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PROJ. MGR. B Wilkerson
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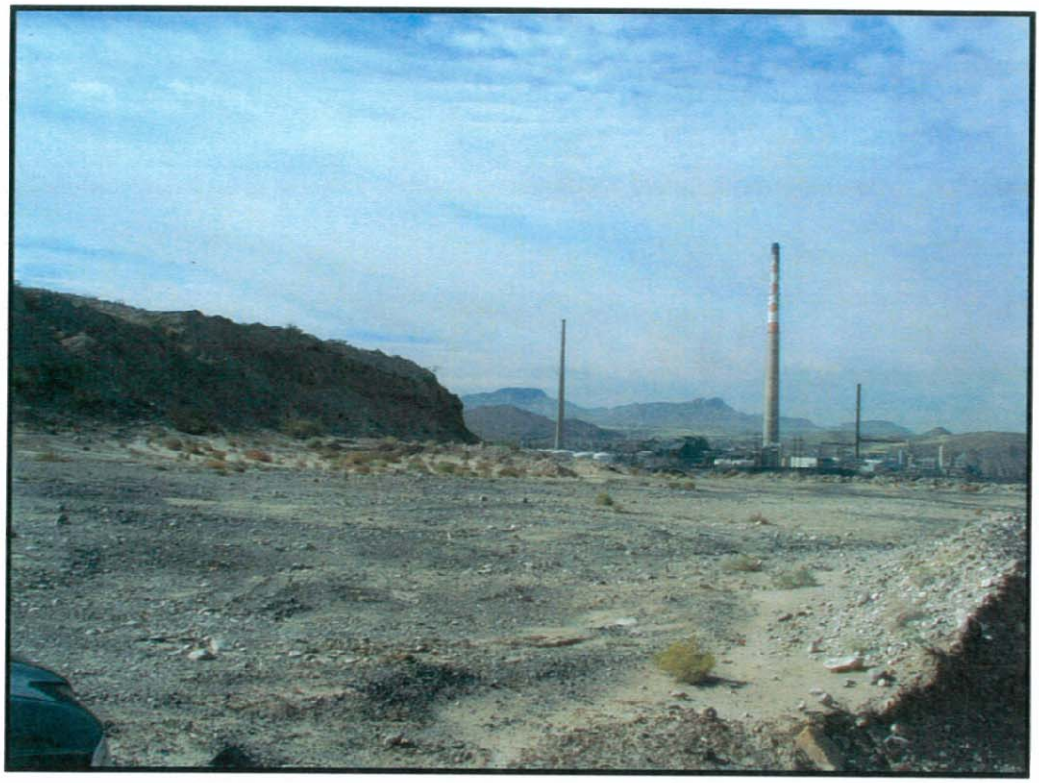
PHASE IV REMEDIAL INVESTIGATION REPORT
EL PASO TEXAS

Prepared for:

SWR 31235

ASARCO, Incorporated
P.O. BOX 1111
EL PASO, TEXAS 79999



Prepared by:

ASARCO
Consulting, Inc.
El Paso, Texas

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T/F/IHW 31235 CO
ARTS COMM# 12460188 RP
PROJ. MGR. B Williamson

PHASE IV REMEDIAL INVESTIGATION REPORT

Prepared for:

ASARCO Incorporated

Prepared by:

ASARCO Consulting, Inc.
2301 W Paisano Drive
El Paso, TX 79922

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1.0 INTRODUCTION

During 1994 and 1995, the Texas Natural Resource Conservation Commission (TNRCC) conducted a series of compliance inspections at the ASARCO Incorporated (Asarco) El Paso Copper Smelter facility. Results of these inspections indicated that unauthorized discharges of solid waste, wastewater, and stormwater had occurred at the facility. Therefore, in 1996, the TNRCC issued an Agreed Order (Docket No. 96-0212-MLM-E) requesting Asarco to conduct a Remedial Investigation (RI) to comply with Title 30, Chapter 335, Subchapter S.

In November 1996, Asarco prepared and submitted to the TNRCC a RI Work Plan (Hydrometrics, 1996) describing the rationale for completing the RI and achieving compliance with the Risk Reduction Standard No. 3 (Closure/Remediation with Controls) of Subchapter S. In general, the technical requirements to meet Risk Reduction Standard No. 3 include the following elements:

- To perform a RI to characterize the nature, extent, direction, rate of movement, volume, composition and concentration of contaminants in environmental media of concern.
- To prepare a Baseline Risk Assessment (BRA) report to describe the potential effects under both current and future conditions caused by the release of contaminants in the absence of any actions to control or mitigate the release.
- To evaluate the relative abilities and effectiveness of potential remedies to achieve compliance with Risk Reduction Standard No. 3.

