	20.0	U			20.000	U	PM
Magnesium											NR
Zinc	10.0	U	10.0	U	10.0	U			15.000	B	PM

U.S. EPA - CLP

4

ICP INTERFERENCE CHECK SAMPLE

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No: ______ SDG No.: AST215

ICP ID Number: ICP-1_______ ICS Source: II950209-2__

Concentration Units: ug/L

Analyte	True Sol. A	True Sol. AB	Initial Found Sol. A	Initial Found Sol. AB	Initial Found %R	Final Found Sol. A	Final Found Sol. AB	Final Found %R
Aluminum	500000	500000	476000	473000.0	94.6	485000	484000.0	96.8
Arsenic		1000		913.0	91.3		921.0	92.1
Cadmium		1000		895.0	89.5		905.0	90.5
Calcium	500000	500000	481000	476000.0	95.2	490000	487000.0	97.4
Iron	200000	200000	179000	177000.0	88.5	181000	180000.0	90.0
Lead		1000		897.0	89.7		915.0	91.5
Magnesium	500000	500000	474000	469000.0	93.8	481000	478000.0	95.6
Zinc		1000		915.0	91.5		937.0	93.7

U.S. EPA - CLP

5A
SPIKE SAMPLE RECOVERY

EPA SAMPLE NO.

G2071C941025

Lab Name: ACZ_LABORATORIES_INC._____ Contract: ASARCO____

Lab Code: _______ Case No.: ______ SAS No.: _______ SDG No.: AST215

Matrix (soil/water): WATER_ Level (low/med): LOW___

% Solids for Sample: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

Analyte	Control Limit %R	Spiked Sample Result (SSR)	C	Sample Result (SR)	C	Spike Added (SA)	%R	Q	M
Aluminum									NR
Arsenic	75-125	2050.0000		100.0000	U	2000.00	102.5		PM
Cadmium	75-125	51.3000		5.0000	U	50.00	102.6		PM
Calcium									NR
Iron									NR
Lead	75-125	537.0000		20.0000	U	500.00	107.4		PM
Magnesium									NR
Zinc	75-125	550.0000		30.7000		500.00	103.9		PM

Comments:

U.S. EPA - CLP

6
DUPLICATES

EPA SAMPLE NO.

G2071C941025

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Matrix (soil/water): WATER Level (low/med): _LOW__

% Solids for Sample: __0.0 % Solids for Duplicate: ___0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum								NR
Arsenic		100.0000	U	100.0000	U			PM
Cadmium		5.0000	U	5.0000	U			PM
Calcium								NR
Iron								NR
Lead		20.0000	U	20.0000	U			PM
Magnesium								NR
Zinc	20.0	30.7000		22.2000		32.1		PM

U.S. EPA - CLP

9

ICP SERIAL DILUTION

EPA SAMPLE NO.

G2071C941025

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

Matrix (soil/water): WATER Level (low/med): LOW__

Concentration Units: ug/L

Analyte	Initial Sample Result (I)	C	Serial Dilution Result (S)	C	% Difference	Q	M
Aluminum							NR
Arsenic	100.00	U	500.00	U			PM
Cadmium	5.00	U	25.00	U			PM
Calcium							NR
Iron							NR
Lead	20.00	U	100.00	U			PM
Magnesium							NR
Zinc	30.70		50.00	U	100.0		PM

U.S. EPA - CLP

10

Instrument Detection Limits (Quarterly)

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: _______ Case No.: _______ SAS No.: _______ SDG No.: AST215

ICP ID Number: ICP-1_______ Date: 12/31/94

Flame AA ID Number : ____________

Furnace AA ID Number : ____________

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum	308.21		200	50.0	PM
Arsenic	193.70		10	100.0	PM
Cadmium	226.50		5	5.0	PM
Calcium	315.89		5000	1000.0	PM
Iron	259.44		100	20.0	PM
Lead	220.35		100	20.0	PM
Magnesium	279.08		5000	1000.0	PM
Zinc	213.86		20	10.0	PM

Comments:

U.S. EPA - CLP

11A

ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

ICP ID Number: ICP-1_______ Date: 04/14/94

Analyte	Wave-length (nm)	Interelement Correction Factors for : Al	Ca	Fe	Mg	CR_
Aluminum	308.21	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	193.70	0.0032100	0.0000000	0.0003160	0.0000000	0.0012800
Cadmium	226.50	0.0000100	0.0000000	0.0001700	0.0000000	-0.0000260
Calcium	315.89	0.0000000	0.0000000	0.0000000	0.0000000	0.0002800
Iron	259.44	0.0000550	0.0000000	0.0000000	0.0002580	0.0000960
Lead	220.35	0.0005960	0.0000000	0.0001220	0.0000000	0.0000000
Magnesium	279.08	0.0000000	0.0000000	0.0000000	0.0000000	-0.0000840
Zinc	213.86	0.0000000	0.0000000	0.0000820	0.0000000	0.0000090

Comments:

U.S. EPA - CLP

11B

ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

ICP ID Number: ICP-1_______ Date: 04/14/94

Analyte	Wave-length (nm)	Interelement Correction Factors for : CU_	MN_	NI_	ZN_	___
Aluminum_	_308.21__	_0.0000000	_0.0010800_	_0.0000940	_0.0000000	
Arsenic__	_193.70__	_0.0000000	_0.0001740_	_0.0007866	_0.0000000	
Cadmium__	_226.50__	-0.0000060	_0.0000000_	-0.0004370	_0.0000000	
Calcium__	_315.89__	_0.0000000	_0.0000000_	_0.0000000	_0.0000000	
Iron_____	_259.44__	_0.0000000	_0.0000000_	_0.0000000	_0.0000000	
Lead_____	_220.35__	-0.0000390	_0.0000800_	_0.0002880	_0.0000000	
Magnesium	_279.08__	_0.0000000	-0.0033000_	_0.0000000	_0.0000000	
Zinc_____	_213.86__	_0.0000000	-0.0000600_	_0.0034300	_0.0000000	

Comments:

U.S. EPA - CLP

12

ICP LINEAR RANGES (QUARTERLY)

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.: AST215

ICP ID Number: ICP-1_______ Date: 08/31/94

Analyte	Integ. Time (sec.)	Concentration (ug/L)	M
Aluminum	5.00	600000.0	PM
Arsenic	5.00	100000.0	PM
Cadmium	5.00	100000.0	PM
Calcium	5.00	1500000.0	PM
Iron	5.00	200000.0	PM
Lead	5.00	100000.0	PM
Magnesium	5.00	100000.0	PM
Zinc	5.00	100000.0	PM

Comments:

U.S. EPA - CLP

14
ANALYSIS RUN LOG

Lab Name: ACZ_LABORATORIES_INC.____ Contract: ASARCO____

Lab Code: ______ Case No.: ______ SAS No.: ______ SDG No.:AST215

Instrument ID Number: ICP-1________ Method: PM

Start Date: 02/14/95 End Date: 02/14/95

EPA Sample No.	D/F	Time	% R	AL	AS	CD	CA	FE	PB	MG	ZN
S0	1.00	1644			X	X			X		X
S1	1.00	1647			X	X			X		X
ICV	1.00	1649			X	X			X		X
ICB	1.00	1652			X	X			X		X
ICSA	1.00	1655		X			X	X		X	
ICSAB	1.00	1658		X	X	X	X	X	X	X	X
ZZZZZZ	1.00	1702									
CRI	1.00	1705			X	X			X		X
[illegible]	1.00	1708			X	X			X		X
[illegible]C1C94	1.00	1711			X	X			X		X
G1081C94	1.00	1714			X	X			X		X
G1091C94	1.00	1718			X	X			X		X
G2071C94	1.00	1721			X	X			X		X
G2071C94	1.00	1724			X	X			X		X
CCV	1.00	1727			X	X			X		X
CCB	1.00	1730			X	X			X		X
G2071C94	1.00	1734			X	X			X		X
G2071C94	1.00	1737			X	X			X		X
ICSA	1.00	1740		X			X	X		X	
ICSAB	1.00	1743		X	X	X	X	X	X	X	X
ZZZZZZ	1.00	1746									
CRI	1.00	1750			X	X			X		X
CCV	1.00	1753			X	X			X		X
CCB	1.00	1756			X	X			X		X

ACZ LABORATORIES, INC.
ICP SAMPLE PROTOCOL/METHOD 200.7 CLP-M
1312 Metals

ANALYST: FD
DATE: 2/14/95
Start Time: 16:46
End Time: 17:59

PROJECT: Asarco
SDG #: AST215
SOP #:
INSTR.: ICP#1
FILE #: AST 215
Approved:
Approved: RVP 2/1

SAMPLE ID		LAB NO.		DF
CAL BLK S0				
CALSTD S1				
ICV				
ICB				
ICSA				
ICSAB				
WASH BLANK				
CRII				
PBW		Type I H2O		1
G-013-C-01C-941025		L4349-01		1
~~G-013-C-01C-941025D~~		~~L4349-01D~~		—
G-108-C-01C-941025		L4349-02		1
G-109-C-01C-941025		L4349-03		1
G-207-C-01C-941025		L4349-04 ← L4349-04 DUP 1		
CCV				
CCB				
G-207-C-01C-941025L		L4349-04L		5
G-207-C-01C-941025S		L4349-04S		1
ICSAF				
ICSABF				
WASH BLANK				
CRIF				
CCV				
CCB				

SAMPLE ID		LAB NO.		DF

Analyze for: As, Cd, Pb, Zn

Spike
Spike Sol. SCN =
Spike Sol. ml =
Sample ml =
SV mg/L =

ANALYST: FP
DATE: 2/14/95

ACZ LABORATORIES, INC.
Standards/Reagents Information
Spectrophotometer, Method EPA 200.7

PROJECT: ASARCO
SDG # AST215
SOP #

INSTR:
FILE #:

Approved:
Approved:

CALIBRATION REAGENTS

CALSTD: IF950208-1 SCN
ICV: IF950116-3 SCN
CCV: IF950126-3 SCN

ICSA: IF950116-4 SCN
ICSAB: IF950209-2 SCN
CRDL: IF950204-1 SCN

CALBLK/CCB PREP: 100 ml nitric acid, 50 ml hydrochloric acid. Q.S. to 1 liter with type 1 water.

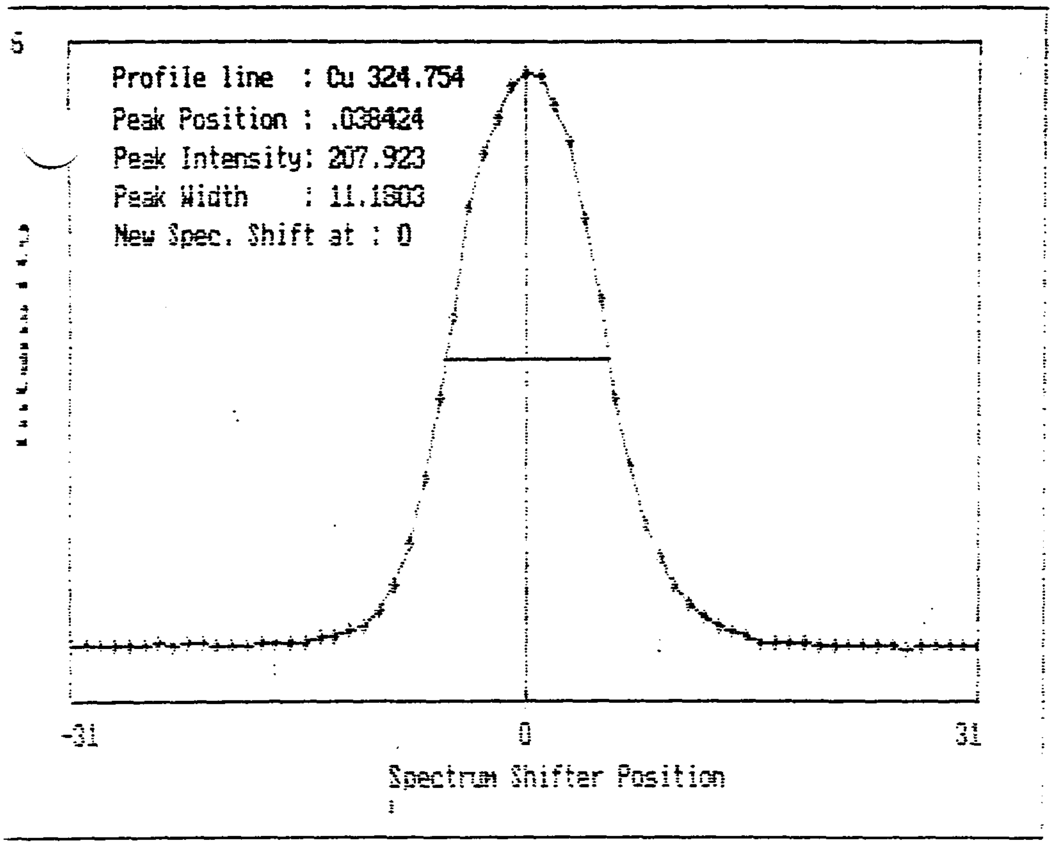
NITRIC ACID: 1236 PCN

HYDROCHLORIC ACID: 1376 PCN

SPIKE: (For post digested samples.)

Spike Sol. #1: ______ SCN
Spike Sol. #2: ______ SCN
Spike Sol. ml : ______
Sample ml : ______

COMMENTS:
Spike made at Extraction.


5
Profile line : Cu 324.754
Peak Position : .038424
Peak Intensity: 207.923
Peak Width : 11.1803
New Spec. Shift at : 0
-31
0
31
Spectrum Shifter Position

2/14

Method: TLCLP Standard: CLPTBLK

Elem	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
Avge	-.023	.024	-.009	.001	.000	.002	-.138
SDev	.002	.000	.000	.000	.000	.000	.000
%RSD	8.53	.582	4.56	15.7	141.	6.73	.307
#1	-.022	.024	-.009	.001	.000	.002	-.138
#2	-.025	.024	-.010	.001	.000	.002	-.139

Elem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
Avge	.000	-.000	.001	.001	.001	-.002	.001
SDev	.001	.000	.000	.000	.000	.003	.000
%RSD	.000	141.	20.2	10.9	.000	141.	38.6
#1	.000	.000	.001	.001	.001	.000	.001
#2	-.000	-.000	.001	.001	.001	-.004	.001

Elem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
Avge	.000	.002	.012	.004	.001	-.002	-.005
SDev	.000	.000	.000	.000	.000	.001	.001
%RSD	.000	15.7	3.69	3.45	47.1	51.4	18.4
#1	.000	.002	.012	.004	.001	-.003	-.005
#2	.000	.002	.011	.004	.001	-.001	-.004

Elem	Si02	Sr4215	Tl3775	U_2924	Zn2138
Avge	.004	-.000	.000	.000	.004
SDev	.001	.000	.000	.000	.000
%RSD	18.1	.000	.000	141.	6.73
#1	.003	-.000	.000	.000	.004
#2	.004	-.000	.000	.000	.004

ethod: TLCLP Standard: CLPTSTD

Elem	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
Avge	2.51	2.21	2.16	.460	1.92	1.32	9.97
SDev	.01	.01	.01	.001	.00	.01	.06
%RSD	.389	.454	.360	.307	.257	.514	.566
#1	2.50	2.20	2.15	.459	1.92	1.32	9.93
#2	2.52	2.22	2.17	.461	1.93	1.33	10.0

Elem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
Avge	.772	.255	.392	.371	1.57	.390	4.41
SDev	.003	.002	.000	.001	.00	.001	.01
%RSD	.440	.610	.000	.228	.279	.145	.314
#1	.770	.254	.392	.371	1.57	.391	4.40
#2	.774	.256	.392	.372	1.58	.390	4.42

Elem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
Avge	.192	.476	8.85	.638	.166	1.37	1.22
SDev	.001	.003	.01	.002	.003	.01	.00
%RSD	.442	.624	.131	.377	1.53	.579	.104
#1	.191	.474	8.84	.637	.164	1.36	1.22
#2	.192	.478	8.86	.640	.168	1.37	1.22