In October of 1998, an initial Phase (Phase I) of the RI, including the preparation of a Baseline Risk Assessment and the evaluation of the abilities and effectiveness of potential remedies, was completed and submitted to the TNRCC for review. In July of 2000, a Phase II RI, which provided additional site characterization data and a logical

interpretation of the occurrence and distribution of chemicals of concern, was completed and submitted to the TNRCC for review. Corrective action measures presented in Phase I were reconsidered in the Phase II RI using additional site characterization. A Phase III RI, which incorporated comments and recommendations resulting from the TNRCC review of the two previous RIs, was undertaken and completed in November 2001. A Remedial Design report, which included design information for implementing the corrective actions developed from the RI activities, was also submitted as a complement to the Phase III RI.

To address concerns expressed by TNRCC and the International Boundary and Water Commission (IBWC), a Phase IV RI was conducted to better understand the groundwater conditions in the Rio Grande floodplain area in the vicinity of monitoring wells EP-111, EP-127, and EP-128 (Investigation Area 5); and to determine if there is a potential risk for the La Calavera residents (Investigation Area 19) and for the International Boundary and Water Commission (IBWC) construction workers to soil contaminants. Results obtained from this investigation are presented in this report. Additionally, as a complement to the Phase IV RI, a study was undertaken to evaluate the source, speciation and potential bioaccesibility of lead and arsenic in residential surface soil in the vicinity of Asarco's smelter.

1.1 PROJECT OBJECTIVES

The primary objectives of the Phase IV RI were:

- To further understand groundwater conditions in the vicinity of monitoring wells EP-111, EP-127, and EP-128 (Investigation Area 5).
- To better understand the preferential pathways for migration of impacted groundwater and to determine whether or not other unknown source metal (arsenic) materials exist in the area.
- To evaluate the relationship between identified source area materials and groundwater impacts in the historic Smeltertown and the Rio Grande floodplain area (vicinity of monitoring wells EP-111, EP-127, and EP-128).

- To evaluate the regional/local hydrogeology and groundwater resources.
- To characterize the surficial soil in the La Calavera residential area to evaluate if metal residuals existing in surficial soil (0 to 18 inches) could pose any threat to local residents.
- To assess the surficial soils (0-5 ft) in the area occupied by the IBWC field office to evaluate whether or not observed Chemicals of Concern (COC) could pose a threat to IBWC construction workers.
- To evaluate the source, speciation and potential bioaccesibility of lead and arsenic in residential surface soil in the vicinity of Asarco's smelter.

1.2 FACILITY DESCRIPTION AND BACKGROUND INFORMATION

The Asarco El Paso Copper Smelter Plant, located within the city limits of El Paso, Texas (Figure 1-1), has been in operation for over 100 years. It began operations in 1887 as a lead smelter. Asarco was formed in 1899. Copper production began in 1910. In the 1930s, the plant added a Godfrey roaster for cadmium oxide production. In 1948, a blast furnace, slag-fuming plant for zinc recovery was constructed. In the late 1970s, an antimony plant was completed, as well as a sinter plant with unloading and bedding systems. The zinc-fuming furnace was closed by 1982. In 1985, the lead plant was closed. The cadmium plant was shut down in 1992. The antimony plant was operated until 1986. The lead, cadmium, zinc and antimony smelting facilities were demolished in 2000. The entire facility was temporarily placed on a Care and Maintenance Program (temporary cessation) in February 1999. Prior to the temporary cessation, the facility produced approximately 140,000 tons of copper per year.

1.3 ENVIRONMENTAL SETTINGS

1.3.1 Adjacent Land Use

Land adjacent to the El Paso Smelter facility consists of commercial, industrial, manufacturing and residential uses (Figure 1-2). A water well survey on the U.S. side of the Rio Grande identified twenty-five wells within a one-half mile radius of the Plant (Figure 1-3). \

FIGURE 1-1. PROJECT VICINITY MAP

FIGURE 1-2. ADJACENT LAND USE

FIGURE 1-3. WATER WELL INVENTORY MAP

Wells surveyed included water supply wells at the University of Texas at El Paso, monitoring wells operated by the International Boundary Water Commission (IBWC), monitoring wells at the Thunderbird Service Station and several private domestic wells. The closest well is a domestic well (TWDB number 49-12-6A) located at 420 Clayton Road, about one-half mile north and upgradient of the Plant.