Elem	SiO2	Sr4215	Tl3775	V_2924	Zn2138
Avge	2.58	2.94	.515	.497	1.28
SDev	.01	.01	.000	.002	.01
%RSD	.449	.274	.055	.342	.606
#1	2.57	2.94	.515	.495	1.28
#2	2.59	2.95	.515	.498	1.29

000 22

ethod: TLCLP Sample Name: ICV Operator: FP
in Time: 02/14/95 16:49:17
omment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1020.	991.	1020.	1020.	1040.	973.	51500.
Dev	2.	1.	7.	6.	2.	1.	177.
RSD	.239	.130	.643	.541	.170	.066	.344
1	1020.	992.	1030.	1020.	1040.	973.	51600.
2	1020.	990.	1020.	1030.	1040.	973.	51400.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	1000.	1000.	1000.	1000.	1000.	51000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1040.	1000.	1030.	1020.	1020.	60800.	51900.
Dev	3.	7.	9.	1.	4.	821.	10.
RSD	.248	.662	.840	.075	.352	1.35	.019
1	1040.	1000.	1040.	1020.	1030.	61400.	51900.
2	1030.	1010.	1030.	1020.	1020.	60200.	51900.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	1000.	1000.	1000.	1000.	60000.	51000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1030.	1020.	50500.	1010.	1040.	1040.	1010.
Dev	1.	2.	115.	[illegible]	15.	15.	35.
RSD	.144	.235	.228	.044	1.5[illegible]	1.48	3.43
1	1030.	1020.	50600.	1010.	1050.	1060.	1030.
2	1030.	1020.	50400.	1010.	1020.	1030.	985.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	1000.	51000.	1000.	1000.	1000.	1000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

em	Si32	Sr4215	Ti3775	V_2924	Zn2138
its	ug/l	ug/l	ug/l	ug/l	ug/l
ge	22700.	1000.	932.	1000.	1040.
Dev	35.	1.	19.	1.	3.
RSD	.152	.125	2.08	.057	.301
1	22700.	1000.	918.	1000.	1040.
2	22700.	1000.	946.	1010.	1040.
rors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	22500.	1000.	1000.	1000.	1000.
e	10.5	10.5	21.0	10.5	10.5

2

ethod: TLCLP   Sample Name: ICB   Operator: FP
un Time: 02/14/95 16:52:31
omment: AST 215 1315
ode: CONC   Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.626	-4.58	8.91	2.61	-.208	.457	15.3
Dev	.445	5.82	2.67	.62	.147	.000	1.4
RSD	71.2	127.	30.0	23.6	70.7	.000	9.12
#1	.311	-8.69	10.8	3.04	-.312	.457	14.3
#2	.940	-.464	7.02	2.17	-.104	.457	16.3
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	10.0	200.	100.	40.0	200.	5.00	1000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.519	2.35	3.07	2.17	-.637	31.9	6.80
Dev	1.47	3.32	2.17	2.30	.900	298.	1.60
RSD	283.	141.	70.7	106.	141.	933.	23.5
1	-.519	4.70	4.60	.541	-.001	242.	5.67
2	1.56	-.000	1.54	3.79	-1.27	-179.	7.93
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	5.00	50.0	10.0	25.0	100.	1000.	1000.

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-1.04	.840	6.79	-1.89	.003	1.07	23.7
Dev	1.48	.004	.80	.45	5.16	2.57	28.8
RSD	141.	.460	11.8	23.6	150000.	240.	122.
1	-.000	.837	6.22	-1.56	-3.64	2.88	44.0
2	-2.09	.843	7.36	-2.21	3.65	-.748	3.36
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	15.0	100.	1000.	40.0	20.0	60.0	100.

lem	[illegible]	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	7.84	.340	9.81	-1.21	-.003
Dev	23.2	.096	30.4	.00	.438
RSD	296.	28.3	310.	.009	15300.
1	-8.56	.408	-11.7	-1.21	-.312
2	24.2	.272	31.5	-1.21	.307
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000
ange	200.	10.0	300.	50.0	20.0

alysis Report QC Standard Tue 02-14-95 04:58:53 PM

thod: TLCLP Sample Name: ICSAI Operator: FP
n Time: 02/14/95 16:55:45
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	3.68	476000.	-63.1	8.32	-.408	.311	481000.
Dev	.56	3533.	137.7	1.63	.025	.214	3053.
RSD	15.2	.742	218.	19.6	6.18	68.9	.635
1	4.08	474000.	-160.	7.17	-.390	.462	479000.
2	3.29	479000.	34.2	9.47	-.426	.159	483000.
rrors	NOCHECK	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass
alue		500000.					500000.
ange		20.5					20.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.552	-2.74	4.37	-47.7	179000.	38.3	474000.
Dev	.747	4.45	7.19	1.8	1399.	234.	3048.
RSD	135.	162.	165.	3.76	.784	613.	.642
1	.023	-5.88	9.45	-46.4	178000.	204.	472000.
2	1.08	.408	-.714	-49.0	180000.	-128.	477000
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass	NOCHECK	QC Pass
alue					200000.		500000.
e					20.5		20.5

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-6.04	-1.87	11.3	-4.62	-.430	-7.80	22.7
Dev	1.31	1.17	.8	3.99	7.449	27.64	116.
RSD	21.7	62.6	7.07	86.5	1730	354.	511.
1	-6.96	-1.04	10.8	-1.79	4.84	-27.3	105.
2	-5.11	-2.70	11.9	-7.44	-5.70	11.7	-59.3
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	Si02	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-7.07	-.289	-60.2	-4.79	3.01
Dev	14.00	.052	54.9	.70	.68
RSD	198.	17.9	91.2	14.5	22.4
1	-17.0	-.253	-99.1	-4.30	2.53
2	2.83	-.326	-21.4	-5.28	3.49
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue					
e					

ethod: TLCLP Sample Name: ICSABI Operator: FP
n Time: 02/14/95 16:58:59
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	938.	473000.	913.	934.	470.	456.	476000.
Dev	1.	2329.	2.	7.	2.	2.	2260.
RSD	.155	.492	.188	.752	.435	.518	.475
1	937.	472000.	915.	929.	468.	454.	474000.
2	939.	475000.	912.	939.	471.	457.	477000.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	500000.	1000.	1000.	500.	500.	500000.
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	895.	434.	445.	430.	177000.	48800.	469000.
Dev	2.	11.	1.	3.	908.	81.	1949.
RSD	.179	2.55	.169	.673	.514	.166	.416
1	894.	427.	445.	428.	176000.	48800.	467000.
2	896.	442.	446.	432.	177000.	48900.	470000.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	500.	500.	500.	200000.	50000.	500000.
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
age	446.	892.	48200.	871.	897.	936.	957.
Dev	.	7.	155.	3.	.	21.	4
RSD	.024	.805	.322	.360	.024	2.24	[illegible]
1	446.	887.	48100.	868.	896.	921.	960.
2	446.	897.	48300.	873.	897.	951.	954.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	500.	1000.	50000.	1000.	1000.	1000.	1000.
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

lem	Si02	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
age	10600.	937.	859.	438.	915.
Dev	111.	4.	13.	2.	6.
RSD	1.04	.478	1.56	.502	.663
1	10500.	935.	849.	436.	911.
2	10700.	940.	868.	439.	919.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	10700.	1000.	1000.	500.	1000.
e	20.5	20.5	20.5	20.5	20.5

ethod: TLCLP Sample Name: WASH Operator: FP
un Time: 02/14/95 17:02:10
omment: AST 215 1315
ode: CONC Corr. Factor: 1

[illegible]	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.308	90.9	7.38	3.06	-.001	.307	126.
Dev	.668	3.9	2.62	.00	.147	.215	10.
RSD	217.	4.27	35.5	.046	17600.	70.1	8.35
1	.780	88.2	5.53	3.06	.103	.155	133.
2	-.164	93.7	9.23	3.06	-.105	.458	118.
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-.272	-1.57	2.56	1.62	46.4	63.8	111.
Dev	1.100	.00	5.79	1.53	.9	361.	8.
RSD	405.	.087	226.	94.7	1.94	566.	7.22
1	-1.05	-1.57	6.65	2.70	45.8	319.	117.
2	.506	-1.57	-1.53	.534	47.1	-191.	105
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
nge							

tem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
ge	-.005	-.850	26.0	-2.52	-.060	8.73	[illegible]
ev	.001	.011	2.4	4.01	1.721	.04	57.5
SD	17.0	1.24	9.22	159.	2860.	.415	[illegible]
	-.006	-.857	27.7	.316	1.16	8.70	40.7
	-.005	-.842	24.5	-5.56	-1.28	8.75	-7.25
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
nge							

em	Si02	Sr4215	Tl3775	V_2924	Zn2138
its	ug/l	ug/l	ug/l	ug/l	ug/l
ge	9.17	.406	17.7	-2.02	.625
eu	20.9	.192	30.5	.00	.021
SD	227.	47.3	221.	.020	3.27
	23.9	.541	35.1	-2.02	.611
	-5.58	.270	-7.70	-2.02	.640
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue					
e					

ethod: TLCLP   Sample Name: CRI   Operator: FP
un Time: 02/14/95 17:05:22
omment: AST 215 1315
ode: CONC   Corr. Factor: 1

n	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	21.9	425.	215.	43.6	413.	10.2	58.4
SDev	1.1	6.	1.	.6	3.	.2	9.1
RSD	5.11	1.37	.273	1.41	.747	2.09	15.6
#1	21.1	421.	215.	44.0	415.	10.0	51.9
#2	22.7	429.	215.	43.1	411.	10.3	64.8
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
alue	20.0	400.	200.	40.0	400.	10.0	
ange	50.0	50.0	50.0	50.0	50.0	50.0	

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	13.4	110.	22.4	52.5	230.	51.0	36.4
SDev	.7	3.	2.2	.0	1.	252.	1.6
RSD	5.47	3.01	9.71	.000	.391	495.	4.41
#1	14.0	108.	23.9	52.5	229.	230.	35.3
#2	12.9	113.	20.8	52.5	230.	-128.	37.5
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK	NOCHECK
alue	10.0	100.	20.0	50.0	200.		
ange	50.0	50.0	50.0	50.0	50.0		

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	33.4	105.	30.6	79.8	48.3	131.	225
Dev	.0	1.	2.4	1.8	1.7	2.	14
RSD	.001	.565	7.66	2.25	3.56	1.56	6.[illegible]
#1	33.4	106.	32.3	81.0	49.6	132.	255
#2	33.4	105.	28.9	78.5	47.1	129	215.
rrors	QC Pass	QC Pass	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
alue	30.0	100.		80.0	40.0	120.	200
ange	50.0	50.0		50.0	50.0	50.0	50.0

lem	Si[illegible]	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	474.	21.2	660.	102.	43.5
Dev	14.	.2	19.	2.	.2
RSD	3.04	.907	2.93	1.68	.500
#1	464.	21.3	646.	100.	43.6
#2	484.	21.1	674.	103.	43.3
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	428.	20.0	600.	100.	40.0
ge	50.0	50.0	50.0	50.0	50.0

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ethod: TLCLP Sample Name: PBW Operator: FP
un Time: 02/14/95 17:08:33
omment: AST 215 1315
ode: CONC Corr. Factor: 1

Elem	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Avge	1.33	53.0	9.95	3.05	.831	.154	72.2
SDev	.11	7.1	11.2	1.23	.147	.428	16.1
%RSD	8.05	13.4	113.	40.3	17.7	279.	22.3
#1	1.26	48.0	17.9	3.92	.935	.456	60.8
#2	1.41	58.0	2.01	2.18	.727	-.149	83.6
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	5000.	600000.	50000.	25000.	25000.	25000.	800000.
Low	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.

Elem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Avge	1.29	.783	2.56	-.003	13.4	76.5	30.6
SDev	1.10	1.11	.00	.766	2.7	343.	6.4
%RSD	85.0	141.	.063	29900.	20.2	448.	21.0
#1	.517	1.57	2.56	.539	11.5	319.	26.1
#2	2.07	-.000	2.56	-.544	15.3	-166.	35.2
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	25000.	100000.	100000	50000.	500000.	1000000.	1000000.
Low	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.

Elem	Mn[illegible]	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Avge	-.001	-.427	82.6	-2.52	6.05	8.37	24.[illegible]
SDev	.000	.598	.8	.45	.00	2.59	35.9
%RSD	18.5	140.	.969	17.7	.075	30.9	151.
#1	-.002	-.004	83.2	-2.21	6.05	10.2	50.6
#2	-.005	-.850	82.1	-2.84	6.05	6.54	-1.65
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	50000.	50000.	800000.	50000.	100000.	100000.	100000.
Low	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.

Elem	S[illegible]	Sr4215	Tl3775	V_2924	Zn2138
Units	ug/l	ug/l	ug/l	ug/l	ug/l
Avge	113.	.475	41.1	-1.21	15.0
SDev	14.	.096	13.8	1.14	.7
%RSD	12.6	20.5	33.7	94.2	4.49
#1	123.	.543	31.3	-.405	14.5
#2	103.	.406	50.8	-2.02	15.5
Errors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
High	214000.	10000.	100000.	100000.	50000.
Low	-500.	-50.0	-1000.	-50.0	-20.0

thod: TLCLP Sample Name:L4349-01 Operator: FP
in Time: 02/14/95 17:11:45
mment: AST 215 1315
de: CONC Corr. Factor: 1

/G-013-~~AT~~-C-01C-941025
SKB 2/20/95

n	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	-.478	281.	7.50	7.44	29.2	.001	8340.
Dev	.668	5.	2.02	.00	.0	.215	3.
RSD	140.	1.84	26.9	.016	.000	31700.	.042
1	-.950	285.	6.08	7.44	29.2	.153	8350.
2	-.006	277.	8.93	7.45	29.2	-.151	8340.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.
lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	1.77	1.57	1.54	-.646	165.	1490.	1590.
Dev	.37	.00	5.79	.000	.	361.	14.
RSD	20.7	.087	376.	.069	.001	24.2	.910
1	1.51	1.57	5.63	-.646	165.	1750.	1580.
2	2.03	1.57	-2.55	-.646	165.	1240.	1600.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.
lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	29.2	.930	535.	-5.04	-.193	6.53	4.49
Dev	.0	.010	2.	.47	8.597	4.17	[illegible]
RSD	.001	1.23	.459	8.85	4460.	63.9	[illegible]
1	29.2	.823	525.	-4.72	5.89	3.58	-15.9
2	29.2	.838	521.	-5.35	-6.27	9.47	24.9
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100	-60.0	-200.
lem	Si02	Sr4215	Ti3775	V_2924	Zn2138		
nits	ug/l	ug/l	ug/l	ug/l	ug/l		
uge	4270.	11.7	2.13	-.480	67.5		
Dev	21.	.2	22.1	.000	.4		
RSD	.489	1.64	1040.	.084	.665		
1	4280.	11.8	17.7	-.480	67.2		
2	4250.	11.5	-13.5	-.480	67.8		
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass		
igh	214000.	10000.	100000.	100000.	50000.		
	-500.	-50.0	-1000.	-50.0	-20.0		

alysis Report Tue 02-14-95 05:18:04 PM

ethod: TLCLP Sample Name: L4349-02 / G-108-C-01C-941025 Operator: FP
n Time: 02/14/95 17:14:57
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1.02	158.	27.4	10.9	42.2	.153	9220.
Dev	1.22	3.	1.3	1.2	.1	.000	25.
RSD	120.	1.63	4.88	11.3	.348	.000	.273
1	1.89	160.	26.5	11.8	42.1	.153	9210.
2	.155	156.	28.4	10.0	42.3	.153	9240.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-1.05	-.001	6.65	2.00	62.0	1810.	2600.
Dev	.73	2.217	2.89	.76	1.8	271.	13.
RSD	69.7	251000.	43.5	38.3	2.90	14.9	.493
1	-.534	-1.57	8.70	2.54	63.2	2000.	2610.
2	-1.57	1.57	4.61	1.46	60.7	1620.	2590.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
ow	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.