1.3.2 Climate

The climate in the area is considered arid and consists of very low relative humidity, low precipitation, hot summers and mild winters. Temperatures in the El Paso area range from the 30's (degrees Fahrenheit) in the winter months to over 100 in the summer months. Spring is the windiest time of the year, creating frequent sand and dust storms. The seasonal wind directions are characterized as being from the south-southeast during June through October, and from the northwest during November through May. The annual lake evaporation for the area is estimated to be 72 inches/year. Pan evaporation tests indicate evaporation rates greater than 100 inches/year. Precipitation averages about eight inches annually, with 75 percent of this precipitation occurring between April and September (Jaco, 1971). The majority of the precipitation comes in the form of intense storms resulting in high precipitation rates over relatively short time intervals.

1.3.3 Geology and Physiography

The facility is located in El Paso County within the Rio Grande Valley floodplain at an elevation of approximately 3,600 feet above mean sea level (Figure 1-1). Geologically, El Paso County lies within the Basin and Range Province of West Texas. The surficial geology of the region is controlled by three mountain ranges (the Franklin Mountains, the Hueco Mountains and the Sierra de Juarez Range) and the Rio Grande Rift (Figure 1-4). The surface geology of the facility area consists of a mix of colluvial and fluvial sediments. The colluvial sediments are generated by the erosion of a laccolith, which is locally known as the "Campus Andesite", and the erosion of the Franklin Mountains.

FIGURE 1-4. PHYSIOGRAPHIC MAP OF THE EL PASO AREA

1.3.4 Hydrogeology

The two major aquifers in the El Paso-Ciudad Juarez area are the Hueco Bolson aquifer, east of the Franklin Mountains, and the Mesilla Bolson aquifer, west of the Franklin Mountains (Figure 1-4). Most of the Mesilla Bolson is in the state of New Mexico.

The major source of the fresh groundwater within the Mesilla Bolson is mainly located in the state of New Mexico and is from the Quaternary to Tertiary age Santa Fe group. The Santa Fe group has thick sequences of clay and silt facies that interfinger with fluvial facies, which create confined/leaky aquifer conditions in the basin fill.

The Hueco Bolson is the principal aquifer for the El Paso area. Structurally, it is a basin created by the down-dropped block between the Franklin Mountains and the Hueco Mountains and subsequently filled with lacustrine and fluvial deposits. Groundwater in the Hueco Bolson occurs in both the fluvial deposits and the underlying lacustrine deposits.

Shallow groundwater underneath the site is not used for drinking purposes and is not hydraulically connected to any of the two major aquifers. The shallow aquifer located underneath the El Paso Plant is composed primarily of interbedded and mixed sand, gravels, boulders and bedrock. The aquifer is considered saline, with a total dissolved solid (TDS) concentration ranging from 3,000 mg/l to 10,000 mg/l.

1.3.5 Surface Water Hydrology

There are two surface water bodies to the west of the Facility: 1) the Rio Grande River, and 2) the American Canal, which is a diversion canal used by the United States to remove water from the Rio Grande. The canal is concrete-lined to reduce the amount of leakage into the subsurface. Local groundwater elevations fluctuate in conjunction with the amount of water in the Rio Grande. Such fluctuations are a result of seasonal releases of water from Elephant Butte Dam, near Truth or Consequences, New Mexico, which is

approximately 100 miles north of El Paso. In the spring, water is released for irrigation purposes, and in the fall the amount of water released is restricted to conserve the water over the winter months.

1.4 SUMMARY OF PREVIOUS REMEDIAL INVESTIGATIONS

To comply with the requirements of the Agreed Order, to date four Phases of RI have been completed at the El Paso Asarco facility.