	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	8.29	1.65	634.	-1.2[illegible]	4.76	13.1	14.3
Dev	.00	.01	8.	1.34	5.16	2.1	15.0
RSD	.008	.319	1.16	10[illegible].	108.	15.9	105.
1	8.29	1.65	640.	-.314	8.41	11.6	3.66
2	8.29	1.66	629.	-2.21	1.12	14.6	24.9
rors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.

lem	[illegible]	Sr4215	Ti3[illegible]75	V_2[illegible]24	Zn2138
its	ug/l	ug/l	ug/l	ug/l	ug/l
ge	49[illegible].	16.2	25.4	-.431	[illegible]
Dev	56.	.0	47.7	.000	[illegible]
SD	1.12	.005	1[illegible]6.	.024	2.[illegible]1
1	5030.	16.2	60.5	-.431	25.8
2	4950.	16.2	-9.77	-.431	24.9
rors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
gh	214000.	10000.	100000.	100000.	50000.
	-500.	-50.0	-1000.	-50.0	-20.0

-thod: TLCLP Sample Name: L4349-03 / G-109-C-01C-941025 Operator: FP
n Time: 02/14/95 17:18:08
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.941	172.	18.5	7.41	191.	-.151	10000.
Dev	1.56	5.	6.0	.00	2.	.001	8.
RSD	165.	2.62	32.2	.019	.848	.535	.084
1	2.04	176.	14.3	7.41	189.	-.150	10000.
2	-.159	169.	22.7	7.41	192.	-.151	10000.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.
lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	6.22	.783	4.61	1.43	42.8	1730.	2990.
Dev	.73	1.11	4.34	1.53	1.8	307.	10.
RSD	11.8	141.	94.2	107.	4.20	17.7	.322
1	5.70	1.57	7.67	2.51	41.5	1950.	2980.
2	6.74	.000	1.54	.347	44.1	1520.	3000.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
ow	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.
lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	2.02	.806	1090.	-4.73	48.5	8.72	18.5
Dev	.00	.008	25.	.89	5.2	7.20	13.8
RSD	.020	.956	2.28	18.9	[illegible]	82.5	75.5
1	2.02	.800	1070.	-4.10	52.2	13.8	8.47
2	2.02	.811	1110.	-5.35	44.9	3.63	28.0
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.
lem	[illegible]	Sr4215	Tl3775	V_2924	Zn2138		
nits	ug/l	ug/l	ug/l	ug/l	ug/l		
vge	4230.	30.0	-5.95	-.870	25.5		
Dev	19.	.4	22.07	.570	.5		
RSD	.442	1.28	371.	64.1	1.76		
1	4220.	29.7	9.65	-1.29	25.2		
2	4240.	30.3	-21.6	-.486	25.9		
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass		
igh	214000.	10000.	100000.	100000.	50000.		
ow	-500.	-50.0	-1000.	-50.0	-20.0		

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alysis Report   Tue 02-14-95 09:24:27 PM   page 1

ethod: TLCLP   Sample Name: L4349-04 / G-207-C-DIC-941025   Operator: FP
un Time: 02/14/95 17:21:20
mment: AST 215 1315
de: CONC   Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.315	430.	18.2	7.89	28.4	-.001	7130.
Dev	1.56	5.	6.6	1.85	.3	.216	24.
RSD	495.	1.20	36.5	23.4	1.04	20800.	.334
1	-.788	426.	22.9	6.59	28.2	.151	7140.
2	1.42	433.	13.5	9.20	28.6	-.153	7110.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.
lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1.50	-2.35	2.56	2.02	219.	1980.	2120.
Dev	.73	1.11	1.45	.77	2.	189.	16.
RSD	49.0	47.2	56.4	37.9	.824	9.55	.758
1	.779	-1.57	1.54	1.48	217.	2120.	2130.
2	2.02	-3.15	3.59	2.56	220.	1850.	2100.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000
ow	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.
lem	Mn257x	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	[illegible]	4.21	1180.	-6.50	18.0	9.44	23.5
Dev	[illegible]	1.20	18	1.34	6.9	5.16	4.6
RSD	[illegible]	28.5	1.56	21.2	38.3	54.7	[illegible]
1	16.5	5.05	1170.	-7.25	13.1	5.79	20.2
2	16.6	3.36	1190.	-5.55	22.8	13.1	26.7
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.
lem	[illegible]	Sr4215	Tl3775	V_2924	Zn2138		
nits	ug/l	ug/l	ug/l	ug/l	ug/l		
vge	[illegible]	15.3	22.1	.734	30.7		
Dev	7.	.1	55.2	.570	.2		
RSD	.101	.625	250.	77.7	.699		
1	7060.	15.4	-17.0	.331	30.6		
2	7070.	15.2	61.1	1.14	30.9		
rors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass		
igh	214000.	10000.	100000.	100000.	50000.		
	-500.	-50.0	-1000.	-50.0	-20.0		

ethod: TLCLP Sample Name: L4349-04D /G-207-C-01C-941025D Operator: FP
un Time: 02/14/95 17:24:31
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	1.02	227.	16.2	5.69	24.9	.151	7810.
Dev	.56	.	1.9	1.23	.1	.427	62.
.RSD	55.0	.006	12.0	21.7	.589	283.	.797
=1	1.42	227.	17.6	6.56	24.8	.453	7760.
=2	.626	227.	14.9	4.82	25.0	-.151	7850.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
cw	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	.490	-1.57	5.63	2.61	110.	1200.	1570.
Dev	3.67	4.43	2.90	1.53	1.	234.	24.
.RSD	749.	283.	51.4	58.7	.822	19.6	1.54
=1	-2.10	1.57	3.58	1.52	110.	1360.	1550.
=	3.08	-4.70	7.68	3.69	109.	1030.	1580.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
w	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.

em	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se[illegible]
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
ge	[illegible]	2.09	607.	2.21	14.4	12.0	[illegible]
Dev	[illegible]	.60	10.	.00	1.7	15.0	[illegible]
RSD	[illegible]	28.9	1.71	.012	11.9	125.	[illegible]
1	16.7	2.52	599.	2.21	15.7	22.6	34.8
2	16.7	1.66	614.	2.21	13.2	1.39	.506
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	[illegible]
w	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	[illegible]

em	Si02	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
ge	[illegible]	11.6	41.1	.736	22.2
Dev	4.	.1	16.6	1.71	.7
RSD	[illegible]	.818	40.5	232.	3.05
1	4180.	11.6	52.9	1.95	22.7
2	4190.	11.7	29.4	-.473	21.7
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	214000.	10000.	100000.	100000.	50000.
	-500.	-50.0	-1000.	-50.0	-20.0

ethod: TLCLP Sample Name: CCV Operator: FP
un Time: 02/14/95 17:27:42
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1270.	9930.	5100.	5030.	10300.	243.	25700.
Dev	2.	12.	11.	15.	21.	1.	20.
RSD	.194	.124	.211	.306	.206	.262	.076
1	1280.	9940.	5090.	5050.	10300.	243.	25700.
2	1270.	9920.	5110.	5020.	10200.	242.	25700.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1250.	10000.	5000.	5000.	10000.	250.	25000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	2550.	2530.	1010.	1270.	5190.	25600.	25200.
Dev	26.	1.	4.	1.	11.	198.	13.
RSD	1.02	.044	.429	.060	.208	.776	.051
1	2570.	2530.	1010.	1270.	5200.	25700.	25200.
2	2530.	2530.	1010.	1270.	5180.	25400.	25300
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	2500.	2500.	1000.	1250.	5000.	25000.	25000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	2560.	5060.	25200	2510.	5100.	5060	5070.
Dev	4.	2.	31.	3.	12.	29.	48.
RSD	.173	.055	.124	.124	.236	.582	.950
1	2570.	5070.	25200	2520	5100	5080.	5000.
2	2560.	5060	25200.	2510.	5090.	5040.	5070.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	2500.	5000	25000.	2500.	5000.	5000.	5000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Si02	Sr4215	Ti3279	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	21900	1020.	5060.	2480	2550.
Dev	46.	3.	25.	6.	4.
RSD	.211	.274	.495	.255	.166
1	21800.	1020.	5050.	2480.	2550.
2	21800.	1020.	5080.	2470.	2550.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	21400.	1000.	5000.	2500.	2500.
ange	10.5	10.5	10.5	10.5	10.5

alysis Report QC Standard Tue 02-14-95 05:34:00 PM page 1

-thod: TLCLP Sample Name: CCB Operator: FP
n Time: 02/14/95 17:30:53
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.786	5.02	10.7	6.53	1.35	.001	42.0
Dev	.445	1.29	13.2	.00	.29	.215	1.4
RSD	56.7	25.7	123.	.006	21.8	37600.	3.33
1	1.10	4.11	1.37	6.53	1.14	-.151	41.1
2	.471	5.94	20.0	6.53	1.56	.152	43.0
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	10.0	200.	100.	40.0	200.	5.00	1000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-.780	2.35	4.09	2.16	7.00	82.?	14.7
Dev	.367	1.11	.72	.77	.90	244.	6.4
RSD	47.1	47.2	17.7	35.4	12.9	294.	43.5
1	-.520	3.13	4.60	1.62	6.35	255.	19.3
2	-1.04	1.57	3.58	2.71	7.64	-89.3	10.2
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	5.00	50.0	10.0	25.0	100.	1000.	1000.

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-.001	1.26	95.9	1.89	[illegible]	[illegible]	[illegible]
Dev	.000	.60	2.4	1.34	6.88	1.04	[illegible]
RSD	2.40	47.?	2.56	70.7	[illegible]	[illegible]	[illegible]
1	-.001	.837	[illegible]	.946	8.51	[illegible]	19.6
2	-.001	1.68	[illegible]	2.84	-1.22	9.47	19.4
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	15.0	100.	1000.	40.0	20.0	60.0	100.

lem	Si02	Sr4215	Tl5??5	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	[illegible]	.407	23.4	-.404	[illegible]
Dev	9.28	.000	55.2	.000	[illegible]
RSD	614.	.006	236.	.007	14.6
1	-5.05	.407	-15.7	-.404	2.83
2	8.07	.407	62.4	-.404	3.45
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000
e	200.	10.0	300.	50.0	20.0

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ethod: TLCLP Sample Name: L4349-04L / G-207-C-DIC-941025L Operator: FP
un Time: 02/14/95 17:34:05
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	2.28	68.1	7.45	3.93	5.82	-.001	1380.
Dev	2.78	1.3	3.95	1.23	.15	.216	24.
RSD	122.	1.89	53.0	31.3	2.53	19300.	1.78
1	4.25	67.1	10.2	4.80	5.92	-.154	1400.
2	.315	69.0	4.66	3.06	5.71	.151	1360.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1.28	1.57	4.09	.513	48.9	363.	415.
Dev	.37	.00	.72	.000	.9	298.	5.
RSD	28.6	.011	17.7	.058	1.84	81.9	1.16
1	1.02	1.57	4.60	.513	48.3	574.	419.
2	1.54	1.57	3.58	.514	49.6	153.	41[illegible].
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
ow	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.

em	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
ge	4.16	-.856	225.	-7.15	8.47	6.18	17.[illegible]
ev	.00	1.197	4.	1.34	6.88	3.62	13.6
RSD	.001	140.	1.78	42.4	81.3	58.5	[illegible]
1	4.16	-1.70	222.	-4.10	17.3	3.62	[illegible]
2	4.16	-.009	228.	-2.21	3.60	8.73	27.[illegible]
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000	800000.	50000.	100000.	100000	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.

em	Si[illegible]	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
ge	13[illegible].	3.10	31.0	.791	9.62
Dev	7.	.00	11.0	.570	.22
RSD	.524	.013	35.5	72.0	2.27
1	1360.	3.10	23.2	1.19	9.47
2	1350.	3.10	38.8	.389	9.78
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	214000.	10000.	100000.	100000.	50000.
	-500.	-50.0	-1000.	-50.0	-20.0

alysis Report   Tue 02-14-95 05:40:25 PM   page 1

thod: TLCLP   Sample Name:L4349-04S   Operator: FP
n Time: 02/14/95 17:37:16
mment: AST 215 1315
de: CONC   Corr. Factor: 1

G-207-C-01C-941025S

lem	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	48.4	2440.	2050.	8.18	2140.	44.8	6900.
Dev	1.4	1.	10.	1.84	13.	.2	6.
RSD	3.00	.026	.481	22.6	.598	.477	.091
1	47.3	2440.	2050.	9.49	2150.	44.7	6900.
2	49.4	2440.	2060.	6.88	2130.	45.0	6900.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	5000.	600000.	50000.	25000.	25000.	25000.	800000.
ow	-10.0	-200.	-100.	-50.0	-200.	-5.00	-5000.

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	51.3	522.	215.	257.	1280.	1890.	2030.
Dev	1.8	7.	2.	.	3.	316.	22.
RSD	3.58	1.27	1.01	.001	.211	16.7	1.11
1	52.6	517.	214.	257.	1270	2120.	2010.
2	50.0	526.	217.	257.	1280.	1670.	2040.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	25000.	100000.	100000.	50000.	500000.	1000000.	1000000.
ow	-5.00	-50.0	-10.0	-25.0	-100.	-5000.	-5000.

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	550.	5.08	1120.	517.	557.	503.	2020
Dev	1.	1.80	43	.	.	9.	39.
RSD	.263	35.4	3.70	.000	.000	1.75	1.94
1	549.	6.35	1150	517.	557.	509.	1990.
2	551.	3.81	1090.	517.	557	497.	2050.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	50000.	50000.	800000.	50000.	100000.	100000.	100000.
ow	-15.0	-50.0	-5000.	-40.0	-100.	-60.0	-200.

lem	Si2[illegible]	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	7010.	14.8	2150.	517.	550.
Dev	18.	.1	58.	1.	2.
RSD	.262	.650	2.69	.110	.325
1	7020.	14.7	2190.	516.	548.
2	7000.	14.8	2110.	517.	551.
rrors	LC Pass	LC Pass	LC Pass	LC Pass	LC Pass
igh	214000.	10000.	100000.	100000.	50000.
ow	-500.	-50.0	-1000.	-50.0	-20.0

alysis Report QC Standard Tue 02-14-95 05:43:36 PM page 1

ethod: TLCLP Sample Name: ICSAF Operator: FP
n Time: 02/14/95 17:40:28
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	3.20	485000.	-76.8	8.46	-.340	.162	490000.
Dev	1.00	1530.	13.6	3.22	.138	.002	1442.
RSD	31.1	.316	17.7	38.1	40.5	1.04	.294
1	2.50	484000.	-67.2	6.18	-.438	.161	489000.
2	3.91	486000.	-86.4	10.7	-.243	.163	491000.
rrors	NOCHECK	QC Pass	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass
alue		500000.					500000.
ange		20.5					20.5

lem	Cd2265	Cu2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	.655	1.20	5.97	-49.4	181000.	31.9	481000.
Dev	1.22	1.10	.70	.1	508.	225.	1519.
RSD	187.	91.8	11.8	.257	.282	707.	.316
1	1.52	1.98	6.47	-49.5	180000.	191.	480000.
2	-.209	.422	5.47	-49.4	181000.	-128.	482000.
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	QC Pass	NOCHECK	QC Pass
alue					200000.		500000.
ange					20.5		20.5