An initial Phase I of the RI was completed in October of 1998. This first phase included the completion of 139 soil borings and installation of 23 monitoring wells. Approximately 626 soil samples were collected during the course of this investigation for laboratory analysis. Relevant findings gathered from this first phase investigation were as follows:

- Ten RI investigation areas (IAs) were identified during the investigation.
- Depths to groundwater ranged from 40 to 60 feet below ground surface (bgs) beneath the Plant to about ten feet bgs in monitoring wells adjacent to the Rio Grande.
- Groundwater within and near the Asarco facility is not used for drinking purposes.
- The nearest water well (domestic well) is located approximately one-half mile north and upgradient from the Plant.
- Water samples (surface) collected from the Rio Grande indicated COC concentrations below the Maximum Contaminant Levels (MCL) and the Fresh Water Chronic Criteria.
- Arsenic was identified as the primary COC in groundwater associated with the facility.
- Source materials occur primarily near the surface and are not in direct contact with the groundwater.

- Impacts to the Rio Grande from groundwater migration may occur if source areas/materials on the Plant are not removed or isolated.
- Materials associated with potential source areas were classified into three Categories.
  - ✓ Category I: Residual byproducts, from current and past smelter operations, associated with distinctly elevated concentrations of metals in underlying groundwater.
  - ✓ Category II: Large volumes of diluted residual by-products (most of the same materials listed as Category I) and debris from demolition of smelter facilities with residual concentrations of metals.
  - ✓ Category III: Copper slag and unfumed lead slag.
- The Plant is underlain by arroyos that have been backfilled with soil, slag, and other materials.
- The arroyos appear to provide a preferential flow path for groundwater and migration of constituents beneath the plant.
- No imminent health threats exist at the Plant because risks are appropriately managed.
- Specific Corrective Action Measures to remediate source areas were identified and developed.

A Phase II RI, which provided additional site characterization data and a logical interpretation of the occurrence and distribution of COC, was completed in July of 2000. This second phase of the investigation included the completion of 94 soil borings and installation of 27 monitoring wells. Approximately 703 soil samples were collected for analysis during this investigation. Corrective action measures presented in Phase I were reconsidered in the Phase II RI based on new findings and results from the additional site characterization. The following is a summary of relevant findings observed upon completion of the Phase II RI:

- The Phase II RI resulted in additional IA designations to 14 from the 10 IA's originally identified in Phase I.
- The primary objectives of the corrective actions were refined to: 1.) reduce the potential for metals exposure to facility workers and the public; and 2.) minimize the potential for transport of metals to groundwater.
- The Area of Contamination Concept (AOC), as explained by the EPA memorandum dated March 13, 1996, is appropriate for use on the El Paso smelter site to construct on-site repositories for containment of Category I materials.
- Arsenic, cadmium, and lead are the predominant COCs in soil at the Facility.
- The construction of a Storm Water Collection and Reuse System was completed in parallel with completion of the Phase II RI.
- Ponds 1, 5 and 6 were decommissioned, therefore removing a major Category I source of groundwater contamination.

A Phase III RI, incorporating comments and recommendations resulting from the TNRCC review of Phase II of the RI, was undertaken and completed in 2002. This phase included the completion of 263 soil borings and installation of 13 additional monitoring wells. Approximately 792 soil samples were collected for analysis during the investigation. The following is a summary of relevant conclusions derived from the Phase III investigation:

- The Phase III RI expanded to 20 IAs from the 14 IAs identified in the Phase II RI.
- Some materials classified as Category I during the Phase I and Phase II RIs, were reclassified as Category II materials.
- The Closed Plants were characterized and incorporated into the site assessment as IA-15, IA-16, IA-17, and IA-18.
- The Asarco property bounding La Calavera residential area was evaluated during the Phase III RI and incorporated as IA-19.

- The Asarco property located east of I-10 was further evaluated during the Phase III RI and incorporated as IA-20.
- A revised groundwater monitoring and sampling program was proposed to TCEQ.
- The source of arsenic observed in Smeltertown and the Rio Grande floodplain area appears to be associated with Category I materials identified in the vicinity of EP-114 and from historic acid releases in the Acid Plant area.
- The implementation of corrective actions to date have resulted in the reduction of COC concentrations in certain areas of the facility.
- The Ephemeral Pond site was selected as the location for constructing a new on-site disposal cell.

A Remedial Design (RD) report, which included design information for implementing the corrective actions developed from the RI activities, was also submitted as a complement to the Phase III RI.