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
uge	-5.38	1.77	9.62	-7.11	5.33	.524	[illegible]
Dev	.08	1.79	4.50	1.33	14.7	15.4	22.5
RSD	1.42	64.8	49.7	18.7	276.	[illegible]	[illegible]
1	-5.32	1.50	6.22	-6.17	15.8	-10.4	57.4
2	-5.45	4.04	15.0	-8.05	[illegible]	11.4	[illegible]
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	Si02	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
uge	-31.4	-.240	-53.8	-7.02	4.11
Dev	84.7	.072	60.6	1.19	.53
RSD	269.	29.8	113.	16.9	12.7
1	-91.1	-.291	-96.7	-6.18	4.59
2	28.4	-.190	-11.0	-7.86	3.33
rrors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue					
e					

alysis Report QC Standard Tue 02-14-95 05:46:49 PM page 1

thod: TLCLP Sample Name: ICSABF Operator: FP
n Time: 02/14/95 17:43:41
mment: AST 215 1315
de: CONC Corr. Factor: 1

i	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	962.	484000.	921.	957.	479.	463.	487000.
Dev	1.	319.	98.	6.	.	.	104.
RSD	.127	.066	10.6	.646	.000	.093	.021
1	961.	484000.	852.	953.	479.	463.	487000.
2	963.	485000.	990.	961.	479.	463.	486000.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	500000.	1000.	1000.	500.	500.	500000.
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	905.	443.	457.	440.	180000.	51300.	478000.
Dev	9.	3.	9.	.	108.	1082.	186.
RSD	.970	.751	1.90	.004	.060	2.11	.039
1	899.	441.	463.	440.	180000.	52000.	478000
2	911.	445.	451.	440	180000.	50500.	478000.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1000.	500.	500.	500.	200000.	50000.	500000
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

tem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	453.	[illegible]	50400	883.	915.	961.	[illegible]
Dev	1.	[illegible]	511		10.	6.	17.
RSD	.323	.646	1.01	[illegible]	1.11	[illegible]	[illegible]
1	452.	927.	50700.	885	908.	965.	950.
2	454.	919.	50000.	881.	922.	957.	937.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	500.	1000.	50000.	1000.	1000.	1000.	1000.
ange	20.5	20.5	20.5	20.5	20.5	20.5	20.5

tem	Si102	Sr4215	Tl3775	U_3924	Zn2138
its	ug/l	ug/l	ug/l	ug/l	ug/l
vge	10700.	[illegible]	961.	[illegible]	937.
Dev	16.	1.	22.	1.	1.
RSD	.150	.140	2.31	.116	.073
1	10800.	958.	945.	446.	938.
2	10900.	956.	976.	447.	937.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	10700.	1000.	1000.	500.	1000.
ange	20.5	20.5	20.5	20.5	20.5

thod: TLCLP Sample Name: WASH Operator: FP
n Time: 02/14/95 17:46:54
mment: AST 215 1315
de: CONC Corr. Factor: 1

lem	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.233	62.1	12.7	1.31	-.105	.153	97.9
Dev	.554	3.2	3.3	1.23	.000	.001	14.7
RSD	238.	5.19	26.0	93.6	.031	.526	15.0
1	.625	64.4	15.0	2.18	-.105	.154	108.
2	-.159	59.9	10.3	.444	-.105	.152	87.5
rors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-.528	-.001	4.09	1.62	34.4	51.0	76.0
Dev	2.201	2.216	.72	1.53	1.8	270.	3.2
RSD	417.	379000.	17.7	94.6	5.24	530.	4.22
1	-2.08	-1.57	4.61	2.70	33.1	242.	78.3
2	1.03	1.57	3.58	.556	35.6	-140.	73.7
rors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	-.004	-.852	17.0	-1.26	-2.47	3.25	5.69
Dev	.000	1.194	2.4	1.34	8.60	3.61	19.6
RSD	10.9	140.	14.1	106.	348.	111.	347.
1	-.004	-.008	15.3	-.315	3.61	5.80	-8.13
2	-.003	-1.70	18.7	-2.21	-8.55	.687	19.6
rors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue							
ange							

lem	SiO2	Sr4215	Tl3775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	19.4	.270	3.92	-.819	1.10
Dev	6.8	.000	5.56	.570	.21
RSD	35.0	.092	142.	70.4	19.3
1	24.2	.270	-.010	-1.21	1.25
2	14.6	.270	7.85	-.407	.945
rors	NOCHECK	NOCHECK	NOCHECK	NOCHECK	NOCHECK
alue					
e					

41

ethod: TLCLP Sample Name: CRIF Operator: FP
un Time: 02/14/95 17:50:05
omment: AST 215 1315
ode: CONC Corr. Factor: 1

E	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
Units	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	21.7	417.	216.	41.4	417.	10.0	49.0
Dev	.8	3.	4.	.0	7.	.0	4.2
.RSD	3.56	.624	1.80	.003	1.73	.032	8.57
#1	22.2	415.	214.	41.4	412.	10.0	51.9
#2	21.1	419.	219.	41.4	422.	10.0	46.0
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK
alue	20.0	400.	200.	40.0	400.	10.0	
ange	50.0	50.0	50.0	50.0	50.0	50.0	

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	11.1	103.	16.8	50.9	229.	38.3	20.5
Dev	.4	.	1.4	.8	4.	270.	4.8
.RSD	3.30	.000	8.65	1.50	1.57	707.	23.5
1	10.8	103.	17.8	51.4	227.	230.	23.9
2	11.4	103.	15.7	50.3	232.	-153.	17.1
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	NOCHECK	NOCHECK
alue	10.0	100.	20.0	50.0	200.		
ange	50.0	50.0	50.0	50.0	50.0		

lem	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	51.9	106.	21.5	62.3	41.1	130.	214.
Dev	.0	1	.8	1.8	12.0	5.	17.
RSD	.002	.561	3.72	2.17	29.3	3.96	[illegible]
1	51.9	106.	22.1	63.6	49.6	135	227.
2	51.5	106.	20.9	61.0	32.5	126.	201.
rrors	QC Pass	QC Pass	NOCHECK	QC Pass	QC Pass	QC Pass	QC Pass
alue	50.0	100.		80.0	40.0	120.	200.
ange	50.0	50.0		50.0	50.0	50.0	50.0

lem	[illegible]	Sr4215	Tl3775	U_2724	Zr2178
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	423.	21.3	603.	101.	43.6
Dev	22.	.2	11.	2.	.4
RSD	5.09	.901	1.82	2.25	1.00
1	408.	21.2	611.	99.5	43.9
2	438.	21.5	596.	103.	43.3
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	428.	20.0	600.	100.	40.0
e	50.0	50.0	50.0	50.0	50.0

ethod: TLCLP Sample Name: CCV Operator: FP
un Time: 02/14/95 17:53:17
omment: AST 215 1315
ode: CONC Corr. Factor: 1

	Ag3280	Al3082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1290.	10100.	5170.	5110.	10500.	247.	26000.
Dev	4.	144.	62.	72.	166.	4.	241.
RSD	.319	1.43	1.19	1.41	1.58	1.55	.926
1	1280.	10000.	5130.	5060.	10400.	244.	25800.
2	1290.	10200.	5210.	5160.	10600.	249.	26100.
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	1250.	10000.	5000.	5000.	10000.	250.	25000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	2560.	2550.	1020.	1290.	5260.	26900.	25700.
Dev	20.	33.	12.	18.	61.	757.	271.
RSD	.786	1.30	1.21	1.36	1.16	2.81	1.06
1	2550.	2530.	1010.	1280.	5220.	26400.	25500.
2	2580.	2570.	1030.	1300.	5300.	27500.	25900.
rors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	2500.	2500.	1000.	1250.	5000.	25000.	25000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb2068	Se1960
its	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
ge	2590.	5140	26200.	2550.	5160.	5120.	5130.
Dev	34	57.	734.	33.	58.	5.	20.
SD	1.31	1.11	2.80	1.30	1.13	.103	[illegible]
1	2570.	5100.	25700.	2520.	5110.	5120.	5190.
2	2620.	5180.	26700.	2570.	5200.	5130.	[illegible]
rors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	2500.	5000.	25000.	2500.	5000.	5000.	5000.
ange	10.5	10.5	10.5	10.5	10.5	10.5	10.5

lem	Si212	Sr4215	Tl3775	V_2924	Zn2138
its	ug/l	ug/l	ug/l	ug/l	ug/l
ge	22000.	1040.	5170.	2510.	2570.
Dev	231.	14.	63.	30.	19.
SD	1.05	1.37	1.21	1.20	.739
1	21900.	1030.	5120.	2490.	2560.
2	22200.	1050.	5210.	2540.	2580.
rors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	21400.	1000.	5000.	2500.	2500.
ange	10.5	10.5	10.5	10.5	10.5

alysis Report QC Standard Tue 02-14-95 05:59:35 PM page 1

thod: TLCLP Sample Name: CCB Operator: FP
n Time: 02/14/95 17:56:28
mment: AST 215 1315
de: CONC Corr. Factor: 1

	Ag3280	A13082	As1936	B_2496	Ba4934	Be3130	Ca3158
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.941	4.56	8.37	6.09	1.66	.001	49.0
Dev	.669	7.11	15.1	1.85	.15	.214	8.4
RSD	71.1	156.	180.	30.3	8.84	18800.	17.1
1	.468	-.467	-2.31	7.40	1.77	-.150	43.0
2	1.41	9.59	19.1	4.79	1.56	.152	54.9
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	10.0	200.	100.	40.0	200.	5.00	1000.