As a result of the Phase III, an additional and final phase of investigation was recommended to: 1) further explore groundwater conditions in the vicinity of monitoring wells EP-111, EP-127, and EP-128 (Investigation Area 5), 2) characterize the surficial soil in the La Calavera residential area to evaluate if metal residuals existing in surficial soil (0 to 18 inches) could pose any threat to local residents, and 3) assess the surficial soils (0-5 ft) in the area occupied by the IBWC field office to evaluate whether or not observed Chemical of Concerns (COC) could pose a threat to IBWC construction workers. As a complement to the Phase IV RI, a study was undertaken to evaluate the source, speciation and potential bioaccesibility of lead and arsenic in residential surface soil in the vicinity of Asarco's smelter.

Table 1-1 presents a summary of soil borings/monitoring wells and soil samples installed/collected during the four Phases of the RI.

TABLE 1-1. SUMMARY OF FACILITY RI MONITOR WELLS, BORINGS, AND SOIL SAMPLES, EL PASO ASARCO COPPER SMELTER, PHASE IV REMEDIAL INVESTIGATION

2.0 REMEDIAL INVESTIGATION RESULTS

This section presents a general summary of data gathered during the Phase IV RI.

2.1 LA CALAVERA RESIDENTIAL AREA (IA-19)

2.1.1 Background Information

The need to address off-Plant areas, particularly the area located east of the Plant (La Calavera residential community), was not recognized in the Agreed Order. This area was added to the RI during Phase III as the result of concern expressed by the EPA and a recognized need to collect background data in the area around the Facility.

The La Calavera residential area has been identified as IA-19 (Exhibit 1 and Figure 2-1). This IA also includes undeveloped land and an historic Asarco Cemetery. The cemetery is located adjacent to the residential community and access is not limited, since there are no barriers. The La Calavera community is in a low-lying ravine, and could be potentially impacted by COCs transported from windblown dust particulate.

IA-19 is adjacent to IA-12 (a slag storage area for Oglebay-Norton Materials, Inc.). Asarco provided access to the slag storage area to Oglebay-Norton under a lease agreement. Oglebay-Norton mined and processed slag from Asarco and sold the slag products for commercial/retail use. Fine particulate and dust was often generated during the operations.

2.1.2 Soil Sample Results

During the Phase III RI, 22 soil samples were collected from seven surface locations (BL25-BL30 and BL51) on Asarco property (Figure 2-1) surrounding La Calavera. Arsenic and lead concentrations ranged from 18 mg/kg to 216 mg/kg and 44 mg/kg to 1,690 mg/kg, respectively (Table 2-1). Eighteen of the samples exceeded the Medium Specific Concentration (MSC) limit of 24 mg/kg for arsenic; the MSC is a regulatory

goal for soils used for residential land purposes. Four of the samples exceeded the MSC lead limit of 500 mg/kg.

TABLE 2-1. SUMMARY OF SOIL SAMPLING RESULTS FOR THE LA CALAVERA RESIDENTIAL AREA (INVESTIGATION AREA 19)

FIGURE 2-1. INVESTIGATION AREA 19 (LA CALAVERA RESIDENTIAL AREA), SOIL SAMPLING LOCATIONS

During July and August of 2001, the EPA conducted a Metal Survey Investigation in El Paso County and New Mexico. One of the locations evaluated in this survey included the La Calavera residential area. A total of 41 surficial soil samples were obtained from 21 sampling locations in this residential community. The samples were analyzed for arsenic and lead. The EPA provided Asarco the results from these soil samples which showed that arsenic concentrations ranged from 13 mg/kg to 850 mg/kg. The lead concentrations ranged from below laboratory detection limits (bldl) to 62 mg/kg. A copy of these soil sample results and a figure showing the arsenic isopleth (i.e. lines of equal concentration) map for stations exceeding 20 mg/kg is included in Appendix A.

Prompted by the EPA survey results, Asarco collected surface soil samples throughout the La Calavera residential area in November of 2001. A total of 114 soil samples were obtained from 35 different locations. At each location, shallow borings (0-18 inches) were advanced using a hand auger. Discrete soil samples for analytical testing were obtained from depths ranging from 0 to 2 inches; 2 to 6 inches;, and 6 to 18 inches. All samples were submitted to Asarco's Technical Services Center in Salt Lake City, Utah for total metal analysis by Energy Dispersive X-Ray Flourescence (EDXRF). Analytical results of soil samples obtained from the 0-2 inch level indicated arsenic and lead concentrations ranging from 13 mg/kg to 230 mg/kg and 54 mg/kg to 760 mg/kg, respectively. One hundred and six of the samples exceeded the arsenic 24 mg/kg MSC for residential land use. Seventeen of the samples exceeded the lead 500 mg/kg MSC, for residential land use. Figure 2-1 shows all sampling locations. A summary of soil data results for the IA-19 is presented in Table 2-1. Laboratory Reports are included in Appendix B.

2.1.3 Speciation and Bioaccessability

Concurrently with the La Calavera soil characterization, Asarco contracted for a study (Walker & Associates, Inc.) to examine the sources, speciation and potential bioaccessability of lead and arsenic in the soils. The results showed, in most cases, that

the samples containing the highest concentrations of arsenic and lead also had a high concentration of iron. This correlation matched the ratio of arsenic, lead and iron found in surface slag sampled on the Asarco plant, which indicates wind blown slag as a likely contributor to the soil contamination in the La Calavera residential area.

The EPA reviewed the speciation results and determined that slag fines from Oglebay Norton Materials Inc.'s slag crushing operation contributed to the soil contamination in the La Calavera area. As a result, Oglebay Norton Materials Inc. entered into a Consent Agreement with the EPA to remediate the yards on San Marcos Drive (La Calavera residential area).

Based on the above information, Asarco has determined not to conduct any further investigation or remediation within the La Calavera residential area (IA-19). The results of the speciation and bioaccessability study are included in Appendix C.

2.2 THE INTERNATIONAL BOUNDARY AND WATER COMMISSION (IBWC), AMERICAN DAM FIELD OFFICE, IA-5

2.2.1 Background Information

To address concerns from the TCEQ Toxicology and Risk Assessment (TARA) staff, Asarco performed a characterization of the surficial soil at the IBWC, American Dam Field Office (Figure 2-2). The purpose of this evaluation was to collect surface soil samples (0 to 5 ft) and assess whether or not IBWC construction workers could be exposed to impacted soils through the inhalation of airborne dust, incidental ingestion and/or dermal contact.

FIGURE 2-2. INVESTIGATION AREA 5 (IBWC AMERICAN DAM FIELD OFFICE), SOIL SAMPLING LOCATIONS

2.2.2 Soil Sample Results

A total of 27 soil samples were obtained from 5 different locations. Originally, Asarco proposed to collect approximately 50 samples from 10 different boring locations (Figure 2-2) throughout the IBWC facility; however, since most of the facility is covered with concrete/asphalt, only five borings were installed. Soil samples were collected in one-foot intervals from the ground surface to the bottom of the boring. All samples were submitted to Asarco's Technical Services Center in Salt Lake City, Utah for total metals analysis in accordance with EPA method 3050.

Laboratory reports showed arsenic and lead concentrations ranged from bldl to 144 mg/kg and bldl to 1,400 mg/kg, respectively. All samples have arsenic concentrations below the 200 mg/kg arsenic MSC for Commercial/Industrial land use (SAI-Ind). Three sampling locations slightly exceeded the 1,000 mg/kg MSC-SAI standard for lead. Samples obtained from the 0-1 ft and 1-2 ft intervals at IBWC-5A and IBWC-5B displayed lead concentrations of 1,400 mg/kg and 1,100 mg/kg, respectively. The sample gathered from IBWC-4B (1-2 ft) had a lead concentration of 1,020 mg/kg. Samples gathered from the same borings at deeper locations displayed concentrations below the lead MSC SAI-Ind Standard.

Table 2-2 contains a summary of soil sample results obtained from the IBWC, American Dam Field Office (IA-5). A copy of the Laboratory Reports is included in Appendix B.

2.2.3 Potential Exposure to Inhalation of Airborne Dust

The potential exposure to inhalation of airborne dust by IBWC workers was evaluated in the Baseline Risk Assessment included in the Phase I RI (October 1998). The model of Bowers, et al., 1994, was used as a screening tool to evaluate lead exposures in adults. TARA reviewed the model results and recommended that Asarco evaluate the data using the Integrated Exposure Biokinetic (IEBK) model for lead in adults. The data was re-evaluated using the IEBK model and the default values from 30 TAC 350.76©(2)p.

Results of this re-evaluation indicated a Risk-Based Exposure Limit (RBEL), due to the ingestion of lead contaminated soil and the inhalation of airborne dust for Commercial/industrial land use, of 1,600 mg/kg (Table 2-3).

TABLE 2-2. SUMMARY OF SOIL SAMPLING RESULTS FOR THE IBWC AMERICAN DAM FIELD OFFICE (INVESTIGATION AREA 5)