	Cd2265	Co2286	Cr2677	Cu3247	Fe2594	K_7664	Mg2790
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	.516	.783	2.56	2.17	8.91	6.38	14.7
Dev	.734	1.11	1.45	.76	.00	280.	6.4
RSD	142.	142.	56.5	35.3	.023	4390.	43.5
1	-.005	1.57	1.54	1.62	8.91	204.	10.2
2	1.04	-.001	3.58	2.71	8.91	-191.	[illegible]
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	5.00	50.0	10.0	25.0	100.	1000.	1000.

	Mn2576	Mo2020	Na5889	Ni2316	Pb2203	Sb[illegible]	Se[illegible]
nits	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
vge	1.04	1.26	89.4	-.446	1.21	[illegible]	[illegible]
Dev	1.48	.60	2.4	1.784	3.44	3.1	[illegible]
RSD	141.	47.1	2.69	199.	284.	25.[illegible]	[illegible]
1	-.000	.845	87.7	-2.21	5.65	10.2	[illegible]
2	2.09	1.68	91.1	.316	-1.22	14.[illegible]	[illegible]
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000	.000	.000
ange	15.0	100.	1000.	40.0	20.0	[illegible]	100.

	Si[illegible]	Sr4215	T13775	V_2924	Zn2138
nits	ug/l	ug/l	ug/l	ug/l	ug/l
vge	7.95	.407	52.7	-.807	3.31
Dev	14.1	.192	47.0	.570	.68
RSD	177.	47.3	89.1	70.6	20.5
1	-2.00	.543	86.0	-1.21	3.79
2	17.9	.271	19.5	-.404	2.85
rrors	QC Pass	QC Pass	QC Pass	QC Pass	QC Pass
alue	.000	.000	.000	.000	.000
e	200.	10.0	300.	50.0	20.0

000 44

ACZ LABORATORIES, INC.
Extract[illegible]
M1312

WG6673[illegible] S 2/1/95 4:03 PM

Analyst: as
Dept: 20
Analysis Date: 1/30/95
Start Time: 12:00p
End Time: 4:00p
Approved: A[illegible]
Approved:

Instrument: 0.00
Matrix Class: SOLID
List Type: I-X-1312
List Function: PREP

Project:
SDG#:
SOP#: X-1312

#	Sample No.	Sample ID	Sample Weight (g)	#2 Extraction Fluid Vol (mL) pH 5 +/- 0.0	Extraction Fluid pH	Extraction Time	Initial pH	Ending Pre-Filter pH	pH After Filter	Time IN	Time OUT
1	PBS		0	2000	4.96	18	5.0	5.1	4.9	4:00p	10:00a
2	L4349-01	Previous	100	2000	5.00	18	8.4	8.6	8.6	4:00p	10:00a
3	L4349-02	Previous	100	2000	4.96	18	7.9	8.6	8.4	4:00p	10:00a
4	L4349-03	Previous	100	2000	4.96	18	7.9	8.3	8.1	4:00p	10:00a
5	L4349-04	Previous	100	2000	4.98	18	7.9	8.9	8.7	4:00p	10:00a
6	DUP	4349-1	100	2000	5.01	18	7.9	8.9	8.7	4:00p	10:00a
	spike	4349-4	after extraction prior to acidification								

Comments: sample was dried in oven (45°C) prior to extraction.

ICP SPK PCN = 1119
SPK vol = 2.0 ml
Samp vol = 200.0 ml

GFAA SPK SCN = II941216-1
SPK vol = 4 ml
Samp vol = 200 ml

X-1312-1.qcfrm

ACZ LABORATORIES, INC.
Extracti(
M1312

WG6673.(01/24/95 2:59 PM

Analyst: (s
Dept: (0
Analysis Date: 1-30 95
Start Time: 12 PM 1-30 ~~95~~ 95
End Time:
Approved:

Project: Asarco
S: AST 215

Instrument: 0.00
Matrix Class: SOLID
Ext Type: EX

#	Sample No.	Sample ID	Sample Weight (g)	#2 Extraction Fluid Vol (mL) pH 5 +/- 0.05	Extraction Fluid pH	Extraction Time	Initial pH	Ending Pre-Filter pH	pH After Filter	Time IN	Time OUT
1	PBS		0	2000	4.96	18	5.0	5.1	4.9	4:00	10:00
2	L4349-01	Previous	100	2000	5.00	18	8.4	8.6	8.6		
3	L4349-02	Previous	100	2000	4.96	18	7.9	8.6	8.4		
4	L4349-03	Previous	100	2000	4.96	18	7.9	8.3	8.1		
5	L4349-04	Previous	100	2000	4.98	18	7.9	8.9	8.7		
6	DUP	4349-1	100	2000	5.01	18	7.9	8.9	8.7		
	Spike	4349-4	after extraction prior to acidification								

Comments: Sample was dried in oven 45°C prior to extraction - 1-31-95

SPIKE KP#1 ~~SCN~~ PCN 1119 spk vol = 2.0 ml spk GFAA SCN - IT941216-1

X-1312-1.qcfrm

ACZ LABORATORIES, INC.
ANALYSIS WORKLIST

BLANK.XLS

1312 Digestion

Analyst: JB
Date: 2-1-95
Start Time: 11:00a
End Time: 3:50p

Project: Asarco
SDG#: ASI 215
Instr:

Approved: AS
Approved:

No.	Lab No.	sample vol.	HNO_3 vol	Final vol	Initial sample & vessel wt	After Digestion sample & vessel wT	% Rec
1	Blank	45.0	5.0	50.0	280.74	279.81	100
2	4349-1				282.51	282.26	100
3	-2				279.63	277.82	99
4	-3				278.74	278.70	100
5	-4				279.52	275.74	99
6	4349-4 spk. ICP				280.91	278.65	99
7	4349-4 spk. GFAA				280.06	280.05	100
8	4349-1 DUP				279.94	279.75	100
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

REMARKS:

Spike
Spike Sol. SCN =
Spike Sol. ml =
Sample ml =

PCN# =
PCN# =
SCN# =
SCN# =

WORK GROUP REPORT (wk02)

Jan 24 1995, 02:34 pm

Work Group: WG6673 for Department: 20 Soil Preparation

Created: 24-JAN-95 Due: Operator: as

Sample	Account Name	C	Product	Matrix	Stat	UA	Workdate	PR	Location	Holddate
L4349-01	Asarco, Inc.	S	X-1312	Soil	WIP	U	22-JAN-95	03		23-APR-95
L4349-02	Asarco, Inc.	S	X-1312	Soil	WIP	U	22-JAN-95	03		23-APR-95
L4349-03	Asarco, Inc.	S	X-1312	Soil	WIP	U	22-JAN-95	03		23-APR-95
L4349-04	Asarco, Inc.	S	X-1312	Soil	WIP	U	22-JAN-95	03		23-APR-95

Comments:

L4349-01 Previously archived
L4349-02 Previously archived
L4349-03 Previously archived
L4349-04 Previously archived

APPENDIX B

CULTURAL RESOURCES LETTER FROM STATE HISTORICAL PRESERVATION OFFICER TO ASARCO